Original Article

Outcome of Supine Percutaneous Nephrolithotomy as a Secondary Procedure for Renal Calculi

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ABSTRACT

Objective: To determine the outcome of supine PCNL in patients with renal calculi with a previous history of renal surgery.

Study Design: Retrospective clinical study

Place and Duration of Study: This study was conducted at the Sami. Medical Centre. Abbottabad from April 2015 to December 2021.

Materials and Methods: Forty-one patients with prior renal surgery received supine PCNL with spinal anesthesia (SA). The outcome included operation time, hospital stay, stone clearance rate, and surgical and SA-related complications.

Results: Out of 41 patients, 70.7% were men. The mean age was 44.04±9.73 SD years, and the calculus size was 2.12±0.29 mm. The majority of the stones (61%) were single. Nephrolithotomy was previously performed in 80.5% of patients, followed by laparoscopic or endoscopic surgery in 12.2%, and partial nephrectomy in 7.3% of the patients. The mean operation time was 104 minutes, 30 hours was the mean hospital stay, and 84% was the stone clearance rate. Complications included fever (12.2%) and blood transfusions (4.6%). Headaches (4.6%), and backaches (4.6%), were caused by spinal anesthesia.

Conclusion: Supine PCNL under spinal anesthesia is a safe and effective therapeutic option for patients with previous open nephrolithotomy. The procedure also requires minimal analgesia and has few postoperative problems.

Key Words: Renal calculi; Percutaneous nephrolithotomy; Supine position; Spinal anesthesia; Previous renal surgery.

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INTRODUCTION

Urolithiasis has long plagued humanity. The lifetime risk of Urolithiasis varies from 1 to 15% depending on gender, age, race, and region[1]. Renal stone incidence and prevalence have increased globally over time[2]. The recurrence of renal stone disease is an economic burden and negatively impacts the quality of life[3]. Rupel and Brown first removed a renal calculus through an operatively established nephrostomy tract in 1941. Since then, this treatment has greatly evolved from open surgery to less invasive surgical treatments due to developments in instruments, techniques, and experience. Due to lower morbidity, lower cost, and shorter operating time with fewer postoperative issues[7], PCNL has largely replaced open surgery. The stone recurrence rate is 50% in 5–7 years[4]. Due to stone recurrence, open surgery patients need PCNL[6]. These include multiple SWL-resistant, complicated, and staghorn stones[7]. Previous surgery complications such as perinephric scars, pelvi-calyceal architecture distortion, and bowel displacement affect the success of PCNL[8]. PCNL as a redo operation after open stone surgery had contradicted results. Some evidence supports it, while others do not[9]. Even though PCNL is usually performed in a prone position, still urologists are increasingly performing it in a supine position due to advantages such as access to the upper pole of the kidney through a puncture in the lower pole, lack of cardiovascular and respiratory risks, decreased operative time, and option of doing the procedure under spinal anesthesia[10]. We aimed to know the success rate and complications of PCNL in the supine position under spinal anesthesia in patients who had re-do surgery for renal calculi.

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MATERIALS AND METHODS

The hospital's ethics and research committee approved this retrospective clinical study from April 2015 to December 2021. The results came from patients with PCNL as redo surgery in a supine position under spinal anesthesia.

There were 41 patients in this clinical research, ranging in age from 29 to 65 years, who had stones larger than 1cm and had previously undergone surgery for renal calculi. Patients with uncorrectable coagulation problems, pregnancy, and those who had never had kidney surgery. Patients with severe kyphoscoliosis, elevated ICP, acute lumbar spine infections, inability to approach intrathecal space (failure of spinal anesthesia), and patients unable to provide informed consent were excluded. Preoperative laboratory testing for Hepatitis B and C, HIV, complete blood count, coagulation profile, serum electrolytes, RFTs, urine analysis, and culture (in cases of active UTI) were all performed on all patients. X-ray KUB, ultrasonography for KUB, an intravenous urogram (IVU), or a non-contrast computed tomography (CT) scan are all included in the radiological investigations. All of these patients received a course of prophylactic antibiotics before surgery. With a 25-27 G spinal needle and 2 to 2.5 ml of bupivacaine into the epidural region between the L3 and L4 lumbar vertebra, an experienced anesthesiologist administered spinal anesthesia in the lean-forward position. The patient was then placed supine for 5 to 10 minutes before being shifted to a 30º Trendelenburg position. Lower serum or xiphoid process anesthesia levels were measured (T6-T7 level). The PCNL operation began in the supine posture once anesthesia was established.

The patient was placed supine, with the ipsilateral lower limb parallel to the trunk and the contralateral lower limb relaxed in the lithotomy position. For the buttock, flank, and shoulder, no bridge/bolster was used. A ureteral catheter was inserted in the ipsilateral pelvi-calyceal system (PCS) after the cystoscopy, and then a Foley's catheter was inserted. After the retrograde pyelogram, the desired calyx was punctured with a 16 G LP needle (in normal patients) or a Chiba needle (in obese patients). After collecting clean urine, a sensor wire was put into the collecting system, and Alken dilators were used to dilate the tract. The size and location of the stones were determined by the pole and punctures. The nephroscopy was done using a 24-French rigid nephroscope (Richard Wolf). The calculi were detected and fragmented using a pneumatic lithoclast. Small stones were removed using grasper while very small fragments were washed by irrigation. Double J stents nephrostomy tubes were inserted when needed to complete the surgery. At the time of discharge and four weeks after surgery, the patients were followed up with USG and X-RAY KUB. Patient's age and gender, calculus size (maximum diameter), stone complexity (as determined by USG), previous surgery (nephrectomy, partial nephrectomy, and laparoscopic or endoscopic surgery), total operative time, hospital stay, cost of anesthetic and analgesic medicines, and complications such as fever (99°F), urinary incontinence, blood transfusions, post-operative infections, spinal headache, hypotension, etc. were all recorded.

The data was analyzed using SPSS 22.0. The frequency and percentages were calculated for categorical variables, and for numerical variables, the mean and standard deviations were calculated. To compare the variables having statistical significance at p=0.05, the Chi-square test and the student t-test were applied.

RESULTS

PCNL in the supine position was performed under spinal anesthesia on 41 patients who had a history of previous surgery for renal calculi. Among these 41 patients, 29 patients (70.7%) were males. The mean age was 44.04 years with a standard deviation of 9.73 years. The mean stone size was 2.21±0.29 centimeters the majority of stones and tracts were singles, i.e., 25 (61%) and 40 (97.5%), respectively (Table 1).

Table No.1: Characteristics of patients (n=41)

Parameters		Frequency (%)
Gender	M:f	29 (70.7%): 12 (29.3%)
Mean age (in years)		44.04 ± 9.73 sd (29-65)
Mean stone size (in cm)		2.12 ± 0.29
No of stones	Single: Multiple	25 (61%): 16 (39%)
No of tracts	Single: Multiple	40 (97.5%): 1 (2.5%)

Out of these 41 patients, 33 patients (80.5%) underwent nephrolithotomy in the past while 3 patients had history of partial nephrectomy (7.3%) and 5 patients had a history of laparoscopic or endoscopic surgery (12.2%) [fig 1]. The mean time for operation was 104 minutes. The mean hospital stay was 30 hours. The stone clearance rate was 84%, and analgesia during the procedure was 23% (Fig 2).

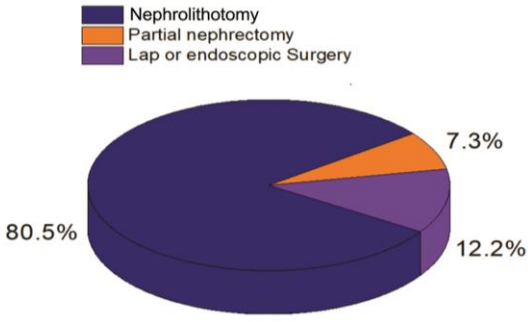

Figure No.1: Previous surgeries for renal stones

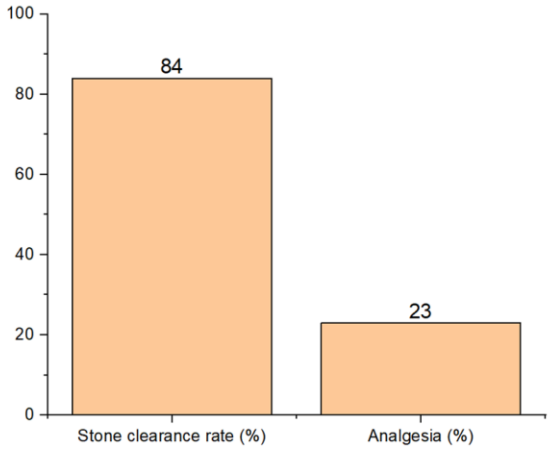

Figure No.2: Stone clearance rate and analgesia in redo-PCNL

Blood was transfused in 2 cases (4.8%), and fever was recorded in 5 cases (12.2%) [Table 2]. Spinal anesthesia-related complications were headache (4.6%), backache (4.6%), and hypotension (2.6%) [Table 2]

Table No.2: Complications (n=41)

Complications related to PCNL		Complications related to SA	
Blood transfusion	2 (4.8%)	Spinal headache	2 (4.6%)
Angioemboli-zation	0 (0%)	Hypotension	1 (2.4%)
Fever >99°F	5 (12.2%)	Backache	2 (4.6%)
Urinary leakage	0 (0%)	RBC patch for headache	0 (0%)
Total	17%	Total	11.6%

DISCUSSION

Renal stones have a high prevalence and recurrence rate of 50% in five years, increasing to 80-90 percent in ten years if untreated[11]. For large, complex, SWL-resistant renal stones, PCNL has replaced almost open surgery. However, open surgery is still preferred in developing countries where PCNL is not readily available or in cases of recurrence renal calculi[12,13]. They may require PCNL due to the high recurrence rate of renal calculi. Patients with prior open surgery had a greater rate of PCNL failure. Anatomic disruptions like perinephric fibrosis, infundibulum stenosis, incisional hernia, and bowel displacement have been linked to previous open renal calculi surgery[14]. In our study, prior surgeries did not affect PCNL success or complications. PCNL could be performed successfully in patients with prior surgery or PCNL without complication, according to Kurtulus FO et al[15], Tugcu V et al[16] and Reddy SV et al.[4]

The mean operative time was 104 minutes in our study. Falahatkar S, et al[17] found similar results (98.75 minutes). They used PCNL on supine patients who had previously had surgery. Reddy et al. reported a mean operative time of 68.91±21.27 minutes[4], and Solkiferim et al[9] reported 70 minutes (55-210 min), while Gulani A et al[8] reported a mean operative time of 68.91± 21.27S minutes. The longer operative times in previously operated patients may be due to multiple puncturing attempts, difficulty dilatation of the scarred kidney, removal of stone fragments by grasping forceps, and retroperitoneum fixation of the kidneys preventing rigid nephroscope access to the pelvicalyceal system (PCS)[18].

Our study's mean hospital stay was 56 hours, indicating early recovery. PCNL in previous open surgery patients had more extended hospital stays in some of the studies. For example, Solkiferim et al[9] reported 3.7 days (1–7 days) hospitalization, Reddy SW et al[4] 3.15±0.95 days hospitalization, Basiri et al five days (3 to 7 days) and Tugcu V et al. [23], 155±30 minutes.

Our study's 84% stone clearance rate matches the reported 69.6% to 95% stone clearance rate in supine PCNL patients. Gulani et al[8] reported an 84% stone clearance rate, which matches our findings. A meta-analysis by Hu H et al[20] found that PCNL had a lower initial stone clearance rate (RR=0.96; 95 percent CI=0.92-0.99; p=0.007). One cause for a comparatively lower stone clearance rate was PCNL's supine position in our study. Supine PCNL exhibited a poorer stone clearance rate than prone PCNL[18].

In our study, 17% of participants had complications. The overall PCNL morbidity ranges from 7.5 to 18%, which is consistent with our study. In our study, 4.6% of patients had blood transfusions. According to the literature, bleeding is one of the most common complications in PCNL, and blood is transfused in 0–10% of cases[9]. Our study found no cases of colonic injury, which is consistent with the literature's data of 0 to 12.5% risk of colonic injury[8]. In this study, 12.2% had a fever over 99°F. Margel D et al[14] reported 10% cases, while Solkiferim et al[9] reported 11% cases of fever in their studies which is consistent with our findings.

We used spinal anesthesia for supine PCNL in this study. Headaches (4.6%), backaches (4.6%), and hypotension (2.4%) were the most prevalent problems. After surgery, the spinal anesthetic group had 18% postoperative headaches and 5% hypotension, according to Mehrabi et al[21]. Mehrabi Set al. concluded that SA was superior to GA for PCNL in 3.75% of cases[22]. SA was safe and effective for PCNL, according to Borzouei et al.[23]

CONCLUSION

PCNL is a safe and effective therapeutic option for patients with previous open nephrolithotomy. It may take longer due to anatomical changes and kidney scar tissue. Additionally, supine PCNL may reduce patient handling, improve airway control, and reduce complications, especially in patients with morbid obesity, reduced cardiac function, or require a lengthy operation. Moreover, supine PCNL with spinal

anesthesia requires minimal analgesia and has few postoperative complications.

Recommendations: More large prospective multicentric trials are recommended to ensure the benefits of supine PCNL under spinal anesthesia to previously operated patients.

Limitations: Apart from the small sample size, all of the patients were operated on in the supine position under spinal anesthesia. There was no comparison group in terms of position in PCNL and anesthesia.

Author's Contribution:

Concept & Design of Study:	Muhammad Nasir Jamil
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Data Analysis:	Hamza Ashraf, Faheem Ul Haq, Muhammad Shahzad
Revisiting Critically:	Muhammad Nasir Jamil, Muhammad Asif
Final Approval of version:	Muhammad Nasir Jamil

Conflict of Interest: The study has no conflict of interest to declare by any author.

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