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ORIGINAL ARTICLE

Supine Percutaneous Nephrolithotomy Under Spinal Anaesthesia: Our Experience Of 365 Cases

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ABSTRACT

Aim:To determine the safety and efficacy of supine PCNL under spinal anesthesia (SA).
Methods: It's a review of secondary data of 365 caseswho underwent supine PCNL under Spinal anesthesia from April 2015 to December 2021. We determined the Outcomesof the procedure in terms of the operation time,stone clearance rate, hospital stay, analgesia requirements,and perioperative complications rate.
Results: Out of 365patients 66.3% were male and the rest were female. The mean age was 47.80 ± 10.46 SD and the mean stone size was 3.4 cm±1.04 SD.Multiple or staghorn stones were found in 57.3% of cases. The majority of stones 57.5% were located in the renal pelvis and calyces. The mean operation time was 65 min ± 2.9 SD, and the stone clearance rate was 87%. Analgesia after surgery was given in 23% of the cases. Fever was noted in 11.23%, and blood was transfused in 3.5% of cases. No case of urinary leakage was observed and angioembolizationwas not needed in any case. The complications associated with spinal anesthesia were spinal headache in 3.56%, hypotension in 3%,and nausea and vomiting in 1.56% of the cases.
Conclusion: Supine PCNL under spinal anesthesia is associated with good clinical outcomes lesser operative time and fewercomplications. Moreover, it is cost-effective as well.
Keywords: Percutaneous nephrolithotomy, supine position, spinal anesthesia

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is a minimally invasive treatment for renal and upper ureteral stones[1,2]. This procedure is recommended for renal stones more than 2cm or ESWL-resistant stones[3-6]. PCNL is mostly performed in the prone position[7]. Still, urologists are increasingly performing it in the supine position nowadays because of the ability to perform other ureteroscopic procedures simultaneously, access to the upper pole of the kidney through a puncture in the lower pole, lack of cardiovascular and respiratory risks and other prone positions challenges, especially in obese patients[8,9]. General anesthesia is used to perform PCNL in the supine position, with more risks and expenses than spinal anesthesia.

Aside from the cost-effectiveness of spinal anesthesia, general anesthesia might be difficult in chronic obstructive lung disease, cardiovascular disease, morbidly obese patients, and the geriatric population[10,11]. Spinal anesthesia is, on the other hand, less expensive, has a less painful postoperative course, and is preferred by anesthetists and surgeons. In certain high-risk cases, spinal anesthesia is preferred over GA[12].

PCNL is usually performed in the supine posture under general anesthesia. However, because of the high rate of complications in general anesthesia, as well as the high cost and complications associated with it, we performed supine PCNL under spinal anesthesia and recorded the age, gender, stone clearance, mean operative time, and perioperative complications.

MATERIAL AND METHODS

This study is a review of secondary data of patients who underwent supine PCNL under spinal anesthesia from April 2015 to December 2021. Ethical approval was taken from the hospital's ethical and research committee.

All Patients aged 13 to 75 years with stones larger than one centimeter in size or stones resistant to ESWL underwent PCNLincluded in the study.Patients with Pregnancy, active UTIs, and uncorrectable coagulation disorders were excluded. Patients with severe kyphoscoliosis, acute lumbar spine infection with

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elevated ICP, inability to approach intrathecal space (due to risk of spinal anesthesia failure), and patients who were unable to give consent were also excluded from the study. In addition to the coagulation profile, all these patients underwent laboratory testing for complete blood count, electrolytes, renal function tests, urine analysis, urine culture, and screening for hepatitis B as well as C and HIV. The size and location of the stones were evaluated using an IVU or a non-contrast CT scan. In preoperative one dose of antibiotics was given to each patient. Two doses of antibiotics were administered post-operatively.

Bupivacaine was injected into the epidural space between the lumbar vertebrae between L3 and L4 using a 25-27 G spinal needle. After lying supine for 5–10 minutes, the patient was subsequently placed in a Trendelenburg position with a 30° gradient. Anesthesia levels were previously checked by anesthesiologists between T6 and T7 (lower sternum or xiphoid process).

The patient was in the supine position, with the contralateral lower limb relaxed in the lithotomy position and the ipsilateral lower limb extended parallel to the trunk. No shoulder bolster, flank, or buttock bridge was employed. Following cystoscopy, a ureteral catheter was placed in the ipsilateral pelvicalyceal system followed by the insertion of foley's catheter.Following the retrograde pyelogram, a 16 G LP needle (in normal BMI individuals) or a Chiba needle (in overweight and obese individuals) was used to puncture the desired calyx. After ensuring clean urine on aspiration, a sensor wire was put into the collecting system. Alken dilators were used for serial dilatation. The nephroscope used was 24 Fr (Richard Wolf) with amPlatz sheath of 26-30 Fr. The calculi were fragmented by a pneumatic lithotripter. Smaller stones were washed while larger fragments were removed by graspers forceps. After stone clearance, a Double J stent wasplaced in all patients for a week. Foley's catheter was removed on 1stpost-operative day and the patient was also sent home on 1stpost-operative day.Flank stitch was removed after 1 week and the patient was also evaluated one week after surgery with Ultrasound and X-ray KUB for residual stones. Double j stent was also removed on the seventh post-operative day.

Postoperative complications such as fever, incontinence, postoperative infections, blood transfusion requirements, and

spinal headachewere recorded. SPSS 22.0 was used to analyze the data. For categorical data, we calculated frequency and percentages, and for numerical variables, we calculated mean and standard deviation. The Chi-square test and the student t-test were used to compare the categorical and numerical variables, respectively. The cutoff for statistical significance was p value<0.05.

RESULTS

PCNL was performed on 365 patients in supine position under spinal anesthesia. The mean age was 47.80 years± 10.46 SD. There were three groups of patients in this study. The majority of patients (48%) were between 41 and 60, with 33.7% between 13 and 40 years. (Fig 1). The average stone size was 3.39 mm, with a standard deviation of 1.04 mm. Most of the stones were multiple, with 209 patients (56.73%) having multiple stones. A single tract was found in 304 (83.3%) patients. In 210 patients (57.5%), stones were located in the pelvis and calyces(table 1)

Table 1. General characteristics of patients (n=365)

Parameters		Frequency (%)
Gender	Male	Male 242 (66.3%)
	Female	Female 123 (33.7%)
Age		47.80 ± 10.46 SD
Mean stone size		3.4 mm ± 1.04 SD
No of tracts	Single	Single 304 (83.3%)
	Double	Double 54 (14.7%)
	Multiple	> 2 tract 7 (2%)
Stoneslocation	Renal pelvis	131 (36%)
	Renal calyces	24 (6.5%)
	Pelvis + Calyces	210 (57.5%)

Fig 1. Age-wise distribution of patients

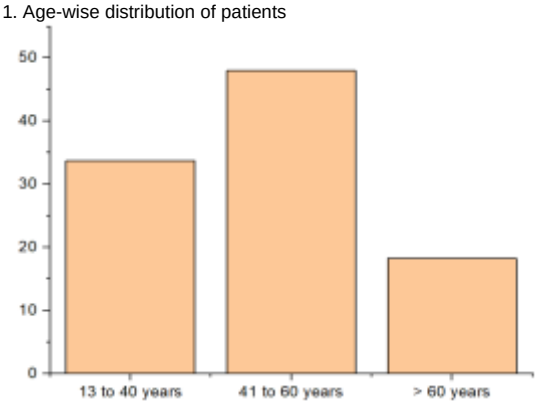
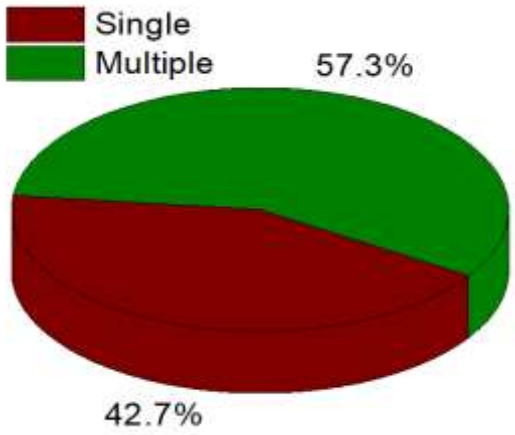


Fig 2. Number of stones in patients



The mean operative time was 65 min ±2.9 SD. The rate of stone clearance was 87%. Fever >99°F was recorded in 41(11.23%) cases. Blood transfusion was required in 41(3.5%) cases.N. The most important complication related to spinal anesthesia was a spinal headache in 13(3.56%) patients. However, none of the patients needed an RBC patch for spinal headaches. Hypotension was noted in 11(3%patients), which was treated with ephedrine.

Table 2. Procedural and anaesthesia-relatedparameters(n=365)

Parameters		**Outcome**
Mean operation time		65 min ± 2.9 SD
Analgesia during operation		**23%**
Duration of hospital stay		26 hours ± 1.65 SD
Stone clearance rate		87%
Fig 2. Number of stones in patients	Urine leakage	0 (0%)
	Blood transfusion	13 (3.5%)
	Fever	41 (11.23%)
Complications related to spinal anaesthesia	Spinal headache	13 (3.56%)
	Hypotension	11 (3%)
	Nausea/vomiting	5 (1.4%)

DISCUSSION

PCNL is used to break down and remove large or multiple renal pelvis and calyceal calculi[12]. Supine posture in PCNL is proclaimed safe and effective in the literature[13,14]. Supine PCNL lowers total operating time, anesthesia-related issues, neuromusculoskeletal injury, and physical stress on OR staffduring the procedure[15]. General anesthesia may be challenging in some circumstances like PCNL for staghorn stones because of the possibility of electrolyte imbalance and fluid absorption[16]; hence spinal anesthesia is a safe alternative in such cases. Surgeons are more worried about the early postoperative recovery of their patients and their early safe discharge from the hospital. Hence theselection of anesthesia matters a lot in such circumstances[17]. Moreover, GA has its own limitations and risks in patients with comorbidities and old age as well as in obese patients. SA offers a safe alternative.

In our study, the mean age was 47.80±10.46 SD. Studies supporting spinal anesthesia for supine PCNL were conducted by Soma et al. in which they reported a mean age of 43.6 years ± 12SD of their 53 patients[18], Ng MT et al. reported a mean age of 55.9 years of their 67 patients[19], Steele D reported a median age of 59 years of their patient[20]. In our study, 66.3% were male participants. Ng MT et al[19], Shoma et al[18], Steele D et al[20] reported 50.7%, 64.1% and 61.7% of their male participants, which is consistent with the results of our study.

In our study, the stone clearance rate was 87%. Our results are similar to thereported stone clearance rate for PCNL in supine positions ranging from 69.6% to 95%[21]. Yuan D et al[22] conducted a systemic review and meta-analysis and determined a pool stone clearance rate of 84.5%. PCNL in the supine position under SA, Steele D et al[6,9], Zhou X et al[14] and shoma et al[18] reported 91%, 69.6%, and 89% success rates of stone clearance,respectively. De Sio M et al[23] and Rana AM et al[24] concluded a stone clearance rate of 84% and 88.7%, respectively in their patients with supine PCNL, which is similarly compatible with the results of our study.

The hospital stay in our study was 26 hours ± 1.65 SD. Rana et al[24] and Shoma et al[18] reported 2 days and 2.5 days, respectively, which is also consistent with the results of our study. Our study's mean operational time was 65 min ±2.9 SD.Steeli et al[20], Zhou X et al[14], and Manohar T et al[25] reported 15 to 300 minutes, 45 to 300 minutes, and 20 to 250 minutes,respectively which are consistent with our results. Fever >99(11.23%) and blood transfusion (3.5%) were the reported complications in our study. There was no pleural rupture or angioembolisation. Shoma et al[18], Ng MT et al[19], Steele et al[20], Zhou X et al reported these complications as blood transfusion (9.4%, 3.2%, 1%0), embolization as (0%, 0.3% and 0%), while none of them reported a case of pleural injury. Fever was reported by Al-Dessoukey AA et al[26], Valdivia JG et al[27], and Shoma AM et al[18]. In our study, we did

not find any case of urinary leakage. Al-Dessoukey AA et al[26] reported 3% urine leakage in supine PCNL patients

Our investigation found spinal headache (3.56%), hypotension (3%), nausea, and vomiting (1.4%). Mehrabiet al. found that the spinal anesthetic group had 18% postoperative headaches and 5.25% hypotension[27]. In 160 prone PCNL cases treated with PCNL under SA, Mehrabi S found that 6.3% of patients required blood transfusions, 3.65% of patients experienced mild to moderate postoperative headaches and dizziness, which improved with the best rest and mild analgesic, and 3.75% of patients required blood transfusions. They concluded that SA was superior to GA for PCNL[28]. Borzouei B et al. concluded that SA was safe and effective for PCNL[29]. Movasseghi Get al. reported that patients who underwent PNCL under SA had better hemodynamic stability and required less analgesia[30].

CONCLUSION

Supine PCNL performed under spinal anesthesia is an effective, safe, and cost-effective treatment option for large, complex, multiple, and staghorn renal calculi. It is associated with a high stone clearance rate, minimal analgesia, and few postoperative complications, and can be performed in patients who are otherwise considered unfit for GA.

Recommendations: It is recommended that additional research studies be conducted to compare the outcomes of supine PCNL under GA with those of a group under general anesthesia.

Limitations: The main limitation was the lack of a group undergoing GA for supine PCNL to compare the outcome correctly.

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