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Comparison of Surgical Outcome of Prone PCNL Vs Supine PCNL

Sandeep Gupta (M.S., M.Ch)[1], Siddharth Saraf (M.S.)[2], Dilip Kumar Pal (M.S., M.Ch)[3*]
[1]Associate Professor, Department of Urology, Institute of Post Graduate Medical Education & Research, Kolkata, India
[2]Post Doctoral Trainee, Department of Urology, Institute of Post Graduate Medical Education & Research, Kolkata, India
[3]Professor & Head, Department of Urology, Institute of Post Graduate Medical Education & Research, Kolkata, India

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***Corresponding author**
Dilip Kumar Pal

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Abstract: Percutaneous nephrolithotomy (PCNL) in the prone position has been established approach, but it is associated with various anesthetic and logistic difficulties. In our study we aimed at comparing the surgical outcomes of PCNL in the traditional prone position with modified supine position. A total of 132 prospective patients planned for PCNL were included in this study of which 68 were performed in Galdakao modified supine Valdivia position and 64 were performed in prone position. The outcomes of stone free rate, stone size, operative time, length of stay (LOS), in hospital and complications were compared. Chi-square and t-tests were used. The mean stone size and LOS between the modified supine and prone groups were comparable. The supine group had a shorter mean surgical time (76 minutes vs. 88 minutes, $p<0.001$), and comparable stone free rate (92.6% vs. 93.7%, $p>0.05$). There were no differences in septic or bleeding complications. In our study, PCNL in the modified supine position gave an advantage of shorter surgical time with comparable stone free rates. It continues to be an effective alternative to the prone approach.
Keywords: PCNL, supine, prone, surgical outcome.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) has stood the test of time and remains the mainstay of treatment for large renal stones since past four decades. Percutaneous access to the kidney was first described by Goodwin et al, when they used it for drainage of urine in a hydronephrotic kidney [1].

Since then it has been an established method for renal access. PCNL was first described by Fernstrom and Johansson in 1976 and since then it has been continuously modified to improve the stone free rates and complications [2].

Since its inception PCNL was described in prone position [3]. The prone position comes with a lower risk of complications such as pleural, lung or liver injury while providing a wide surgical field for puncture, adequate nephroscopic manipulation, easier upper pole access, a good distension of the collecting system and feasibility of bilateral procedures. However difficulty in obtaining combined retrograde and antegrade access to the renal cavities when needed and anaesthetic complications remained a concern. Since then a lot of positions were described including lateral decubitus by Grasso and Kerbl, split-leg position by Scarpa and reverse lithotomy position by Lehman [4-6]. PCNL in the supine position was first described by Valdivia *et al.* [7]. A new position was described after doing some modification in the original Valdivia (supine Valdivia and modified lithotomy position). The patient was placed slight lateral with sand bag placed to raise flank, ipsilateral leg is extended with contralateral leg abducted and flexed more commonly called as the Galdakao-modified supine Valdivia (GMSV) position [8]. It has got many advantages over prone position like simultaneous access to upper and lower tract, better airway control, less retro colon injury and better safety profile while maintaining a low pressure system [9-12]. In our study we compared the surgical outcome in patients undergoing PCNL in prone position and GMSV position.

MATERIALS AND METHODS

Study was conducted between September 2017 to August 2018 in urology department of Institute of Post Graduate and Medical Education and Research Kolkata. Patients with renal stones with sterile preoperative urine culture were included in the study. We excluded patients with age less than 12 years, bilateral stone disease, previously operated or with uncontrolled coagulopathies. Informed written consent

and clearance from institutional ethical committee were taken. Patients were evaluated by preoperative USG (ultrasonography) KUB (kidney, ureter, and bladder), Intravenous Pyelography (IVP), and Computed Tomography (CT) urography. In case of multiple stones, the stone size was calculated by adding the sum of all stones [13]. Patients were randomised to undergo PCNL in the GMSV position (68 patients) and prone position (64 patients).

Patients who were planned for supine PCNL were placed in GMSV position. Surface marking of posterior axillary line, iliac crest and 12th rib was done (figure 1). At first a ureteric catheter was placed into desired pelvicalyceal system (PCS). Calyx was punctured by initial puncture needle under fluoroscopic guidance 20˚ below of horizontal line. Tract dilatation was done with 24 French single step dilator. Stones were fragmented by pneumatic lithoclast. Total tubeless PCNL (overnight Ureteric catheter only) was considered in cases with no PCS injury, mild haematuria and no residual fragments on fluoroscopy. Patients with larger stone burden, PCS injury were chosen for tubeless PCNL (Double J stent only). Patients with matrix stone or the one requiring second look surgery were given a nephrostomy in addition to Double J stent**.** Amplatz sheath was then removed after observing any haematuria or tract bleeding.

Patients in the prone PCNL group were first placed in the lithotomy position for the placement of ureteric catheter and per-urethral catheter after which they were turned prone. The rest of the procedure was done as described for the supine group.

Patients were followed up for fever, requirement of blood transfusion. A plain X-ray abdomen or a CT imaging was done to confirm stone free status after 4 weeks of procedure. Statistical analysis of data was done by Statistical Package for the Social Sciences (SPSS 25.0.0.0).

RESULTS

Total 132 patients underwent PCNL of which 68 of them were done in GMSV position and 64 of them were done in prone position. Patient characteristics were shown in the Table 1(a) and stone characteristics were shown in the Table 1(b). Operative time was defined from starting of cystoscopy to closure of nephrostomy site. Mean operative time was 76±11.3 minutes for the supine arm and 88±12.5 minutes for the prone arm (table 2). 5 patients in supine arm and 4 in the prone arm were found to have residual calculus (>5mm) which were managed by extra corporeal shock wave lithotripsy. Complete clearance without significant stone size was achieved in total 63 (92.6%) patients of the supine arm and 60 (93.7%) patients of the prone arm. Complications were classified according to Clavien Dindo Classification. Five patients (7.4%) in supine arm and four patients (6.3%) in the prone arm developed >38˚C fever for >48 hours which were managed conservatively. Three patients (4.4%) in the supine arm and three patients (4.6%) in the prone arm required blood transfusion. There was no colon injury, nephrostomy leak in any patient. The mean length of stay was 3.22±0.45 days for supine arm whereas 3.27±0.34 for prone arm which was statistically insignificant. Table 2 shows the surgical outcome in different variable.

Fig-1: Galdakao modified supine Valdivia position with marking of posterior axillary line, 12th rib and iliac crest

Table-1 (a): Patients characteristics

	Supine PCNL	**Prone PCNL**
Age (years)	41±13.2	44±11.5
Male	43	40
Female	25	24

Table-1(b): Stone Size

	Supine PCNL	**Prone PCNL**
Stone size	Mean ± SD	Mean ± SD
Over all Tubeless	2.8±0.9 3.51±0.87	2.7±0.8 3.55±0.97

Total tubeless	2.57±0.69	2.67±0.67

Table-2: Operative and postoperative variable

	Supine PCNL	**Prone PCNL**
Variable	Mean ± SD	Mean ± SD
Operative time in minutes (overall)	76±11.3	88±12.5
Stone clearance rate (%)	92.7	93.6
Hospital stay (days)	3.22±0.45	3.27±0.34
Post op complication	Number of patients (%)	Number of patients (%)
Fever	5(7.4)	4(6.3)
Blood transfusion (one unit)	3(4.4)	3(4.6)

DISCUSSION

PCNL has been the procedure of choice for renal stones more than 2 cm for nearly four decades, but like most surgical techniques, there have been constant efforts to improve the technique and its surgical outcome around the globe. While PCNL in the prone position continues to be the preferred approach for most urologists, supine positioning has gained wide acceptance in the past decade or so.

Supine position per se has undergone various modifications since it was first introduced [7]. We used the Galdakao-modified supine Valdivia position described by Ibarluzea *et al*. [8]. Although the supine position gives advantages of the less patient handling, better drainage of the Amplatz sheath, the ability of the surgeon to sit, a combination of antegrade and retrograde approaches, easier change from spinal or regional to general anesthesia and higher tolerance, especially in patients with pulmonary or cardiovascular disease, it is not free of disadvantages [14]. Limitation of supine PCNL includes a more difficult nephroscopy because of poor filling of the PCS leading to a small surgical field [15]. Difficult approach to the upper calyx also being one of the major drawbacks [16].

The Valdivia position initially showed an inferior stone free rates [7]. Wang et al in their randomized trial also depicted an inferior stone free rate [17]. However meta-analysis in the past have shown equivalent and even higher stone free rates for supine PCNL [18, 19]. We identified comparable stone free rate in our study (92.6% vs 93.7%).

Overall mean operative time was 76±11.3 minutes for the supine arm and 88±12.5 minutes for the prone arm. Shorter operative times with supine PCNL has been an established fact in previous randomized trials [20, 21].

In our study [table 2] 3 patients in each group (4.4% vs 4.6%)patients underwent blood transfusion which is comparable to available literature showing 4% and 2.5% rate of blood transfusion [10,19]. As far as post-operative fever was concerned our study showed total 5 patients in supine and 4 in prone group (7.4% vs 6.3%) developed fever which was comparable to 5.8% incidence of fever [22].

Our study had the limitations of small sample size and not being done in a double blinded fashion. Lack of postoperative evaluation of renal function also comes as a drawback.

CONCLUSION

Our study supports the efficacy and safety of PCNL in the modified supine position while its shorter mean operative time gives it an advantage over the traditional procedure. Modified supine PCNL continues to be an effective alternative to prone approach.

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