

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

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## ABSTRACT

**Background:** 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 for either with PCNL(n=50) or with ESWL(n=50). Success rate and complications were recorded and analyzed. **Results:** 50 patients underwent ESWL and 30 patients had stone clearance in 1-3 months. 50 patients underwent PCNL out of which 40 patients had stone clearance. Complications were minor in nature and found in 12% of patients undergoing ESWL while 30% patients undergoing PCNL has minor complications. **Conclusion:** PCNL is superior to ESWL for renal stones of 1-2 cm in size.

**Keywords:** PCNL, ESWL, renal stones.

## 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 nephro-lithotomy (PCNL). 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 regarding success rate of stone clearance, and complications. This study was undertaken to evaluate success rate and complications of PCNL and ESWL in management of renal stones of size 1-2 cm.

## MATERIALS AND METHODS

After approval of the ethical committee, this prospective study was carried out to evaluate stone clearance of ESWL vs. PCNL in patients with renal stones of size 1-2 cm. The study was conducted at SCBMCH, Cuttack. Bilateral kidney stone,

radiolucent stone, stone size >2cm, Age < 12yrs or >75years, bleeding diathesis, pyonephrosis, severe hydronephrosis, and cardiorespiratory disease were excluded from the study. Patients in group A(50) were allocated for PCNL while in Group B(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, Intra Venous Urogram (IVU) and Non contrast CT (NCCT), hematology, biochemical and urine tests, were done to determine the stone site and size. For failed ESWL the auxiliary procedures like ureteroscopy/PCNL was done. The patients were followed up at one and three months 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, i.e., complete stone clearance, or clinically insignificant residual fragments (CIRF)  $\leq 4$  mm at three months. Complications were classified according to modified Clavien grading system. Patient of solitary renal calculus of 1-2 cm. were evaluated similar to PCNL. Measurement of Hounsfield Unit of renal stone during CT was done. All patients underwent ESWL using The Dormer 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 one and three months. Success included stone-free, 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

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significant residual fragments > 4 mm after three sessions of ESWL. Post ESWL instructions were rest for 7 days, plenty of oral fluids, to pass urine in a strainer for collection of stone, antibiotics for seven days with on demand analgesics till next x-ray. Patient and attendant 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 two 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 <0.05 was considered significant. Results were analyzed using Student's t-test and chi-square test, Fischer exact test multivariate analysis and one-way ANOVA.

### RESULTS

There was no significant difference in demographic parameters like age, sex and weight. 10 patients in PCNL group and 9 patients in ESWL group 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 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 respectively. [Figure 1]

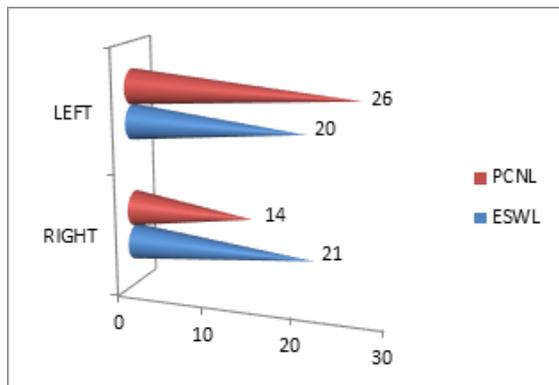


Figure 1: Right and left side stones

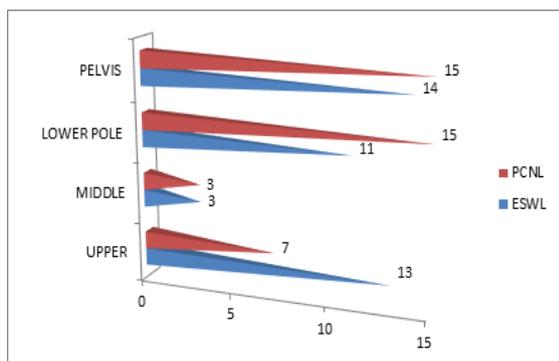


Figure 2: Stone location

There were 20 upper polar, 6 middle pole, 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=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 calculated according to two tailed Fisher exact t test. [Figure 2]

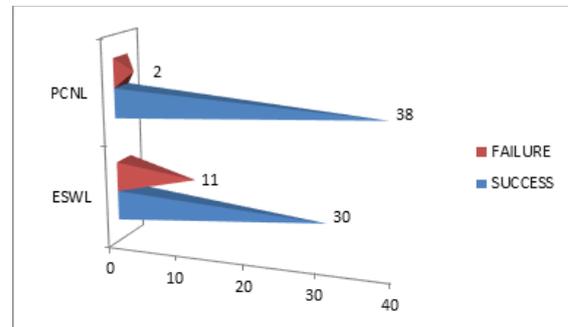


Figure 3: Stone clearance

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 value 0.0069 (<0.05) by Chisquare test. [Figure 3] The overall failure was 13 (16.05%) with 11 (26.83%) and 2 (7.32%) in ESWL and PCNL respectively. The need for auxiliary procedure was 7 (17.07%) in ESWL and 2 (5%) with p value =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- 11 days) with a p value -0.0001 (95% CI 4.90 to 6.14) in ESWL and PCNL respectively. The retreatment rates in two groups was 23/41 (56%) and 2 (5%) p value =0.0001 in ESWL and PCNL respectively. 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 value -0.6259. [Table 1] Complications were mostly minor and 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%), 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 none invasive. Now a days 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 1-2cm in size.<sup>[5-7]</sup> In our study, in PCNL group, 17 (42.5%) patients were in stone size between 1.0 cm to 1.5cm

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 three months was 73.17%, which is close to result of Saxby et al.<sup>[8]</sup> reporting stone clearance of 75% for similar size stones. Okan Bas et al.<sup>[6]</sup> 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.<sup>[17]</sup> on radiolucent stone of size 1-2 cm located at lower poles on Indian patients -3 month stone free rate of ESWL was 73.8%, the retreatment rate was 63.4% and the auxiliary procedure rate 22.2%. However McDougall et al.<sup>[5]</sup> in a prospective study reported poor outcome 50% stone clearance at the end of 12 weeks by ESWL. Rao et al.<sup>[10]</sup> 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.<sup>[11]</sup> in reported a clearance rate of 63.6% at the end of 12 weeks and another study by Yuruk et al.<sup>[13]</sup> had a success rate of 54.8%. One of the initial studies done by Chariag et al.<sup>[3]</sup> reported stone clearance of 92% by ESWL probably because of unmodified Dormer and liberal use of shock waves till all the fragments got cleared. In the current study, stone clearance in PCNL group after one sitting was 95.00% which closely matches the result of Saxby MF et al.<sup>[8]</sup> Similar results were also reported by other workers Albala et al.<sup>[9]</sup> (92%), Rao et al.<sup>[10]</sup> (94%), Young Duk You et al.<sup>[11]</sup> (100%), Yuruk et al.<sup>[13]</sup> (100%), Deem et al.<sup>[14]</sup> (85%), Joshua D. Wiesenthal et al.<sup>[15]</sup> (95.3%), Okan Bas et al.<sup>[16]</sup> (98%), NH Wankhade et al.<sup>[18]</sup> (97%). The nearly identical success rates of different investigators says that PCNL is not affected by other stone variables that affect ESWL outcomes. In the recent study of Anup Kumar et al.<sup>[17]</sup> the lower success rate after PCNL (86.1%) is probably because of difficulty in monitoring radiolucent stones under fluoroscopy. This is close to study done by Saxby M.F et al.<sup>[8]</sup> Neto et al.<sup>[6]</sup> P Rao et al.<sup>[10]</sup> and Anup Kumar et al.<sup>[17]</sup> In our study, mean post procedure hospital stay in PCNL and ESWL group was  $5.72 \pm 1.78$  and  $0.2 \pm 0.8$  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.<sup>[8]</sup> noted similar findings. Grade-1 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 patient (12.19%), Grade III complications seen in 0 and 2 patient (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.<sup>[16]</sup> study Grade 1 complications were seen in 4 % and 4 %, Grade II complications were seen in 1.3 % and 4%, Grade III complications seen in 1.3% and

4% of ESWL and PCNL respectively. In a study of Anup et al.<sup>[17]</sup> Grade 1 complications were seen in 2% and 8%, Grade II complications in 1% and 2% in ESWL and PCNL respectively. No Grade III complications were seen. Fayad et al.<sup>[19]</sup> 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 stones was  $14.35 \pm 0.98$  mm and  $14.35 \pm 0.98$  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.<sup>[20]</sup> 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.<sup>[21]</sup> evaluated and treated 96 patients with urinary stones with 10 to 30 mm diameter with two PCNL and ESWL method. The results showed that the success percentage with PCNL method was 95.3%, which is significantly higher compared to the success rate of ESWL method (i.e., 63.4%).

## CONCLUSION

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

## REFERENCES

1. Stamatelou KK, Francis ME, Jones CA, Nyberg Jr LM, CurhanGCJKi. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. 2003; 63(5):1817-1823.
2. Srisubat A, Potisat S, Lojanapiwat B, Setthawong V, LaopaiboonMJCdosr. Extracorporeal shock wave lithotripsy (ESWL) versus percutaneous nephrolithotomy (PCNL) or retrograde intrarenal surgery (RIRS) for kidney stones. 2014;11:1-5.
3. Charig CR, Webb DR, Payne SR, Wickham JE. Comparison of treatment of renal calculi by open surgery, percutaneous nephrolithotomy and extracorporeal shockwave lithotripsy. British Medical Journal Clinical Research Ed. 1986;292,(6524):879-883.
4. Mays N, Challah S, Patel S, Palfrey E, Creeser R, Vadera P, et al. Clinical comparison of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy in treating renal calculi. BMJ. 1988;297(6643):253-258.
5. McDougall E., Denstedt J., Brown R.D. Comparison of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy for the treatment of renal calculi in the lower pole calyces. J Endourol. 1989;3:265.
6. Netto NR Jr, Claro JF, Lemos GC, Cortado PL, Renal calculi in lower pole calyces: what is the best method of treatment? J Urol. 1991;146(3):7213.
7. Cass AS. Extracorporeal shock-wave lithotripsy or percutaneous nephrolithotomy for lower pole nephrolithiasis? Endourol. 1996;10: 17-20.

8. Saxby MF, Sorahan T Slaney P, Coppinger SWV ,A case-control study of percutaneous nephrolithotomy versus extracorporeal shock wave lithotripsy. Br J Urol 1997;79:317-323.
9. Albala DM, Assimos DO, Dayman RV, DenstedtJD,Grasso M, Gutierrez-Aceves J, et al.Lower pole I: a prospective randomized trial of extracorporeal shock wave lithotripsy and percutaneous nephrostolithotomy for lower pole nephrolithiasis-initial results. Journal of Urology 2001; 166(6):2072-80.
10. Rao PP, Desai RM, Sabnis RB, Patel HS, Desai MR ,The relative cost-effectiveness of PCNL and ESWL., for medium sized (<2 cms) renal calculi in a tertiary care urological referral center. Ind J Urol. 2001;17:121-3.
11. You YD, Kim JM, Kim ME. Comparison of the Cost and Effectiveness of Different Medical Options for Treating Lower Calyceal Stones Less than 2cm: Extracorporeal Shock Wave Lithotripsy versus Percutaneous Nephrolithotomy, Korean J Urol. 2006;47(7):703-707.
12. Preminger GM. Management of lower pole renal calculi: shock wave lithotripsy versus percutaneous nephrolithotomy versus flexible ureteroscopy. Urological Research. 2006;34(2): 108-11.
13. Yuruk E, Binbay M, Sari E, Akman T, Altinyay E, Baykal M, Muslumanoglu AY, Tefekli A. A prospective, randomized trial of management for asymptomatic lower pole calculi. Journal of Urology 2010;183:1424-1428.
14. Deem S, De-Fade B, Modak A, Emmett M, Martinez F, Davalos, Percutaneous nephrolithotomy versus extracorporeal shock wave lithotripsy for moderate sized kidney stones J. Urology. 2011;78:739-43.
15. Wiesenthal JD, Ghiculete D, Honey RJ, Pace KT. A comparison of treatment modalities for renal calculi between 100 and 300 mm<sup>2</sup>: are shockwave lithotripsy, ureteroscopy, and percutaneous nephrolithotomy equivalent? J Endourol 2011; 25: 481-5.
16. Okan Bas, Bakirtas H, Sener NC, Ozturk U, Tuygun CHN, Goksel Goktug MA. Bdurrahim mamoglu. Comparison of shock wave lithotripsy, flexible ureterorenoscopy and percutaneous nephrolithotripsy on moderate size renal pelvis stones. Urolithiasis, 2014;42(2): 115120-115125.
17. Kumar A, Kumar N, Vasudeva P, Kumar Jha S, Kumar R, Singh H. A prospective, randomized comparison of shock wave lithotripsy, retrograde intrarenal surgery and miniperc for treatment of 1 to 2 cm radiolucent lower calyceal renal calculi: a single center experience. J Urol. 2015;193:160-164.
18. Wankhade NH, Jayant Gadekar, Babaji B. Shinde, Tatte JA. Comparative Study of Lithotripsy and PCNL for 11-15 mm Lower Caliceal Calculi In Community Health Hospital. J Clin Diagn Res. 2014;8(6):12-14.
19. Fayad AS, Elsheikh MG, Ghoneima W. Tubeless minipercutaneous nephrolithotomy versus retrograde intrarenal surgery for lower calyceal stones of ≤2 cm: A prospective randomised controlled study. Arab J Urol. 2016;15(1):36-41.
20. Albala DM, Assimos DG, Clayman RV, Denstedt JD, Grasso M, Gutierrez-Aceves J, et al. Lower pole I: a prospective randomized trial of extracorporeal shock wave lithotripsy and percutaneous nephrostolithotomy for lower pole nephrolithiasis-initial results. Journal of Urology 2001;166(6):2076-80
21. Wiesenthal JD, Ghiculete D, Honey RJ, Pace KT. Evaluating the importance of mean stone density and skin-to-stone distance in predicting successful shock wave lithotripsy of renal and ureteric calculi. Urol Res. 2010;38(4):307-13

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