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COMPARISON OF PERCUTANEOUS NEPHROLITHOTOMY AMONG PATIENTS WITH NEW VERSUS PREVIOUS HISTORY OF EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY

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Abstract:
Aim: To compare Percutaneous Nephrolithotomy (PCNL) among patients with new vs previous history of Extracorporeal Shock Wave Lithotripsy (ESWL).

Methodology: We conducted this cohort study at multiple centers including Akber Medical Complex, Mardan, KPK and Rizwan Medical Center, Peshawar, KPK in the duration from November, 2022 to April, 2023. Total 150 patients at Urology department, patients were divided in two groups, Group A had patients who had previous history of ESWL while Group B had patients with no history of ESWL. The outcomes and complications between both groups were assessed.

Results: Patient's mean age recorded was 44.55±9.2 years. Mean size of the stones was 520.2±76.04 mm^2. The stone free rate was achieved in 78.7% patients in group A while in group B 82.7% (P = 0.53). No significant difference was seen in operative time between both groups, hospital stay was significantly lower in group A (P = 0.04). No significant difference was seen between both groups regarding complications (P = 0.96).

Conclusion: We conclude that patients with a prior history of extracorporeal shock wave lithotripsy (ESWL) who undergo percutaneous nephrolithotomy (PCNL) exhibit comparable rates of stone clearance and incidence of adverse outcomes to those found in PCNL cases without prior shock wave lithotripsy treatment.

Keywords: Stone Free Rates, PCNL, Renal Stones, Complications, Shock Wave Lithotripsy

INTRODUCTION:

The treatment of kidney stones, a condition known as nephrolithiasis, has witnessed significant advancements over the years, with various minimally invasive techniques aimed at providing

effective relief to patients [1]. Among these, percutaneous nephrolithotomy (PCNL) has emerged as a cornerstone intervention for the management of renal calculi [2]. A question that has recently come into focus within the urological community pertains to the comparative outcomes of PCNL among patients with a new history of extracorporeal shock wave lithotripsy (ESWL) versus those with a previous history of ESWL [3].

ESWL has been a popular choice for treating kidney stones due to its non-invasive nature. This procedure employs shock waves to fragment stones into smaller, passable fragments, minimizing the need for surgical intervention [4]. Many patients find ESWL appealing because it offers a relatively quick and painless way to address kidney stones. However, its effectiveness may vary depending on stone size, location, and composition. Moreover, some patients experience stone recurrence or incomplete stone clearance after ESWL, necessitating additional treatments [5-7].

PCNL, on the other hand, is a minimally invasive surgical procedure that involves creating a small incision to access and remove kidney stones. It is often considered when ESWL is deemed less suitable or has failed to provide adequate stone clearance. PCNL offers the advantage of directly addressing stones of varying sizes and compositions, making it an essential tool in the urologist's arsenal [8-10].

ESWL is the gold standard treatment for renal stones that are less than 2 centimeters in size. While PCNL is utilized for calculi that are more difficult and measure more than 2 centimeters in size [11]. Because the ESWL therapy costs not that much therefore, on average each session, those with moderate incomes can now easily afford to have the procedure done. Because of this, SWL has been misused in recent years, particularly in areas with less developed infrastructure and hospitals that are not academic [11, 12].

As we embark on this exploration, we anticipate uncovering valuable insights that will contribute to the ongoing dialogue surrounding the optimal treatment pathways for kidney stones. The results of this comparative analysis hold the potential to enhance the management strategies for nephrolithiasis, ultimately improving patient outcomes and quality of life.

MATERIAL AND METHODS:

The present cohort study was carried out at multiple centers including Akber Medical Complex, Mardan, KPK and Rizwan Medical Center, Peshawar, KPK in the duration from November, 2022 to April, 2023, subsequent to obtaining ethical approval from the hospital. The study excluded persons who displayed symptoms of congenital renal abnormalities, ureteropelvic junction obstruction, patients below the age of 18, individuals with abnormal coagulation profiles, those with current urinary tract infections, and participants who failed to attend follow-up appointments. Furthermore, participants who did not have CT scan studies prior to the PCNL surgery were excluded from the present study. The study involved a total of 150 participants who were divided equally into two groups: Group A, which consisted of individuals with a prior history of ESWL, and Group B, which included participants with no previous ESWL experience.

Prior to performing PCNL, all patients underwent non-contrast computed tomography (CT) scans in order to assess the size of the stones. Moreover, a comprehensive evaluation was performed, encompassing a complete blood count, serum electrolyte analysis, renal function tests, coagulation assessments, urine routine analyses, and culture testing. The difficulty of stones was evaluated by employing the Guy's stone score (GSS). Patients who were found to have bacterial colonies in their preoperative urine cultures were administered the necessary antibiotic treatment. The PCNL procedure was conducted utilizing the conventional approach, with the patient positioned in the prone posture.

The selection between the triangle or Bull's eye approach was contingent upon the particular case, with a predilection for accessing the lower pole as the entry point inside the calyx. The utilization of contrast-assisted opacification of the collecting system was implemented in order to enhance the secure insertion of an 18 G needle into the intended position within the kidney. Following this, a series of fascial dilators of progressively larger sizes were employed in conjunction with a

guidewire. Subsequently, Alken metallic dilators were inserted over the olive tip to establish a tract. A 24-30 French Amplatz sheath was introduced into the tract, facilitating nephroscopy for the purpose of identifying and extracting renal calculi. The Pneumatic Lithoclast device was employed for the purpose of stone fragmentation, while a three-prong grasper was utilized to facilitate the retrieval of stones. Following that, a 6 French double-J stent was placed in an antegrade fashion. The nephrostomy tube was fastened using silk thread. During the three-month follow-up session at the outpatient clinic, the medical professionals employed ultrasound and X-ray KUB techniques to evaluate the potential existence of any remaining stones. A satisfactory outcome of therapy was defined as the identification of residual fragments measuring ≤ 4 mm or the absence of any fragments on radiological examination. Multiple outcomes, such as the duration of the surgical procedure, the rate of successful removal of stones, the length of hospitalization, and the occurrence of complications, were documented for both cohorts.

The statistical analysis was conducted utilizing IBM SPSS 24. Numerical data was reported in terms of mean and standard deviation, while categorical data was provided as frequency and percentages. The Chi-Square test was utilized to assess the association between categorical variables, whereas the T-test was utilized to examine the differences between numerical variables. The chosen significance threshold for both tests was set at $P < 0.05$.

RESULTS:

We conducted this study on 150 patients having mean age of 44.55±9.2 years. The frequency of male patients was 98(65.3%) and female patients was 52 (34.7%). In 88 (58.7%) patients the renal stones were on the left side while in 62 (41.3%) patients renal stones were on the right side. The mean size of the stones was 520.2±76.04 mm^2. Regarding the outcomes between both groups, group A patients who had a history of ESWL, the stone free rate was achieved in 78.7% patients while in group B who had no history of ESWL had 82.7% stone free rate, the difference was not significant (P = 0.53). The mean operative time in group A was 141.15±33.61 minutes while 136.71±35.53 minutes in group B, there difference was not significant (P = 0.43), however we found significant difference between the mean hospital stay between both groups, the mean hospital stay in group A was 3.33±0.96 days and 3.68±1.08 days in group B (P = 0.04)

Regarding the postop complications between both groups we observed that in group A 12% patients had fever while in group B 10.7% patients had fever, in group A Ileus was found in 2.7% patients while in group B it was found in 4% patients, in group A the need for transfusion was needed in 4% patients while in group B 5.3% patients needed transfusion, in group A 5.3% patients had developed sepsis while in group B 6.7% patients had developed sepsis. We did not find any significant difference between complications in both groups (P = 0.96).

Figure 1 Gender distribution

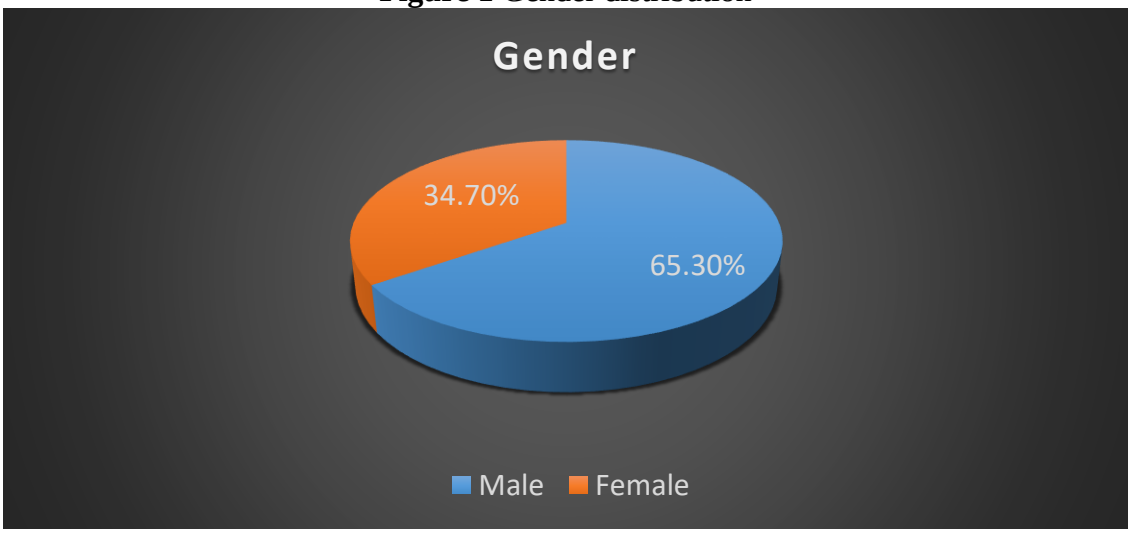

Table 1 Comparison of outcomes between both groups

Outcomes	Group A	Group B	P value
Stone free rate	78.7%	82.7%	0.53
Mean operative time (Mins)	141.15±33.61	136.71±35.53	0.43
Mean hospital stay (Days)	3.33±0.96	3.68±1.08	0.04

Table 2 Comparison of postoperative complications between both groups

		Groups		Total	P value
		Group A (History of ESWL)	Group B (No history of ESWL)		
Complications	Fever	9	8	17	0.96
		12.0%	10.7%	11.3%	
	Ileus	2	3	5	
		2.7%	4.0%	3.3%	
	Transfusion need	3	4	7	
		4.0%	5.3%	4.7%	
	Sepsis	4	5	9	
		5.3%	6.7%	6.0%	
	No complications	57	55	112	
		76.0%	73.3%	74.7%	
Total		75	75	150	
		100.0%	100.0%	100.0%	

DISCUSSION:

Extracorporeal shock wave lithotripsy (ESWL) is widely regarded as the preferred treatment modality for smaller renal calculi, specifically those measuring less than 2 cm in diameter. On the other hand, percutaneous nephrolithotomy (PCNL) is often employed for the treatment of bigger stones, particularly those of a complex nature that surpass a size of 2 cm. The affordability of extracorporeal shock wave lithotripsy (ESWL) per procedure has significantly increased, particularly for those with moderate incomes.[13] The accessibility of ESWL at a lower cost has led to its excessive utilization, particularly in underdeveloped regions and non-academic healthcare facilities. Recent studies have identified many variables that have been associated with decreased success rates in extracorporeal shock wave lithotripsy (ESWL). These characteristics include an increased skin-to-stone distance, elevated body mass index (BMI), higher stone Hounsfield units, and the presence of stones situated in the lower pole of the kidney. As a result, urologists are increasingly seeing patients who have previously had ineffective extracorporeal shock wave lithotripsy (ESWL) in their clinical practice.[14]

The repeated application of extracorporeal shock wave lithotripsy (ESWL) has the potential to induce alterations in renal morphology, including fibrous degeneration and distortion of the collecting system. The existing body of literature has a restricted number of studies that have investigated the effects of previous unsuccessful and frequent extracorporeal shock wave lithotripsy (ESWL) treatments on the outcomes and complications of subsequent percutaneous nephrolithotomy (PCNL).[15]

Extracorporeal Shock Wave Lithotripsy (ESWL) typically has a lower incidence of problems. When present, common acute consequences are associated with the mechanical harm induced by the shock waves. The impact of these shock waves has the potential to cause harm to delicate arcuate veins, resulting in the occurrence of interstitial bleeding and the formation of hematoma. Moreover, the renal cortex may experience segmental shrinkage, leading to the development of interstitial fibrosis. Regular extracorporeal shock wave lithotripsy (ESWL) treatments may potentially result in the displacement of stone particles towards the renal mucosa.[16] A study observed the constriction of the calyceal infundibulum and the deposition of stone fragments under the pelvicalyceal mucosal layer in individuals who had previously had unsuccessful extracorporeal shock wave lithotripsy (ESWL) procedures. In a similar vein, a separate investigation revealed that

the presence of stone fragments within the renal tissue and a constricted calyceal infundibulum raised the probability of residual stones following percutaneous nephrolithotomy (PCNL) surgery. Consequently, this led to lower rates of successful stone clearance among patients who had previously undergone unsuccessful extracorporeal shock wave lithotripsy (ESWL).[17]

A study found that there were no statistically significant disparities in terms of operating duration (measured in minutes), unfavorable outcomes of percutaneous nephrolithotomy (PCNL), and length of hospital stay between patients who had previously undergone open surgery or experienced unsuccessful extracorporeal shock wave lithotripsy (ESWL).[18] Aforementioned study findings indicated that the operational and fluoroscopic imaging durations were comparable among the study groups.[17] Similar to the above mentioned studies we also find no significant difference between operating time in both groups.

A study conducted by researchers revealed a greater occurrence of renal vascular damage among individuals who had previously undergone open renal stone operations[19]. Nevertheless, a separate investigation revealed that prior shock wave lithotripsy (SWL) interventions on the identical kidney did not have an impact on the efficacy rate, duration of surgery, occurrence of unfavorable surgical outcomes, or length of hospital stay subsequent to percutaneous nephrolithotomy (PCNL).[20] However, there was a higher incidence of bleeding observed in patients who had undergone prior shock wave lithotripsy (SWL) for renal stones. The duration of the surgical procedure and the volume of blood loss were observed to be elevated as a result of calculus pieces adhering to scarred tissues inside the renal pelvicalyceal system[21]. According to another study, percutaneous nephrolithotomy (PCNL) can be conducted with a reasonable level of safety in persons who have undergone prior surgical procedures, such as open stone surgery or previous PCNL. The meticulous manipulation of the nephroscope is of utmost importance in order to minimize the occurrence of significant problems, particularly in those who have undergone prior open renal surgery. The presence of scar tissue in the retroperitoneal region has the effect of diminishing the mobility of the kidneys. Additionally, if the nephroscope is handled in a harsh manner, it can generate a substantial torque, which in turn may lead to renal lacerations and bleeding. These problems can include vascular issues of considerable severity.[22]

CONCLUSION:

From our study we conclude that patients with a prior history of extracorporeal shock wave lithotripsy (ESWL) who undergo percutaneous nephrolithotomy (PCNL) exhibit comparable rates of stone clearance and incidence of adverse outcomes to those found in PCNL cases without prior shock wave lithotripsy treatment. Furthermore, it is worth noting that the previous occurrence of extracorporeal shock wave lithotripsy (ESWL) does not have a substantial effect on the duration of the surgical procedure. However, it does have a notable influence on the length of hospitalization.

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