

A Prospective Study of Effectiveness of ESWL versus PCNL in Patients with Kidney Stone Size 1-2 cm

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Abstract

Aim: The aim of our study was to evaluate the efficacy and safety of extracorporeal shock wave lithotripsy with that of percutaneous nephrolithotomy for managing kidney stones measuring between 1 to 2 cm.

Methods: This study, conducted at a tertiary care hospital in Odisha, included 100 patients with kidney stones (range: 1–2 cm) who were posted for surgery by either PCNL (n=50) or by ESWL (n=50). Success rate and complications were recorded and analyzed.

Results: Fifty patients underwent ESWL and 30 patients had stone clearance in 1-3 months. Fifty patients underwent PCNL, out of which 40 patients had stone clearance. Complications were minor in nature and were found in 12% of patients undergoing ESWL while 30% of patients undergoing PCNL had minor complications.

Conclusion: PCNL is superior to ESWL for renal stones of 1-2cm size.

Keywords: PCNL, ESWL, Renal Stones.

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Introduction

The incidence of kidney stone is increasing day by day. As per National Health and Nutrition Examination Survey 2012, 10.6% of men and 7.1% of women in the United States are affected by renal stone disease, compared to just 6.3% of men and 4.1% of women in 1996. In India incidence shows wide regional variation with high number of cases reported from west and north India compared to south India. Most of the renal stones diagnosed today are below 2 cm

which may be due to easy and early accessibility to X-ray and ultrasonography. The preferred treatment of 2 cm stone is percutaneous nephrolithotomy (PCNL). [1] The treatment of choice for 1-2 cm renal stones is not definite. Literature is divided with regard to optimum management of these stones by PCNL or ESWL (Extracorporeal Shock Wave Lithotripsy) regarding success rate of stone clearance and complications. This study was undertaken to evaluate success rate and

complications of PCNL and ESWL in the management of renal stones of size 1-2cm. [2-4]

Materials and Methods

After approval of the ethical committee, this prospective study was carried out to evaluate stone clearance by ESWL versus PCNL in patients with renal stones of size 1-2 cm. The study was conducted at SCB Medical College Hospital, Cuttack, Odisha, India. Patients with bilateral kidney stones, radiolucent stones, stone size >2 cm, age <12 years or > 75 years, bleeding diathesis, pyonephrosis, severe hydronephrosis and cardiorespiratory disease were excluded from the study. Patients in group A (n=50) were allocated for PCNL while in Group B (n=50) included patients who underwent ESWL. Informed written consent was obtained from all patients enrolled in the study.

Clinical history was taken and physical examination was done. Radiological studies [Plain X-ray KUB, USG Abdomen & pelvis, Intravenous urogram (IVU), Noncontrast CT (NCCT) Abdomen & pelvis] were done to determine the stone site and size. Hematological, biochemical and urine tests were also done. For failed ESWL, auxiliary procedures like ureteroscopy or PCNL was done. Patients were followed up at 1 and 3 months after intervention by routine postoperative x-ray and ultrasound.

All PCNL procedures were done by standard technique in general anaesthesia in prone position. PCNL procedure success was defined as no residual stone visible on X-ray KUB. Success included stone-free status, i.e., complete stone clearance or clinically insignificant residual fragments (CIRF) ≤ 4 mm at 3 months. Complications were classified according to modified Clavien grading system. Measurement of Hounsfield Unit of renal stone during CT was done. Patients underwent ESWL using the Dornier compact delta II. The

fragmentation of the calculus during the therapy was monitored by fluoroscopy. Post procedural plain X-ray was done to document fragmentation and clearance at the end of 1 and 3 months. Success included stone-free status, i.e., complete stone clearance, or clinically insignificant residual fragments (CIRF) <4 mm with no symptoms at 3 months after ESWL. Failure was defined as residual stone fragments, i.e., clinically significant residual fragments > 4mm after 3 sessions of ESWL. Post ESWL, instructions given were rest for 7 days, plenty of oral fluids, passage of urine in a strainer for collection of stone, antibiotics for 7 days with on demand analgesics till next x-ray. Patient and attendants were explained about possible complications. Patients were followed up at 1 month after ESWL with a plain abdominal film. If there were fragments of significant size, a second session of ESWL was planned. In between 2 sessions, minimum 30 days gap was maintained. However, if there were only insignificant fragments, the patients were re-evaluated after 1 month. The final results were considered after 3 months from the first ESWL session. The data was subjected to statistical analysis with SPSS version 16 statistical software and Microsoft excel. The p-value of <0.05 was considered significant. Results were analyzed using Student's t-test and chi-square test, Fischer's exact test multivariate analysis and one-way ANOVA.

Results

There was no significant difference in demographic parameters like age, sex and weight. Ten patients in PCNL group and 9 patients in ESWL group were lost to follow up. There were 35 stones on right and 46 on left (1.3:1). In the ESWL group right side stone was 21 (51.2%) while in the PCNL group right side stone was seen in 14 (35%), p value = 0.18. The left side stones were seen in 48.8% and 65% in ESWL and PCNL group respectively [Figure1].

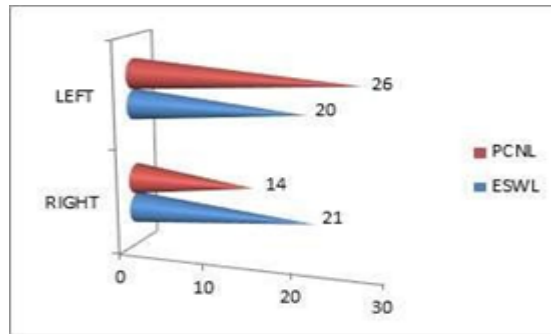


Figure 1: Right and left side stones

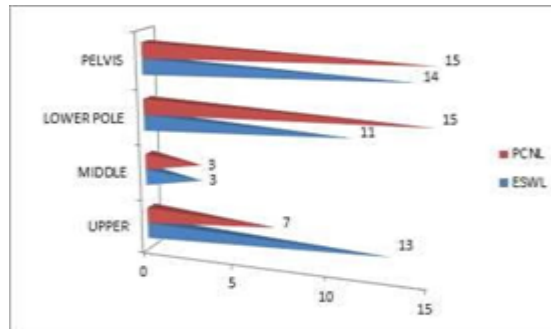


Figure 2: Stone location

There were 20 upper polar, 6 middle polar, 26 lower polar and 29 renal pelvic stones. The distribution in ESWL and PCNL in upper, middle, lower pole and pelvis was 13 (31.7%) and 7 (17.5%), $p=0.27$; 3 (7.3%)

and 3 (7.5%), $p=1.0$; 11 (26.8%) and 15 (37.5%), $p=0.3474$ and 14 (34.1%) and 15 (37.5%), $p=0.82$ respectively. The p value was calculated according to two tailed Fisher’s exact t test [Figure2].

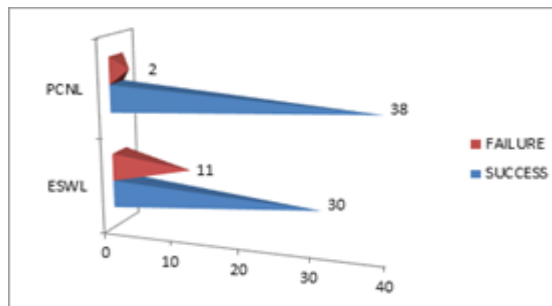


Figure 3: Stone clearance

The overall success rate at 3 months was 68 (83.95%) with 30 (73.17%) in ESWL and 38 (95.00%) in PCNL group, $p=0.0069$ (<0.05) by Chi-square test [Figure3]. The overall failure was 13 (16.05%) with 11 (26.83%) and 2 (7.32%) in ESWL and PCNL group respectively. The need for auxiliary procedure was 7 (17.07%) in ESWL and 2 (5%) in PCNL group, $p=0.1691$ by Chi-square test. The mean hospital stay in the two groups was 0.2 ± 0.89 days (range 0-3 days) and

5.725 ± 1.78 days (range 4-11days) in ESWL and PCNL group respectively, $p=0.0001$ (95% CI 4.90 to 6.14). The re-treatment rates in the two groups was 23/41 (56%) and 2 (5%) in ESWL and PCNL group respectively, $p=0.0001$. The blood transfusion in ESWL was 0 and 5 (12.5%) in PCNL group, $P=0.01$. The emergency admission rate was 3 (7.3%) and 1 (2.5%) in ESWL and PCNL groups respectively, $p=0.6259$. Complications were mostly minor and were found in 9.7% in patients undergoing ESWL as compared to 30% in

patients undergoing PCNL. The two-tailed P value equals 0.0446. Grade- I complications were seen in 3 (7.3%) and 5 (12.19%), Grade- II complications were seen in 1 (2.4%) and 5 (12.19%) and Grade III complications seen in 2 (5%) of PCNL.

Discussion

ESWL, URSL and PCNL have completely replaced the open surgery for renal stone management. ESWL is favored by many urologists as the treatment of choice for less than 2 cm renal stones as it is noninvasive. Nowadays PCNL is also gaining popularity for treatment of these stones. Literature is divided over the right choice between PCNL and ESWL for the management of renal stones 1-2 cm in size. [5-7] In our study, in PCNL group, 17 (42.5%) patients were in stone size between 1.0 cm to 1.5 cm and 23 (57.5%) were in stone size between 1.5- 2.0 cm. In ESWL group 44% were in stone size between 1.0-1.5 cm and 56% were in stone size between 1.5-2.0 cm. In our study the overall success in ESWL group at the end of 3 months was 73.17%, which is close to the result of Saxby et al, [8] reporting stone clearance of 75% for similar size stones. Okan Bas et al. [6] in their study observed stone free rate of 86% after mean of 2.6 sessions of ESWL. Complication rate evaluated by modified Clavien grading system was 7.6%. In a similar prospective study done by Anup et al. [17] on radiolucent stone of size 1-2 cm located at lower poles on Indian patients, the 3-month stone free rate of ESWL was 73.8%, the re-treatment rate was 63.4% and the auxiliary procedure rate was 22.2%. However Mc Dougall et al. [5] in a prospective study reported poor outcome, i.e., 50% stone clearance at the end of 12 weeks by ESWL. Rao et al. [10] in a prospective study done on 257 patients reported success rate of 69.3% at the end of 12 weeks by ESWL. Young Duk et al. [11] reported a clearance rate of 63.6% at the end of 12 weeks and another study by Yuruk et al. [13] had a success rate of 54.8%. One of the initial studies done by

Chariag et al [3] reported stone clearance of 92% by ESWL, probably because of unmodified Dormer and liberal use of shock wave till all the fragments got cleared. [12] In this current study, stone clearance in PCNL group after one sitting was 95%, which closely matches the result of Saxby MF et al. [8] Similar results were also reported by other workers like Albala et al [9] (92%), Rao et al [10] (94%), Young-Duk You et al. [11] (100%), Yuruk et al. [13] (100%), Deem et al [14] (85%), Joshua D Wiesenthal et al, [15] (95.3%), Okan Bas et al. [16] (98%) and NH Wankhade et al. [18] (97%). The nearly identical success rates of different investigators means that PCNL is not affected by other stone variables that affect ESWL outcomes. In the recent study of Anup Kumar et al., [17] the lower success rate after PCNL (86.1%) was probably because of difficulty in monitoring radiolucent stones under fluoroscopy. This is close to study done by Saxby MF et al, [8] Netto et al, [6] PP Rao et al, [10] and Anup Kumar et al. [17] In our study, mean post procedure hospital stay in PCNL and ESWL group was 5.72±1.78 days and 0.2±0.8 days respectively. The mean hospital stay is much less in ESWL group than PCNL group and this difference was statistically highly significant ($p < 0.0001$). Saxby et al. [8] noted similar findings. Grade- I complications were seen in 3 patients (7.3%) and 5 patients (12.19%), Grade II complications were seen in 1 patient (2.4%) and 5 patients (12.19%) and Grade III complications were seen in 0 and 2 patients (5%) of ESWL and PCNL respectively. These complications rate as per modified Clavien grade are similar to those observed in contemporary series. In Okan Bas et al. [16] study, Grade 1 complications were seen in 4% and 4%, Grade II complications were seen in 1.3% and 4% and Grade III complications were seen in 1.3% and 4% of ESWL and PCNL respectively. In the study of Anup et al., [17] Grade 1 complications were seen in 2% and 8% and Grade II complications

were seen in 1% and 2% in ESWL and PCNL respectively. No Grade III complications were seen. Fayad et al. [19] evaluated the difference between MPCNL and RIRS methods in the treatment of stones smaller than 2 cm at the terminal calyx. The results of their study showed that the size of the stones was 14.35 ± 0.98 mm and 14.35 ± 0.98 mm in the two groups respectively. In their study, the rates of stone absence were around 93% and 82% in MPCNL and RIRS methods, respectively. In another study, Albala et al. [20] investigated the treatment of urinary stones with a mean size of 14.43 mm at the lower calyx using PCNL and ESWL methods. They showed that the absence rate of stones was about 95% in PCNL group, which was significantly higher compared to the absence rate of stones in ESWL method which was 40%. Wiesenthal et al. [21] evaluated and treated 96 patients with urinary stones with 10 to 30 mm diameter with PCNL and ESWL methods. The results showed that the success percentage with PCNL method was 95.3%, which was significantly higher compared to the success rate of ESWL method (i.e., 63.4%). [22]

Conclusion

The success percentage of PCNL method is higher compared to ESWL method of treatment of stone size less than 2 cm.

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