How to Cite:
Shahzad, I., Hussain, K., Yousuf, M. A., Manzoor, M., Pathan, G. M., & Ahmed, T. (2023). Percutaneous nephrolithotomy using fluoroscopic guided renal access. *International Journal of Health Sciences*, *7*(S1), 1151–1157.
https://doi.org/10.53730/ijhs.v7nS1.14328

Percutaneous nephrolithotomy using fluoroscopic guided renal access

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***Abstract*---**Objective: To report our experience of over 500 patients treated with Percutaneous nephrolithotomy (PCNL) at a tertiary as well as secondary Care hospital. Despite PCNL's early success as a minimally invasive treatment option, its popularity has waned after the advent of extracorporeal shockwave lithotripsy (ESWL). Over time, however, urologists were forced to rethink the role of PCNL in the treatment of Urolithiasis after clinical experience with ESWL revealed its limitations, particularly for lower pole stones with anatomical complexity and the challenges faced for open surgical procedures, particularly stones in an intrarenal pelvis. Urologists have advanced into the era of ever-expanding PCNL versatility thanks to advancements in tools, camera systems, and intracorporeal lithotripsy technology, and they now have expert skills of percutaneous stone dissolution in to all parts of

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2023.
Manuscript submitted: 27 Feb 2023, Manuscript revised: 09 April 2023, Accepted for publication: 18 May 2023

the kidney. Patients and Methods: Between 2013 and 2019, 500 participants (358 males, 142 females, and aged 15-55 years) were addressed with PCNL by a single Urologist in our institution at both a tertiary care hospital and a secondary care hospital. Stones averaged 2.5 cm in diameter (ranging from 1.5 to 3.5 cm). Under fluoroscopic supervision, the calyx of either the lower pole or the upper pole of the kidney was perforated. With the use of a fluoroscope, the functional channel was widened with an Alken metallic dilator. Internal lithotripsy was performed via pneumatic probes. Results: Overall, 90% of patients were stone-free 4 weeks after PCNL; 82.4% were completely stone-free, 7.6% had therapeutically inconsequential residual stones that cleared on their own within 4 weeks, and 10% required supplementary treatments. In terms of mortality, one patient died of urosepsis, 3.5% of participants suffered urinary tract infections (without indications of urosepsis), 3.2% had renal colic, and 3.2% had upper urinary tract blockage, for a total early complication rate of 20%.10% patients required transfusion and 5 patients (.01%) developed prolonged bleeding thus underwent conventional renal angiography. Out of them 2 did not show any artherial blush and weretreated conservatively. 03 required angiographic embolization and one patient developed pleural injury during puncture due to high kidney position thus procedure was abandoned and was managed accordingly. Conclusions: These findings demonstrate that PCNL does not result in considerable blood loss or serious problems for the vast majority of patients. One of the best ways to lessen the likelihood of difficulties when using PCNL is to have it performed by a seasoned professional. The treatment of PCNL is a very effective method for the quick and risk-free elimination of stones.

Keywords---percutaneous nephrolithotomy, urinary calculi, lithotripsy.

Introduction

It was in the 1970s when percutaneous nephrolithotomy (PCNL) was developed as a minimally invasive method of removing kidney stones [1]. However, ESWL's arrival in the mid-1980s led to a decline in PNL's popularity [2]. Practical training with ESWL has exposed its limitations in recent years, and as a result, the function of PNL in treating urolithiasis has been rethought. Urologists have found that PNL is preferable to ESWL for some patients; this is especially true when dealing with large or numerous kidney stones or stones located in the inferior clayx [3]. Stone-free rates of >90% [4] are now possible with to advancements in tools and lithotripsy technologies such as ultrasonography, pneumatic devices, the holmium:yttrium-aluminium-garnet laser, and flexible nephroscopes.

When properly performed, PNL is a safe therapeutic option with a low risk of complications.

The initial puncture may cause further complications if it injures a vital organ nearby. Post-operative bleeding, UTIs, and fever are other possible problems. An access site for the kidney can be placed by US or fluoroscopic guidance. We also discuss our experience with Fluoroscopic-guided PCNL in more than 500 patients in a combination tertiary and secondary care setting, while PNL is often performed only under fluoroscopic guidance in North America.

Patients and Methods

Between 2013 and 2019, 500 patients (358 men, 142 females, mean age 35 years, range 15-55years) with calculi received PCNL at our facilities after a standard preoperative evaluation. This information was gathered in retrospect and analysed for its significance. The pre-PCNL stone position is depicted in.

Table 1

STONE LOCATION	MALE IN NUMBERS (n=358%)	FEMALE IN NUMBERS (n=142%)
RENAL PELVIS	238	99
UPPER CALYX	45	15
LOWER CALYX	43	20
MULTPLE CALYX	32	08

The prone posture was used for each and every surgical operation. Initial puncture and the rest of the treatment were carried out in a specialised urological operating room while the patient was under general anaesthesia. Every operation was performed by the same urologist. Every single patient was put into the lithotomy posture, and then a 5Fr lithotomy stone was inserted into their urinary tract using a cystoscope. A foley urethral catheter was threaded into the patient's urethra and anchored at the PUJ using a ureteroscope. Injecting contrast dye or methylene-blue dye through the ureteric catheter allowed doctors to see inside the pelvicalyceal system, and occluding the pelvi-ureteric junction stopped any small stone particles from travelling down the ureter. The patient was placed in the prone position, and the kidney was perforated via the appropriate calyx using standard technique and fluoroscopic supervision.

Under fluoroscopic supervision, a needle of either 18 G or 16 G size was inserted into the correct calyx. In order to minimise radiation exposure and establish the briefest straight tract here between skin and calyx, we utilized a fluoroscopic facilitated puncture through the fornix of the desired calyx, allowing a peripheral puncture. This allowed us to traverse minimal cortical tissue, prevent harm to any main intrarenal vessel, and prevent any visceral injury.[5] A 0.032-inch floppy-tipped guidewire was

then inserted into the collecting system via the needle. Under fluoroscopic guidance, the working channel then widened to 27 Fr utilizing Alken telescoped steel dilator; this allowed for the proper placement of an amplantz sheath.[6] Afterward, a pneumatic lithotripsy probe was used to find the stone, and a standard 26 F nephroscope subsequently inserted into the kidney via the tract to destroy it. The Swiss lithoclast, an ultrasonic lithoclast, and an electrohydraulic probe were used for the fragmentation process. Forceps and a saline flush were used to collect the fragments. After percutaneous nephrolithotomy (PCNL), a nephrostomy tube consisting of a 16 to 18 Fr Foley catheter has been inserted.

A plain x-ray of the KUB was performed 24 hours after the procedure, and the nephrostomy tube, foley, and urteric catheter have all been removed the next day if there were no remaining Calculi. We analyzed the frequency and nature of complications, paying particular mind to haemorrhaging and damage to the neighbouring organs. When bleeding was so severe that the operation had to be aborted and/or a blood transfusion was needed, it was deemed a significant complication.

Results

Out of the total 500 patients, 290 had stones in their right kidney and 210 in their left; the average (range) time spent in surgery was 60 minutes. The majority (67.4%) of the stones treated were located in the renal pelvis, whereas the rest occurred elsewhere in the body (TABLE.1). The overall rate of stone-free patients was 90% four weeks following treatment (N-450—-). Eighty-two percent (N = 412) of patients experienced complete stone freedom immediately following a single PCNL, and 7.6 percent (N = 38) experienced spontaneous stone passage within 4 weeks.

Table 2

TREATMENT SUCCESS RATE	RATE IN MALES (N)--------	RATE IN FEMALES (N)------
PRIMARILY STONE FREE	310	102
CLINICALLY INSIGNIFICANT RESIDUAL STONES	17	21
AUXILLIARY PROCEDURES	31	19

In conclusion, 450patients (90%) only required one PNL, whereas the remaining 50 (10%) required additional procedures. There were a total of 27 ancillary procedures because numerous individuals required more than one additional intervention. A total of 26.4% of primary PCNLs (132 patients) experienced early complications, the most prevalent of which were transitory fever in 72 patients (54.5%), clinically relevant bleeding in 12 cases (9.09%), or both. Twenty-four percent (24.24%) of patients experienced UTIs (without urosepsis), while another twenty-seven percent (27.27%) experienced clinically insignificant bleeding, fever, and a UTI;

five percent (3.7%) experienced renal colic due to urinary tract obstruction; and thirty-three percent (40.03%) needed blood transfusions.

The occurrence of early complications demonstrated in Table. 3.

COMPLICATIONS OF	PRIMARY PCNL N=132(26.4%)
Transient fever	72(54.5%)
Clinically significant bleeding	12(9.09%)
Both the above	04(3.03%)
UTI	32(24.24%)
Renal colic	5(3.7%)
Blood transfusion requirement	40(30.3%)
Angio-embolization	3(2.27%)
Clinically insignificany bleeding,fever,UTI	36(27.27%)

Discussion

While ESWL was formerly the gold standard for managing renal stones, the development of PCNL and its subsequent successful application have made it essential. Patients with complicated stone disease can benefit from PCNL because it optimises stones clearance with little renal damage [7]. The elderly, minors, the morbidly obese, and those with renal abnormalities such PUJ blockage or horseshoe kidneys are all safe candidates for PNL [5,8-10]. In addition, in certain patients [11,12] percutaneous therapy of bilateral renal stones is both safe and efficacious. In order for PCNL to be successful, an optimal access tract must be attained. Minerals in the renal pelvis, as well as those found in the middle or inferior calyx, can be passed through a subcostal route in the posterior middle calyx or inferior calyx. Some writers [13] recommend entering the ureter through the superior calyx to remove stones in the upper ureter or staghorn stones. According to the current findings [14-16], the total stone-free percentage following PCNL is between 71% and 95%, based on stone the size and location. After 4 weeks, 90% of patients were stone-free; 82.4% were completely stone-free, 7.6% had minimal residual stones following a single PCNL, and 10% required additional treatment.

Only 26.4% of the current treatments experienced difficulties, despite known postoperative complications for percutaneous procedures reaching up to 83% [15,17]. Most were not life-threatening and responded well to non-invasive treatment, with few blood transfusions and no need for emergency surgery. Previous findings indicate that between 1% and 11% of patients undergoing percutaneous surgery on the kidneys would experience bleeding, necessitating a transfusion of blood plasma or whole blood [15,17,18]. However, in 3% of individuals [17,19], significant haemorrhage with indications including hypotension, shock, or renal

failure may occur. Renal access which is not anatomically precise is associated with heavy bleeding. The ideal route of entry is similar to a tiny radial nephrotomy through a region of avascular transparenchyma. 9.09% of patients experienced bleeding severe enough to warrant a blood transfusion during this study. This phase of percutaneous surgery, the nephrostomy tract, could be dilated with a set of coaxial Alken dilators, which allowed for excellent intraoperative bleeding control. Renal angioembolization was necessary for 5 individuals.

In 02patients no source was identified, probably it was venous and by the time patient was put to the burden of angio-embolization it spontaneously stopped.03 patients underwent angioembolization with coils and thereafter discharged home safely. A total of 54.5% of patients experienced a temporary fever, which was treated conservatively with antibiotics based on urine cultures repeated after the procedures. This also shows that stones do harbor bacteria's which become obvious after stone fragmentation thus make it necessary to do a stone culture post-operatively. Although in this study we did not conduct any stone cultures .There was one case of pneumothorax which became obvious on initial puncture thus procedure was abandoned, which was due to supracostasl puncture in an excessively higher position of the kidney. In rest of the cases we did not encounter any injuries to the surrounding organs.

We attribute this success to the well-trained Surgeon who performed the surgeries as well as the careful selection and placement of the piercing into the target calyx using fluoroscopic guidance. The most crucial part of the treatment is having access to the pelvic region through the calyx of choice, which is why, unlike in our series, it is performed by a qualified urologist and not a radiologist. In addition, with the exception of one treatment, all of the current operations were performed through a subcostal incision, which eliminates the risk of intrathoracic complications such as hydrothorax or pneumothorax. Patients with renal stones treated by PCNL can experience a substantial decrease in the morbidity associated to percutaneous renal surgery provided the percutaneous tract is established and the procedure is administered by a well-trained team. In essence, the current findings demonstrate that PCNL does not result in serious blood loss or any serious consequences. Complications from PCNL are less likely when performed at an established facility. The findings demonstrate that PCNL is a reliable method for removing stones quickly and safely.

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