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Supine Percutaneous Nephrolithotomy: Single centre initial experience in Nigeria

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Abstract

Background: Large and complex kidney stones represent one of the most challenging urological pathologies. Percutaneous nephrolithotomy (PCNL) is the treatment of choice in these cases. Supine PCNL enables a single positioning throughout the procedure with numerous benefits. We set out to analyse our initial experience of this procedure.

Aim: To review the outcomes of initial cases of Supine PCNL in a West African setting.

Materials and methods: A retrospective, observational study was conducted on patients who underwent supine PCNL between March 2022 and March 2024 at Eleos Specialist hospital, Umuahia, Nigeria. All the patients, irrespective of their age and gender, whose renal stones needed treatment in the form of PCNL as the primary treatment were included in the study. The study excluded patients with previously operated kidneys, and uncontrolled coagulopathies. Informed consent for the procedure was obtained from the patients.

Results: The total number of participants were eight with average age of 60.1 years. Three were females, five were males. The largest stone had a diameter of 5.6cm, while the smallest was 1.2cm, while the average size is 3.14cm, with average stone clearance of 90%. Average time of surgery was 161.7minutes and average post-operative admission duration was 4.9 days. In 2 cases, ancillary procedures were necessary for complete stone clearance. One patient had gaseous dilation, fever and vomiting, the other had fever.

Conclusion: Supine PCNL can be done safely in our setting with comparable outcomes to those in other climes.

Keywords: Supine PCNL; Percutaneous Nephrolithotomy; Nephrolithiasis; Kidney Stones; Staghorn Calculi; Pneumatic lithotriptor

1. Introduction

Percutaneous nephrolithotomy (PCNL) was first described by Fernström and Johansson in 1976 in the prone position. Initially, it was considered the only position to obtain renal access due to increased concerns about colonic and vascular injury associated with alternative positions.[1,2] In 1987, Valdivia Uría postulated that PCNL could be performed in the supine decubitus position and, using preoperative CT scans for patient evaluation, demonstrated similar outcomes and complications for PCNL performed in the prone position. He described potential advantages in terms of ergonomics, and the administration of anesthesia.[3] Though prone position remains the dominant position for PCNL, the use of supine PCNL is on the rise—20% of all PCNLs entered into the Global PCNL study of the Clinical Research Office of the

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Endourological Society were performed in the supine position.[4] Supine PCNL has several advantages including reduced anaesthetic complications, cardiovascular compromise, and reduced radiation exposure of the surgeons.[2]

2. Materials and methods

A retrospective observational study was conducted on patients who underwent supine PCNL between September 2023 and March 2024 at Eleos Specialist Hospital, Umuahia, Nigeria. A consultant urologist with experience in Supine PCNL performed the surgery on patients with renal stones. All the patients, irrespective of their age and gender, whose renal stones needed treatment in the form of PCNL as the primary treatment were included in the study. The study excluded patients with previously operated kidneys and uncontrolled coagulopathies. Informed consent for surgery was obtained from the patients.

All the patients were assessed preoperatively through proper history taking, clinical examination, and laboratory parameters, including full blood count, serum creatinine, and urine culture. An expert radiologist performed ultrasound of the kidney, ureter, and urinary bladder. A computed tomography (CT) urography was performed to understand the pelvicalyceal anatomy and the location, number, and size of the stones. The sum of all the stones was taken to determine the size of multiple stones.

Data was collected from the clinical notes, operation notes and radiology database. Patient information like age, sex, and American Society of Anesthesiologists (ASA) status was obtained. The case sheets provided information on comorbidities such as diabetes, hypertension, ischaemic heart disease, malignancy, and glomerular filtration rate. Data on previous renal stone treatment and urolithiasis risk factors such as hyperuricaemia and hypercalcaemia were also collected.

The anaesthetist's and surgeon's notes were used to obtain information regarding the type of anaesthesia, surgical procedure, and stone clearance rate achieved after the procedure. Data regarding operative time, number of days in the hospital, complications (both short—and long-term), and need for blood transfusion were obtained from the hospital clinical record.

In all cases, they received preoperative antibiotics in the form of cephalosporins or according to a urine culture sensitivity report. The surgery was performed under combined Spinal and Epidural Anaesthesia or General anaesthesia. The Galdakao-modified supine Valdivia position was used in all cases. A pelvicalyceal system puncture was made by the operating surgeon under fluoroscopic guidance. All the punctures except one were made through the lower calyx. One puncture was made through the middle calyx. A 5F ureteric catheter was placed into the PCS. A 24Fr Amplatz sheath was used to extract stone fragments. In all cases, stones were fragmented by pneumatic or laser lithotriptor. At the end of the procedure, a Double-J (DJ) stent with or without a nephrostomy tube was used to obtain postoperative drainage.

All cases were followed up for postoperative complications. Patients were discharged with a dry nephrostomy tube site and in an afebrile condition.

3. Results

The mean age of patients included in the study was 61. 5 (55.6%) of them were males while 3 where females. Regarding stone properties, 30.0% of patients had stones lodged in the mid pole and lower pole of the left kidney, respectively, followed by 10% who had stones lodged in the staghorn of the left kidney, and the staghorn, mid pole, and the lower pole of the right kidney respectively. The mean stone size was 3.14 centimetres. Of the nine surgeries performed, complete stone clearance was achieved in 4 (44.4%) of the patients with 3 (33.3%) and 2 (22.2%) achieving above and less than 80% stone clearance respectively. Of those with insufficient stone clearance, 2 (40%) received ancillary procedures for residual stones. Post-operatively complications like bleeding, fever, gaseous dilation and vomiting were recorded in 50%, 25%, 12.5% and 12.5% of patients, respectively. However, only 3 (33.3%) received a blood transfusion. The mean pint of blood transfused was 1.67 pints.

3.1. Section A: Socio-Demographic details

Table 1 Socio-demographic detail of patients.

Variable		Frequency (n)	Percentage (%)	Minimum	Maximum
Age	Mean ± SD	61 ± 11.30		43	74
Gender	Male	5	62.5		
	Female	3	37.5		

As highlighted in Table 1, the mean age of patients included in the study varied between 43 years to 74 years with a mean ± standard deviation of 61 years ± 11.30 years

3.2. Section B: symptoms

Table 2 Symptoms of patients

Variable		Frequency (n)	Percentage (%)
Symptom	Right flank Pain	5	55.6
	Left Flank Pain	4	44.4

5 (55.6%) of patients presented with symptoms of right flank pain, while 4 (44.4%) presented with symptoms of left flank pain.

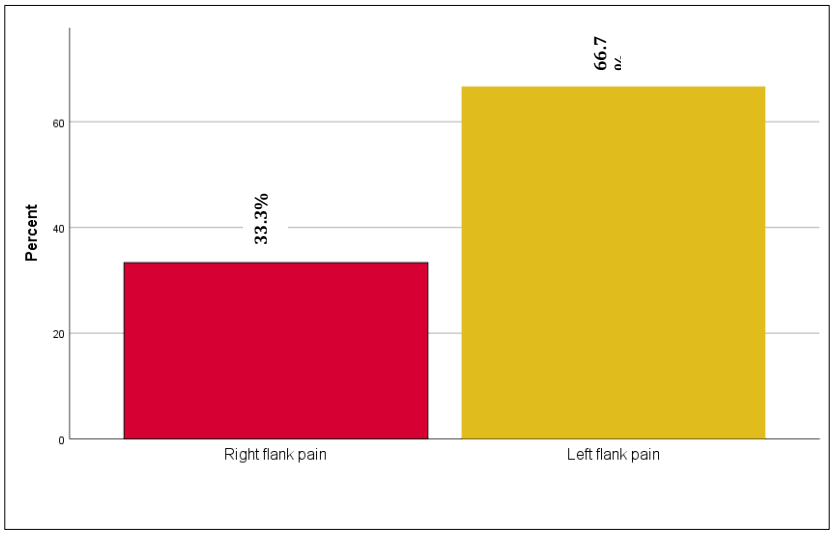

Figure 1 Symptom presentation of patients

3.3. Section C: Stone properties

An analysis of Table 3 reveals that 30.0% of patients had stones lodged in the mid pole and lower pole of the left kidney, followed by 10% who had stones lodged in the staghorn of the right kidney and the staghorn, mid-pole, and lower pole of the right kidney respectively. In general, 88.9% of the patients had less than 5 kidney stones while 1 had over 5 kidney stones.

Table 3 Stone properties of patients

Variable		Frequency (n)	Percentage (%)	Minimum	Maximum
Stone Diameter	mean ± SD	3.14 ± 1.41		1.2	5.6
Stone Location	Staghorn right kidney	1	10.0		
	Mid-pole right kidney	1	10.0		
	Lower pole right kidney	1	10.0		
	Staghorn left kidney	1	10.0		
	Mid-pole left kidney	3	30.0		
	Lower pole left kidney	2	30.0		
Number	≤ 4	8	88.9		
	≥ 5	1	11.1		

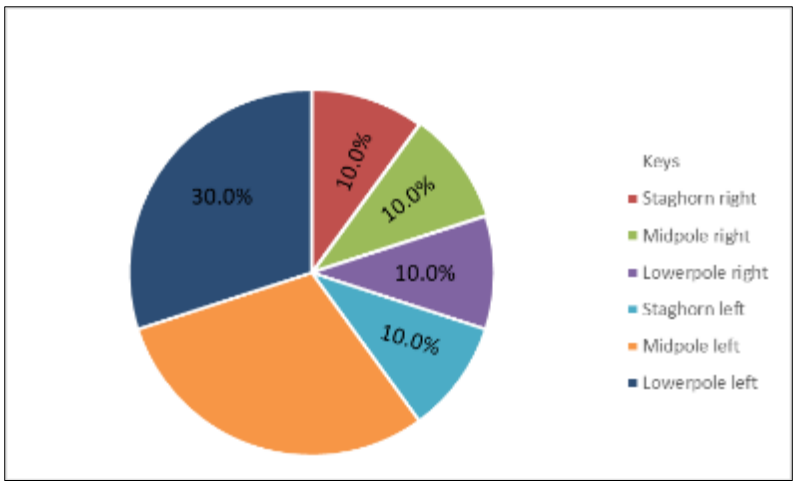

Figure 2 Location of kidney stones

3.4. Section d: clinical and surgical characteristics

Table 4 Clinical and surgical parameters of patients

Variable		Frequency (n)	Percent (%)	Minimum	Maximum
Comorbidities	Yes	2	25.0		
	No	6	75.0		
Anesthesia	General	2	25.0		
	Spinal and Epidural	6	75.0		
Surgery Position	Left	6	66.7		
	Right	3	33.3		
Route of extraction	Mid pole	5	55.6		
	Lower pole	2	22.2		
	Mid pole & lower pole	2	22.2		
Stone clearance	≤ 80%	2	22.2		

	81 - 99%	3	33.3		
	100%	4	44.4		
Ancillary Procedure	Yes	2	40.0		
	No	3	60.0		
Complications	Bleeding	4	50.0		
	Fever	2	25.0		
	Gaseous dilation	1	12.5		
	Vomiting	1	12.5		
Duration of surgery	Mean ± SD	161.67 ± 61.52		75	250
Blood Transfusion	Mean ± SD	1.67 ± 0.58		1	2
Post-surgical stay	Mean ± SD	4.89 ± 3.66		3	14

Pre-operative investigation revealed that 2 (25%) of patients had a comorbid condition (hypertension) while 7 (75%) had no comorbidity. Prior to the surgery, 2 (25%) of patients received general anaesthesia and (75%) received spinal and epidural anaesthesia. 6 (66.7%) of the surgeries were performed on the left side and 3 (33.3%) on the right side with kidney stones being extracted from the mid pole (55.6%), lower pole (22.2%) and through both the mid and lower pole (22.2%). 100% stone clearance was recorded in 4 (44.4%) of the cases, followed by 3 (33.3%) of cases where 81 – 99% stone clearance rate was recorded, and 2 (22.2) with ≤ 80% stone clearance. Of 5 patients with residual stones, 2 (40%) received ancillary procedures targeted at residual stones. Table 4 also reveals that the time taken to perform PCNL surgeries ranges from 75 minutes to 250 minutes with a mean ± standard deviation time of 161.67 ± 61.52. Post-surgical complications were recorded for all except one patient with bleeding (50%) been the most prominent complication followed by fever (25%) and gaseous dilation (12.5%) and vomiting (12.5%). 3 (33.3%) patients out of the 8 received blood transfusion with the mean transfused blood being 1.67 pints.

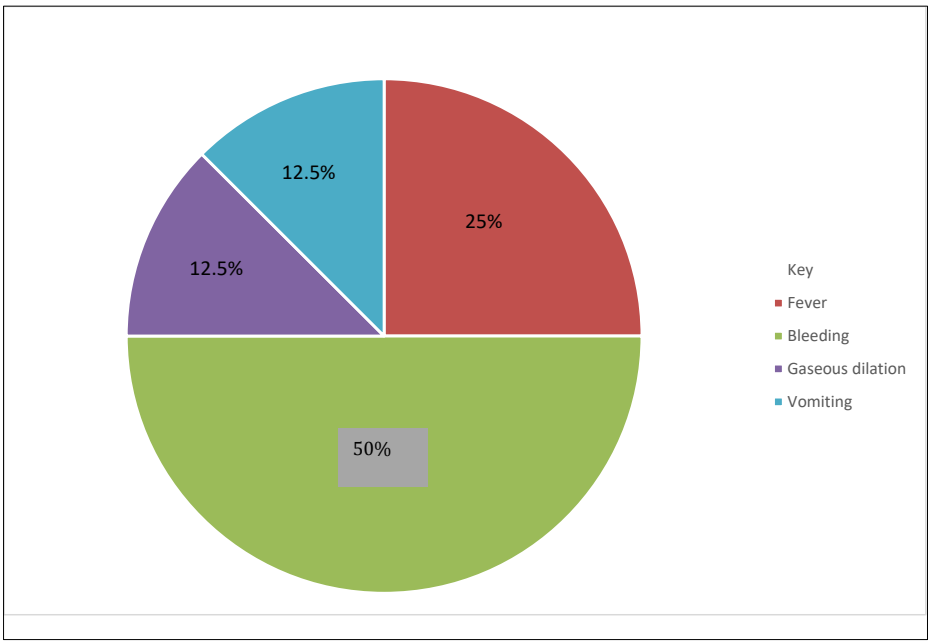

Figure 3 Complications of supine percutaneous nephrolithotomy

4. Discussion

Supine PCNL allows one positioning of the patients throughout the entire operation hence reduction in theatre time, facilitates patient monitoring and ventilation by the anesthesiologist, enables a combination of PCNL and RIRS, and provides the surgeon with the option of operating in a seated position [5].

In this report, supine PCNL was used in 8 patients; the mean age of the patients was 60.1years. The average operative duration, including the time of ureteric catheter insertion, was 161.7mins. Nour et al reported a duration of 130 (90–210) min.[6] Mean operative times of 85 and 98 min were reported by Valdivia et al. and Falahatkar et al. [7,8], respectively. Hoznek et al reported a mean (range) operative duration of 123 (50–245) min.[9]

Several studies have confirmed that there are no limitations in terms of stone size.[5] This report included 2 patients with staghorn stones (25%) and the mean (range) stone burden was 31.4mm (12–56) mm. Seven patients (14%) with a staghorn stone were included in the study of Hoznek et al. [5]. Falahatkar et al. included 11 patients (9%) with a staghorn stone in their study and Nour et al had 12 patients (22%) with staghorn stones[6,8]. Manohar et al reported 11% of patients with staghorn stones.[10]

The average stone clearance was 90%; this was comparable to the rate reported by Manohar et al.and Nour et al 95% & 91% respectively.[6,10] Hoznek et al, Lim et al and Falahatkar et al.achieved a stone clearance rate of 81%, 66.7% and 77.5%, respectively.[8,9,11] This might be because the number of patients in this report was less than in the other three. Shoma et al.found a stone clearance rate of 89% in their study that included 53 patients.[12] A similar result was given by De Sio et al., who reported a stone clearance rate of 88.7% in their study of 39 renal units.[13]

There were grade II complications in 4 of the patients (50%), graded according to the Clavien system.[6] There was bleeding requiring a transfusion in three patients. Other complications include fever, vomiting. There was no incidence of colonic perforation. Similar complications have been reported in literature. Manohar et al and Nour et al reported bleeding but with a lower ratio of patients needing transfusion.[6,10] Hoznek et al in addition to the above reported urinary fistula in 2 patients.[9]

List of abbreviations

- Percutaneous Nephrolithotomy (PCNL)
- American Association of Anaesthesiologists (ASA)

Conclusion

Supine PCNL can be safely performed in the Nigerian setting with comparable outcomes as what is obtainable in other climes. The performance of this procedure in a position that requires lesser human resources as well as prone to lesser anaesthetic complications makes it appealing as far as the skills for this technique is available.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Was obtained from the health and ethics committee of the Federal Medical Centre, Umuahia, Nigeria.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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