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Original Research Article

A COMPARATIVE STUDY BETWEEN SUPINE POSITION VERSUS PRONE POSITION IN PERCUTANEOUS NEPHROLITHOTOMY

Selvan Ramamoorthy[1], Thiruvasagamani[2], S.K.Subhakanesh[3], A.Larif[4]

[1]*M.Ch Postgraduate, Department of Urology, Government Tirunelveli Medical College, Tirunelveli, India.*
[2]*Professor and HOD, Department of Urology, Government Tirunelveli Medical College, Tirunelveli, India.*
[3]*Assistant Professor, Department of Urology, Government Tirunelveli Medical College, Tirunelveli, India.*
[4]*Assistant Professor, Department of Urology, Government Tirunelveli Medical College, Tirunelveli, India.*

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Corresponding Author:
Dr. Selvan Ramamoorthy,
M.Ch Postgraduate, Department of Urology, Government Tirunelveli Medical College, Tirunelveli, India
Email:selvanrmoorthy@gmail.com

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ABSTRACT

Background: Percutaneous nephrolithotomy (PCNL) is the first choice for treatment of large renal stone >2 cm. The prone position is the classical position preferred by most surgeons. Aiming to improve patient anesthesia and surgery-related inconveniences of the prone position, Valdivia et al., 1987, described the performance of PCNL with the patient in the supine position. Hence, we aimed to study the safety and efficacy of flank-free modified supine position in PCNL compared to the standard prone position.

Materials and Methods: In this prospective study, conducted in Department of Urology, Tirunelveli Medical College, 120 patients with renal stones of size 2-4cm who underwent PCNL were analyzed during the period from June 2022 to June 2023. Patients were divided into two groups of each 60 patients: Group I – PCNL done in prone position Group II – PCNL done in modified flank supine position. Patient's demographics, size, location and Hounsfield unit of the stone, number of tract, fluoroscopy time, operative time were recorded. Postoperatively drop in haemoglobin; need for blood transfusion, fever, urine leakage, hospital stay, stone-free status, and other complications were assessed.

Results: There was no statistically significant difference between the prone and supine positions regarding stone size Hounsfield unit, body mass index and fluoroscopy time. The mean intra operative time was 78.3 min in supine group and 96.7 min in prone group. The mean hemoglobin drop was 1.18 g/dl and 1.24 g/dl in supine and prone position. Fever occurred in 3.3% of cases in each group. Blood transfusion was needed in one patient in prone group. The mean post-operative hospital stay was 4.1 and 3.86 days in supine and prone group. Two patients in each group require relook PCNL. Stone free rate at 1month was 94.5% in supine and 93.2% in prone group.

Conclusion: PCNL in the modified supine position proved to be a safe and effective choice compared to the prone position for adult patients with renal calculi. Supine PCNL proved to be less time consuming and quick to perform and comparable to prone PCNL in respect to other operative parameters.

Keywords: Supine, Prone, PCNL, renal stone.

INTRODUCTION

PCNL is the best course of action for large and complicated upper urinary tract calculi, such as stag horn stones, stones that are resistant to SWL, or calculi developing in kidneys with abnormal pathology.[1] Since it provides for more percutaneous access and instrument manipulation and is more known to urologists, the prone position is the conventional posture for PCNL. It does, however, have significant drawbacks, especially in older, obese, and cardiac individuals. It also does not work for those who have anomalies in their bones.[2] It might make anesthesia-associated complications

worse, like breathing and heart problems due to posture. Additional disadvantages include the possibility of spinal and peripheral nerve damage, patient turnover during surgery, and the inability to combine PCNL with other ureteroscopic procedures. A research by Valdivia and associates, published in 1998, shown that PCNL may be performed safely and effectively while a patient is supine.[3] When PCNL is performed in the supine position, all of the drawbacks of the prone position are eliminated. These include the possibility of performing PCNL in conjunction with other ureteroscopic procedures, the ability to access the kidney's upper pole through a lower pole puncture, the absence of respiratory and cardiovascular risks, and other common issues associated with the prone position, particularly in patients who are obese.[4]

PCNL in the supine position has drawbacks such as limited area for renal puncture, a statistically insignificantly decreased stone-free rate, and trouble holding the nephroscope. Further concerns about selecting a suitable position for PCNL emerge when the benefits and drawbacks of these two techniques are considered. There are numerous studies that compare these two sites for PCNL. The purpose of this research is to give a more precise evaluation of PCNL's safety and efficacy in supine and prone positions for patients with renal calculi.

MATERIAL AND METHODS

This study was done in a tertiary care teaching hospital in department of urology for a period of one year. We gathered information from 120 patients who had PCNL while supine or prone. The hospital's ethical and scientific committee granted ethical permission. Individuals who had undergone unsuccessful SWL therapy or had stones bigger than two cm in diameter were included into consideration for the trial. Individuals who were pregnant, had ongoing UTIs, or had uncontrollably high coagulation were excluded

The surgical position was determined by the surgeon's preference, and all patients signed written, informed consent forms. All patients had assessment procedures before to surgery, which included a complete medical history, a physical examination, and laboratory testing. CT urography as well as kidney, ureter, and bladder ultrasonography were done on all of the patients.

All patients received prophylactic antibiotics prior to surgery, and sterile urine cultures were guaranteed. Following the end of anaesthesia, the procedure's operational time was documented. It involved patient positioning and the PCNL technique, which included implanting double J. Stents. Under general anaesthesia, a cystoscopy was done for prone PCNL, and then a Foley's catheter was inserted after the ureteral catheter was inserted under fluoroscopic guidance in the ipsilateral pelvi-calyceal system. After that, the patient was turned over to face down.

The patient receiving PCNL in a supine position had the ipsilateral lower limb stretched parallel to the trunk and the contralateral lower limb in a relaxed lithotomy position. A bridge was used to raise the buttock. After a cystoscopy, a Foley's catheter was inserted and a ureteral catheter was inserted under fluoroscopic guidance in the ipsilateral pelvicalyceal system.

Following the ureteral catheter's placement and insertion, patients in both groups received the same care. After the retrograde pyelogram, a 16G LP needle—or, in the case of obese patients, a Chiba needle—was used to puncture a target calyx under fluoroscopic guidance. After the urine was clear, a sensor wire was inserted, ideally into the upper ureter, and placed into the collecting system. In every instance, serial dilatation was carried out using Alken dilators. The quantity of punctures was determined by the size and position of the stones.

Nephroscopy was performed using a 24 rigid French Nephroscope. Stones were broken and fragmented using a pneumatic lithotripter. The small stones were cleared away or removed using irrigation pumps or forceps. Nephrostomy tubes were inserted in some cases, but double J stents were implanted in all cases for a period of 28 days.

Patient’s demographics, size, location and Hounsfield unit of the stone, number of tract, fluoroscopy time, operative time were recorded. Postoperatively drop in haemoglobin; need for blood transfusion, fever, urine leakage, hospital stay, stone-free status, and other complications were assessed.

For data analysis, SPSS version 25.0 was utilized. While frequencies and percentages were computed for qualitative variables, the mean and standard deviation were calculated for quantitative variables. The student T test was used to compare quantitative variables, and the Chi square test was used to compare qualitative variables.

RESULTS

In this prospective study, 120 patients with renal stones of size 2-4cm who underwent PCNL were analyzed during for a period of one year. Patients were divided into two groups of each 60 patients: Group I – PCNL done in prone position Group II – PCNL done in modified flank supine position.

In our study population, mean age was 37.63 years with a SD of 12.08, there was not much difference in between two groups with mean age in prone group was 37.3 and in supine group it was 37.97. In our study population, 76 were male patients and 44 were female patients. There were not much difference when compared between prone (36:24) and supine (40:20) groups.

Coming to body mass index, the mean BMI among study group was 27.28 with SD of 2.11; it was 27.55

in prone group and 27 in supine group, no significant difference with a p value of 0.315. In our study group, 22 patients had history of previous surgery, 14 had DJ stenting, 6 had URSL, 2 had PCN.

In our study in 40 patients, the location of stone was pelvis. In 24 patient's pelvis and lower calyx, in 26 patients it as pelvis and middle calyx. In 16 patients, it was pelvis and upper calyx. Staghorn calculus was seen in 14 patients.

The mean stone size was 3.03 in prone group and 3.09 among supine group with no statistical difference (p-0.632). In 96 patients, one stone was present and in rest 24 patients' two stones was found. In 106 patients, single tract was found and rest had two tracts.

Mean Hounsfield units in prone group was 1040 and it was 977 in supine group, there was no statistically significant difference with a p value of 0.212.

The mean operative time in our study group was 96.07 in prone position and it was 78.3 in supine position, this was statistically significant with p value less than 0.001. There was also significant difference in duration of hospital stay duration with 4.1 days in prone group and 3.86 days in supine group with a p value of 0.027. [Table 1]

Coming to complications fever was seen in 2 cases in both groups. Hb drop was 1.24 gms in prone group and 1.18 gms in supine group, which was not statistically significant with a p value of 0.208. Urine leakage was not seen in both groups. In our study group, 14 patients needed auxiliary procedure. [Table 2]

Table 1: Mean Operative Time Vs Position

POSITION	OPERATIVE TIME	
	MEAN	SD
PRONE	96.07	6.85
SUPINE	78.3	8.15
UNPAIRED T TEST		
P VALUE -0.001		
SIGNIFICANT		

Table 2: Mean Post-Operative Hospital Stay Vs Position

POSITION	POST OPERATIVE HOSPITAL STAY	
	MEAN	SD
PRONE	4.1	1.97
SUPINE	3.86	1.07
UNPAIRED T TEST		
P VALUE -0.027		
SIGNIFICANT		

DISCUSSION

PCNL has been the preferred method for treating renal calculi, including stag horn stones, ever since it was first used. The most common position for a patient during PCNL is prone, as first reported by Fernstrom and Johansson in 1976,[5] though this is still up for debate. Since then, the positioning stone clearing rate and complication reduction have been adjusted in the strategy. The prone position remains popular among urologists and is used in more than 80% of the world's centers, even though the supine position was established for PCNL more than 20 years ago.[6] Sitting upright is a common way for PCNL to be performed in a number of South American cities. The literature has deemed the supine position to be both safe and effective.[7] In this prospective study, 120 patients with renal stones of size 2-4cm who underwent PCNL were analyzed during for a period of one year. Patients were divided into two groups of each 60 patients: Group I – PCNL done in prone position, Group II – PCNL done in modified flank supine position.

In our study population, mean age was 37.63 years with a SD of 12.08, there was not much difference in between two groups with mean age in prone group was 37.3 and in supine group it was 37.97. In our study population, 76 were male patients and 44 were female patients. There were not much difference when compared between prone (36:24) and supine (40:20) groups.

Coming to body mass index, the mean BMI among study group was 27.28 with SD of 2.11; it was 27.55 in prone group and 27 in supine group, no significant difference with a p value of 0.315. In our study group, 22 patients had history of previous surgery, 14 had DJ stenting, 6 had URSL, 2 had PCN.

In our study in 40 patients, the location of stone was pelvis. In 24 patient's pelvis and lower calyx, in 26 patients it as pelvis and middle calyx. In 16 patients, it was pelvis and upper calyx. Staghorn calculus was seen in 14 patients.

The mean stone size was 3.03 in prone group and 3.09 among supine group with no statistical difference (p-0.632). In 96 patients, one stone was present and in rest 24 patients' two stones was found. In 106 patients, single tract was found and rest had two tracts. Mean Hounsfield units in prone group was 1040 and it was 977 in supine group, there was no statistically significant difference with a p value of 0.212.

The mean operative time in our study group was 96.07 in prone position and it was 78.3 in supine

position, this was statistically significant with p value less than 0.001. Furthermore, a statistically significant difference was observed between the prone and supine operational periods (44.63 minutes ±12.44 SD VS 53.02 minutes ±12.67 SD, P <0.04) and (78 minutes versus 88 min, p<0.05) by Chapagain A et al,[8] and Wang Y et al.[9] Additionally, Falahatkar S,[10] found that there was a statistically significant difference (p<0.05) in the amount of operating time required for PCNL supine and prone positioning, with the supine position requiring less time. Wu P et al,[11] and Liu L et al,[12] found that supine PCNL had a significantly (p<0.05) shorter operational time in their meta-analyses.

There was also significant difference in duration of hospital stay duration with 4.1 days in prone group and 3.86 days in supine group. Similar results were obtained by Al-Dessoukey et al (49.8 Hrs. 81.2 Hrs. p<0.02).[13] Valdivia JG et al,[14] found that there was a numerical but statistically insignificant difference in the mean hospital stays of patients in supine and prone positions (4.2 vs. 4.3 days, p=0.42).

Coming to complications fever was seen in 2 cases in both groups. Shoma AM et al (5% vs. 4%),[15] Valdivia JG et al (11.1% vs. 7.6%),[14] and Al-Dessoukey (5.9% vs. 5%),[13] also found similar results of greater cases of fever in the patients operated in prone position.

Hb drop was 1.24 gms in prone group and 1.18 gms in supine group, which was not statistically significant with a p value of 0.208. Urine leakage was not seen in both groups. In our study group, 14 patients needed auxiliary procedure. In our study, there were more postoperative problems in the prone group (17% vs. 14.5%). Similarly, the group in the prone position had a higher risk of post-operative complications according to Mazzucchi E,[16] and Chapagain A et al.[8]

CONCLUSION

According to our research, supine PCNL has several statistical advantages over prone PCNL, such as a much shorter mean operative time, a lower need for analgesics, and a shorter length of hospital stay. Numerous advantages were noted, such as fewer fever episodes and no urine leaks. When all other things are equal, supine position during PCNL for patients with renal calculi has a higher safety profile and a favorable outcome. Patients with renal stones are advised to undergo PCNL while supine.

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