BANGLADESH JOURNAL OF
UROLOGY
Bangladesh J. Urol. 2021; 24(2): 200-204
www.banglajol.info/index.php/BJU
DOI: https://doi.org/10.3329/bju.v24i2.59495

Original Article
ISSN : 2304 - 8514 (Print)
ISSN : 2304 - 8522 (Online)

Comparative Study between Supine Position and Prone Position in PCNL

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Received: 08 - 09 - 2021
Accepted: 31 - 12 - 2021
Conflicts of interest: None

Abstract

Introduction: *For many years, the prone position has been the standard for PCNL, whereas the supine position has only recently gained popularity. The research on surgical outcomes is still lacking.*

Objective: *To compare the surgical outcomes of prone versus supine PCNL.*

Methods: *In this prospective study, 60 patients were enrolled who underwent for PCNL. Among them 30 patients had PCNL in prone position and 30 had PCNL in supine position. Patient's body mass index (BMI), stone size, operative time, stone free rate, length of stay in hospital, and postoperative complications were all recorded. SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data, which included Chi-Square and t-tests. A p-value of 0.05 or less was considered statistically significant.*

Results*: There were no significant differences in gender, age, body mass index, stone location, or comorbidity between the two groups in this study. Operative time was significantly shorter in supine group (74.67 ± 11.94 min) than that of prone group (90.33 ± 8.70 min). Hospital stay was significantly longer in prone group (3.10 ± 0.61 min) than that of supine group (2.30 ± 0.47 min). Stone free rate was slightly higher in prone group than supine group but the difference was not statistically significant. Need of blood transfusion was little higher and post-operative complication was little higher in supine group but the differences was not statistically significant.*

Conclusion*: Supine and prone PCNL are equally effective for achieving high stone free rate. However, supine position demonstrated shorter operative and hospital stay time compared to prone position.*

Keywords: PCNL, supine, Prone

Introduction

One of the most frequent urological illnesses is nephrolithiasis.[1] The incidence varies by region, with rates ranging from 1–5% in Asia, 7–13 percent in North America, and 5–9% in Europe.[2] Calcium is the most common stone type, responsible for about 80% of all urolithiasis cases.[3] The treatment choices for nephrolithiasis are determined by the size and location of the stones. Extracorporeal shockwave lithotripsy (ESWL), ureteroscopy retrieval (URS), and percutaneous nephrolithotomy (PCNL) are all active treatment alternatives.

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For large and difficult renal calculi, percutaneous nephrolithotomy (PCNL) has been the gold standard since 1976.[4] The PCNL procedure has several advantages, including a higher stone-free rate for larger renal calculi when compared to ESWL, the ability to treat large kidney stones (>20 mm), the ability to treat inferior calyx stones that are difficult to treat with ESWL, and lower morbidity in both systemic response and postoperative renal function preservation when compared to open surgery.[5] PCNL in the prone position has a high success rate and low morbidity. But this approach is not suitable for obese people or those with cardiac disease. Furthermore, the ureter catheter insertion necessitates a change of position, which is a drawback.[6] Gabriel Valdivia introduced a supine position at PCNL in 1987 to address the aforementioned issues. The supine position has several advantages over the prone position: it is easier for the patient, it poses fewer cardiopulmonary risks, no repositioning of the patient is required, it exposes the operator to less radiation, and ureteroscopy can be performed concurrently with PCNL.[7] Despite the benefits listed above, the supine position has been associated with a higher risk of visceral organ, intra-abdominal organ, and blood vessel injuries. This raises the question of which position is preferable between prone and supine PCNL.[6] The purpose of the study was to compare efficacy and safety profiles to see if one position is better than the other.

Methods:

In this prospective study, 60 patients who were scheduled for PCNL were enrolled according to the following selection criteria:

Inclusion criteria

- Adult patients of both sexes
- Patient with single or multiple kidney stones
- Patients with stone size > 1.5 cm
- Patients with stone size <1.5 cm who have previously failed SWL or retrograde lithotripsy.

Exclusion criteria

- Patients with contraindications to the procedure in the prone or supine position
- Patients with coexisting renal anomalies
- Patients with uncorrectable bleeding disorders
- Patients with active urinary tract infection
- Obese patients
- Pregnancy patients.

PCNL was performed in prone position for 30 patients and supine position for the remaining 30 patients. Patient demographic information was gathered and recorded. At 3 months, all patients had postoperative X-ray to determine stone-free rates. Patient's body mass index (BMI), stone size, operative time, stone free rate, length of stay in hospital, and postoperative complications were all measured. SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data, which included Chi-Square and t-tests. A p-value of 0.05 or less was considered statistically significant.

Results:

Males were predominant than females in both the supine and prone groups. Mean age of the patients in supine group was 49.50 ± 10.33 years and prone group was 47.87 ± 9.25 years. There was no significant difference between the groups. Mean BMI of the patients in supine group was 23.29 ± 1.21 kg/m^2 and prone group was 22.72 ± 1.66 kg/m^2. There was no significant difference between the groups. Regarding comorbidities, DM was found in 3 (10.0%) and 1 (3.3%) cases in supine and prone group respectively; HTN was found in 2 (6.7%) and 3 (10.0%) cases in supine and prone group respectively; CKD was found in 1 (3.3%) and 2 (6.7%) cases in supine and prone group respectively. There was no significant difference in comorbidities between the groups (Table I).

Most of the cases single stone was found in both the groups (60.0% in supine and 70.0 in prone group). Most of the stone resided in lower pole and pyelum in both the groups. In supine group, stone was located in lower pole 43.3% and in pyelum 33.3% cases and in prone group, stone was located in lower pole 46.7% and in pyelum 36.7% cases. In most of the case, stones were composed of either calcium oxalate or calcium phosphate. In supine group, stones were composed of calcium oxalate, calcium phosphate and uric acid in 15 (50.0%), 8 (26.7%) and 7 (23.3%) cases respectively while in prone group, stones were composed of calcium oxalate, calcium phosphate and uric acid in 18 (60.0%), 10 (33.3%) and 2 (6.7%) cases respectively. There were no significant differences in number of stone, location and stone analysis between the two groups (Table II).

Operative time was significantly higher in prone group (90.33 ± 8.70 min) than that of supine group (74.67 ± 11.94 min). Hospital stay was significantly higher in prone group (3.10 ± 0.61 min) than that of supine group (2.30 ± 0.47 min). Stone free rate was slightly higher in prone group than supine group but the difference was not statistically significant. Need of blood transfusion was little higher and post-operative complication was little higher in supine group but the differences was not statistically significant (Table III).

Table 1: *Baseline characteristics of the patients (N=60)*

	Supine (n=30)	Prone (n=30)	p-value
Gender			
Male, n(%)	19 (63.3%)	21 (70.0%)	0.777
Female, n(%)	11 (36.7%)	9 (30.0%)	
Age (years), mean ± SD	49.50 ± 10.33	47.87 ± 9.25	0.521
BMI (kg/m^2), mean ± SD	23.29 ± 1.21	22.72 ± 1.66	0.133
Side			
Right, n(%)	17 (56.7%)	14 (46.7%)	0.603
Left, n(%)	13 (43.3%)	16 (53.3%)	
Co-morbidity			
DM, n(%)	3 (10.0%)	1 (3.3%)	0.675
HTN, n(%)	2 (6.7%)	3 (10.0%)	
CKD, n(%)	1 (3.3%)	2 (6.7%)	

Table II : *Stone characteristics of the patients (N=60)*

	Supine(n=30)	Prone(n=30)	p-value
Number of stone			
Single, n(%)	18 (60.0%)	21 (70.0%)	0.590
Multiple, n(%)	12 (40.0%)	9 (30.0%)	
Stone location			
Lower pole, n(%)	13 (43.3%)	14 (46.7%)	0.912
Middle pole, n(%)	5 (16.7%)	4 (13.3%)	
Upper pole, n(%)	2 (6.7%)	1 (3.3%)	
Pyelum, n(%)	10 (33.3%)	11 (36.7%)	
Stone analysis			
Calcium oxalate, n(%)	15 (50.0%)	18 (60.0%)	0.195
Calcium phosphate, n(%)	8 (26.7%)	10 (33.3%)	
Uric acid, n(%)	7 (23.3%)	2 (6.7%)	

Table III: *Comparison of outcomes between the two groups (N=60)*

	Supine(n=30)	Prone(n=30)	p-value
Operative time (min), mean ± SD	74.67 ± 11.94	90.33 ± 8.70	<0.001
Hospital stay (day), mean ± SD	2.30 ± 0.47	3.10 ± 0.61	<0.001
Stone free rate, n(%)	25 (83.3%)	27 (90.0%)	0.708
Blood transfusion, n(%)	5 (16.7%)	6 (20.0%)	1.000
Post-operative complication, n(%)	6 (20.0%)	4 (13.3%)	0.729

Discussion

There were no significant differences in gender, age, body mass index, stone location, or comorbidity between the two groups in this study. Mean age of the patients in supine group was 49.50 ± 10.33 years and prone group was 47.87 ± 9.25 years. Mean BMI of the patients in supine group was 23.29 ± 1.21 kg/m^2 and prone group was 22.72 ± 1.66 kg/m^2. In the supine and prone groups, DM was observed in 10.0% and 3.3% cases, HTN in 6.7% and 10.0% cases, and CKD in 3.3% and 6.7% cases, respectively. Similar findings were observed in the study of Satyagraha et al.[8] and Jones et al.[9].

Operative time was significantly shorter in supine group (74.67 ± 11.94 min) than that of prone group (90.33 ± 8.70 min). This result was comparable to the study of Satyagraha et al.[8], which revealed that the mean operative time was approximately 21 minutes shorter in the supine group compared to the prone group (p = 0.001). Other studies found comparable results in terms of shorter operative times when using the supine position.[6,9]

Due to the reduced operating time, the supine position is associated with lower surgical disposable expenses when compared to the prone position. In the supine position, less irrigant was necessary for the same reason. The supine position was also associated with less draping and gowning requirements, which is important in the prone position because the patient must be repositioned.

The stone free rate between the two groups were nearly same (83.3% in supine and 90.0% in prone) with p=0.708. Similar finding also observed in the study of Satyagraha et al.[8]. Several meta-analyses and systematic reviews have also found that supine and prone PCNL are equally effective.[6] The systematic reviews by Mak et al.[4] and Liu et al.[6] also found no significant difference in stone free rates between the two groups. Several prospective studies, however, found that the supine group had a higher rate of stone-free rates.[9] Valdivia et al.[10] reported that stone-free rates were considerably higher (77.0% versus 70.2%) in the prone group than in the supine group.

The transfusion rate was nearly identical in both groups, 20.0% in the prone and 16.7% in the supine (p=1.000). In this study, unlike others, the amount of blood transfusion was not measured. Blood transfusion was found 27.6% in the supine group and 18.2% in the prone group.[6] Mak et al. revealed that patients in the prone group required more blood transfusions than those in the supine group (27.5% vs 7.5%).[4]

Although there were no significant differences between the two groups, the total complication rate in this study was slightly higher in the supine group (20.0% versus 13.3%). This finding was consistent with the findings of Satyagraha et al[8]. No significant difference was found in complication rates between supine and prone troup.[6] However, this conclusion contradicted Jones et al.[9], who reported that the prone group had a considerably greater rate of total problems than the supine group.

The prone group's hospital stay was significantly longer (3.10±0.61 minutes) than the supine group's (2.30±0.47 minutes) in this study. Jones et al.[9] found similar results.

Conclusion:

The operative time and hospital stay were shown to be significantly shorter in the supine position than in the prone position. In supine posture, stone free rate and blood transfusion were found to be slightly lower than in prone position. However, the risk of postoperative complications was marginally higher in the supine position than in the prone position. According to the findings of this study it can be concluded that supine and prone PCNL are equally effective for achieving high stone free rate.

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