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Efficacy of ESWL in Comparison to PCNL for Uric Acid Stones upto 2cm

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ABSTRACT

Introduction: When looking through the literature, it's clear that majority of the researchers who compared traditional PCNL and ESWL don't agree on the stone clearance rate for uric acid stones between the two therapy methods. So, more research needs to be done in this area. The technique for having a high stone clearance rate should be suggested for people with kidney stones in the future. **Methodology:** The Department of Urology at the Institute of Kidney Diseases in Peshawar ran this randomized controlled study from July 2024 to December 2024. The trial included 160 patients, 80 in each group, who were between the ages of 15 and 55 and had symptomatic renal uric acid stones up to 2 cm in size. We did not include people with abnormal coagulopathy, people who had recently taken NSAIDs, people with urinary tract infections, pregnant women, people with abnormal upper urinary tract anatomy, or people with axial skeletal abnormalities. Group A had PCNL while group B had ESWL. Procedure was considered effective when there was the presence of no stones in the kidney except residual stone fragments < 4 mm on postoperative CT scan. **Results:** Patients in group A were an average of 35.86 years old, whereas patients in group B were an average of 38.05 years old. There were 160 patients, 84 of whom were men and 76 of whom were women. This means that there were 1.1 men for every woman. I found that PCNL and ESWL were 90.0% and 70.0% effective at clearing stones, respectively, with a p-value of 0.0016. **Conclusion:** We concluded that PCNL is better than ESWL at getting rid of stones in people with renal calculus ≤20 mm.

INTRODUCTION

People have had urinary stone illness since ancient times. Also, the number of people who get kidney stones has gone up in the previous few decades as the economy has grown. It is a prevalent cause of illness, with a lifetime frequency of 5–10%. Also, kidney stones are a recurring problem, with lifetime recurrence rates as high as 50%. Because of this, urolithiasis is thought to be a disorder that has a big impact on quality of life and socioeconomic factors.[1]

The ways to treat kidney stone disorders are changing every day, and there are now a number of urological technologies that can help people with symptomatic stone disease. Treatment options for renal and proximal ureteric calculi include extracorporeal shockwave lithotripsy (ESWL), flexible ureterorenoscopy (FURS), miniaturized percutaneous nephrolithotomy (mini-PCNL), and traditional percutaneous nephrolithotomy (PCNL), under the guidelines of the American Urological Association and the American Urological Association.[2,3] Ultrasound-guided lithotripters make the treatment easier and more effective, especially for uric acid stones that are less than 20 mm in size, because they are better at finding the stones directly.[4] Shock wave lithotripsy is now used to cure 96% of urinary tract stones. Once the stone's location is known, hundreds of shock waves are aimed at it, focusing on the exact spot to break it up into tiny pieces. These pieces, which are usually 1 to 2 mm long, are then naturally removed from the body by urine. Non-Contrast Computed Tomography (NCCT) is now the best way to diagnose renal colic and tell the difference between radiolucent urinary stones.[5] One study found that the stone removal rates for PCNL and ESWL were 90.8% and 76.3%, respectively.[6] The use of mini-PCNL approaches has expanded even more recently. You can now categorize them as Chinese mini-PCNL, micro-PCNL, mini-micro-PCNL, super-mini-PCNL, and ultra-mini-PCNL.[7]

When looking through the literature, it's clear that majority of the researchers who compared traditional PCNL and ESWL don't agree on the stone clearance rate for uric acid stones between the two therapy methods. So, more research needs to be done in this area. The technique for having a high stone clearance rate should be suggested for people with kidney stones in the future.

MATERIALS AND METHODS

The Department of Urology at the Institute of Kidney

Diseases in Peshawar ran this randomized controlled study from July 2024 to December 2024. Before the study began, it got the go-ahead from the ethical review committee. The trial included 160 patients, 80 in each group, who were between the ages of 15 and 55 and had symptomatic renal uric acid stones up to 2 cm in size (stones in the renal pelvis or calyces on x-ray KUB, pelvic ultrasound, or CT KUB with flank pain). The sample size for this experiment was based on the stone clearance rates for regular PCNL and ESWL, which were 90.8% and 76.3%, respectively[6]. The confidence interval was 95%, and the power was 80%. There are 160 patients in total, with 80 in each group. We did not include people with abnormal coagulopathy (high PT and APTT), people who had recently taken NSAIDs, people with urinary tract infections (pus cells in urine routine examination), stones larger than 20 mm on CT KUB or ultrasound, pregnant women, individuals with axial skeletal anomalies (scoliosis and kyphosis) or aberrant upper urinary tract anatomy (ectopic kidney, pelvi-ureteric junction blockage, and horseshoe kidney).

The study included only patients who met the requirements. A history, examination, and laboratory tests (including a coagulation profile, ALT, AST, serum creatinine, random blood sugar, CBC, and urine analysis) were performed on each patient. Additionally, they underwent radiographic examinations (non-contrast pelvic abdominal CT, pelvic abdominal ultrasonography, and X-RAY KUB). The person gave their informed permission. A consultant urologist with five years of experience and certification from the College of Physicians and Surgeons Pakistan did the procedure. A lottery randomly put patients into two groups, A and B. Group A had PCNL while group B had ESWL. In PCNL, the cystoscopy was done initially while the patient was lying on their back and the ureteric catheter was passed. After that, a Foley's catheter was put in place and attached to the ureteral catheter. Then, retrograde pyelography was done. We got to the kidneys through the skin with the help of fluoroscopy and a renal puncture needle that had a guidewire running through it. A single-step metal dilator was utilized to widen the tract to 17Fr, and a 12-Fr-sized small nephroscope was used. Using a pneumatic lithoclast, the stones were broken up into smaller pieces, which were then collected. A suitable nephrostomy catheter was put in at the end of the procedures and taken out the next day. After six weeks, the DJ stent was taken out. In ESWL Suit, ESWL was done. A proforma was used to write down all the information that was gathered.

We put the data into SPSS version 22.0. We found the mean and standard deviation for things like the patient's age, the length of the surgery, and the length of their hospital stay. We figured up the frequencies and percentages for things like gender, stone clearance, and any stones that were still there. We looked at and judged how well it worked. Stone clearance was broken down by age and gender to examine how it changed. We used the Post-Stratification Chi-Square Test and a P-value of less than or equal to 0.05 was seen as statistically significant. All of the results were shown in tables and graphs.

RESULTS

The average age of the participants in the study was 36.13 ± 8.78 years, and they ranged in age from 15 to 55. Group A patients were 35.86 ± 9.04 years old on average, whereas group B patients were 38.05 ± 8.86 years old on average. Of the 160 patients, 84 were men and 76 were women, resulting in a male-to-female ratio of 1.1:1. The average size of the stones in groups A and B was 14.80 ± 1.98 mm and 14.84 ± 2.32 mm, respectively. The average amount of time spent in surgery was 37.25 ± 3.87 minutes for group A and 49.73 ± 4.98 minutes for group B. Table 1 displays the distribution of the various variables in both groups.

In my investigation, the efficiency of PCNL and ESWL in terms of stone clearance rates was 90.0% and 70.0%, respectively, with a p-value of 0.0016 (Table 2). Table 3 shows how efficacy changes with age and gender.

Table 1

Distribution of different variables (n=160).

Variables		Group A (n=80)	Group B (n=80)
		Number (%)	Number (%)
Age (years)	15-35	42 (52.50%)	32 (40.0%)
	36-55	38 (47.50%)	48 (60.0%)
Gender	Male	41 (51.25%)	43 (53.75%)
	Female	39 (48.75%)	37 (46.25%)

Table 2

Comparison of Effectiveness (n=160).

Variable	Group A (n=80)		Group B (n=80)		P-value
	Yes	No	Yes	No	
Effectiveness	72 (90.0%)	08 (10.0%)	56 (70.0%)	24 (30.0%)	0.0016

Table 3

Stratification of Effectiveness with Respect to Age and Gender.

Variables		Group A (n=80) Effectiveness		Group B (n=80) Effectiveness		P-value
		Yes	No	Yes	No	
Age (years)	15-35	39 (92.86%)	03 (7.14%)	20 (62.50%)	12 (37.50%)	0.0013
	36-55	33 (86.84%)	05 (13.16%)	36 (75.0%)	12 (25.0%)	0.171
Gender	Male	38 (92.68%)	03 (7.32%)	29 (67.44%)	14 (32.56%)	0.004
	Female	34 (87.18%)	05 (12.82%)	27 (72.97%)	10 (27.03%)	0.119

DISCUSSION

This study shows that ESWL and PCNL are both safe and effective ways to treat kidney stones that are less than 20 mm in size. The results help us better grasp the pros and cons of each treatment method and are in keeping with what is already known about the topic.

PCNL has been shown to clear stones more quickly than ESWL, especially for larger stones. In this study, 90% of the patients were stone-free, which is a lot more than the 70% of ESWL patients (p=0.0001). This agrees with what Bozzini et al.[8] found, which backs up these results by showing that PCNL removed stones from infants at a higher rate than other methods.

The 2019 Junbo study[9] examined renal stones in the lower pole that ranged in size from 10 - 20 mm. Only 8 studies were included, and they included a variety of study designs. While the rate of complications was the same

after PCNL, the stone-free rate was higher than following RIRS or ESWL.

The success and stone-free rates of RIRS, PCNL, and ESWL were examined by Chung[10], who combined data from 35 studies using various techniques. It ignored the degree of certainty in the evidence. The success rate for ESWL was the lowest of the three available treatment options.

Kim[11] examined the effectiveness of RIRS, ESWL, and PCNL. Both RCTs and non-RCTs were included, and the degree of confidence in the evidence was not examined. The stone-free rate, retreatment rate, and auxiliary procedure rate were all significantly higher for PCNL and RIRS than for ESWL.

The goal of Kallidonis 2020[12] was to find the best way to deal with lower pole stones that were 20 mm or less in size. There was no published procedure for it, and it had 15 RCTs. It used Cochrane's risk of bias tool to check the quality of the studies that were included and GRADE to check the strength of the evidence. PCNL and RIRS had a higher rate of stone-free results than ESWL, although ESWL had a lower rate of complications.

Tsai[13] investigated six potential lower pole stone treatments in 2020: cautious monitoring, RIRS, PCNL, tiny PCNL, micro PCNL, and ESWL. There were 13 RCTs with 1832 participants in all. The study's plan was not documented. It employed the GRADE technique to assess the reliability of the evidence and the Cochrane risk of bias tool to evaluate the quality of the methodologies. ESWL had higher rates of retreatment and was the least effective treatment when compared to PCNL, tiny PCNL, and RIRS.

Because ESWL is a non-invasive treatment with a lower likelihood of initial complications, it is frequently the first choice. However, a number of factors, such as the stone's size and placement, affect how well ESWL works. The results of this study demonstrate that stones in the lower calyx or renal pelvis are more challenging to remove with ESWL and sometimes necessitate many sessions or further treatments, which is in line with earlier research.[14] ESWL is more effective on stones less than 2 cm but less effective on larger stones, especially those in the lower calyx where there are more leftover fragments, per a study by Burgos Lucena et al.[15]

Studies have shown that PCNL does not cause any significant long-term harm to the kidneys or impede their function, which shows that the operation is safe and effective in the long run. This is really important for babies because their long-term health is something that needs to be thought about. ESWL is usually safe, although there are concerns about how it can damage kidney function in the long run, especially in very young children. Researchers are still trying to figure out exactly what kind of damage many ESWL treatments can cause and how important it is for patients. But studies have shown that this kind of harm can happen.[16,17]

CONCLUSION

We concluded that PCNL is better than ESWL at getting rid of stones in people with renal calculus ≤20 mm. There were a lot less problems with PCNL than with ESWL. We think PCNL should be the first choice for treating renal calculus that is 20 mm or less.

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