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Urology

MODIFIED SUPINE VERSUS PRONE PERCUTANEOUS NEPHROLITHOTOMY: SURGICAL OUTCOMES FROM A TERTIARY HEALTH CARE CENTRE MANGALORE.

KEY WORDS: PCNL, Modified Supine position, Prone position.

Dr E Muneendra Kumar

Department of Urology, AJIMS, Mangalore, Karnataka, India.

Dr Vijai R*

Department of Urology, AJIMS, Mangalore, Karnataka, India. *Corresponding Author

Dr Pritam Sharma

Department of Urology, AJIMS, Mangalore, Karnataka, India.

Dr Roshan Shetty

Department of Urology, AJIMS, Mangalore, Karnataka, India.

ABSTRACT

Background: The traditional prone positioning of percutaneous nephrolithotomy (PCNL) is associated with various anaesthetic and logistic difficulties. We aimed to compare the surgical outcomes of PCNLs performed using our modified supine position with those performed in the standard prone position. **Methods:** A prospective group of 188 patients undergoing PCNL were included in this 2 site study: 98 were performed in the modified supine position were compared with 90 undergoing PCNL in the prone position. The outcomes of radiation dose, radiation time, stone free rate, body mass index (BMI), stone size, operative time, length of stay (LOS), in hospital and complications were compared. **Results:** There were no significant differences in mean radiation time, radiation dose, stone size, length of stay and stone free rate between the modified supine and prone groups. The supine group had a higher mean BMI and shorter mean surgical time. There were no differences in septic or bleeding complications. **Conclusions:** This prospective study comparing the modified supine position with the standard prone position demonstrates reduced operative time in modified supine position but length of hospital stay, stone-free rates and complications were similar. Given the benefits of the modified supine position for the surgical and anaesthetic teams, particularly with obese patient groups, and should be considered by all surgeons performing PCNLs.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the treatment of choice for renal stones ≥ 2 centimetres [1]. The traditional prone position for PCNL is favoured by a majority of urologists [2] due to familiarity with the procedure, larger surface area for choice of puncture site and a potentially more direct approach to the kidney [3]. However, the prone position is associated with several anaesthetic, surgical and logistical disadvantages. As a result, several alternative positions are increasingly being utilised including complete supine, modified supine, or flank positioning [4-9] as they offer advantages including reduced ventilation and circulation difficulties, less radiation exposure to the surgeon, more direct renal puncture and avoidance of repositioning the patient during the procedure [4-9].

The modified supine position that combines a tilted supine position with lithotomy provides the additional benefit of allowing simultaneous retrograde access to the upper tracts. This enables a dual approach to large staghorn calculi and ureteric stones potentially reducing the operative time, trauma to the patient and increasing the stone free rate [10]. While there is substantial data comparing the supine PCNLs with the prone position, there is a paucity of data comparing the modified supine to the prone position and the current literature has no clear consensus on which position is superior. Thus, the aim of this study is to determine the surgical outcomes of patients undergoing PCNL in the 2 positions.

METHODS

This study was conducted from May 2018 to January 2023 which is a prospective study conducted on 188 patients undergoing PCNL where 98 patients prospectively undergoing PCNL in the modified supine position were compared to 90 patients in the standard prone position.

The modified supine position PCNL is performed using a C-shaped vacuum beanbag on the operating table. Under general anaesthesia the legs are placed in the lithotomy position, with the ipsilateral hip flexed with a flexed knee, and

the contralateral leg is abducted and supported in an extended position [10]. The beanbag is rolled under the hips and shoulders to tilt and support the torso at approximately 20 to 30 degrees. The ipsilateral arm is supported with a flexed elbow over the chest with the contralateral arm tucked next to the torso with an extended elbow. Suction is applied to the beanbag, thus supporting the patient in the tilted position. The number of punctures and pole of puncture was determined on the size and location of the calculus. All PCNLs (modified supine and prone) had ureteric catheters placed and ureteropelvic junction occlusion balloons were not used in any of the procedures. Nephrostomies were inserted if clinically indicated.

All patients booked for PCNL went into a pool of patients and then were allocated to an individual surgeon's list by the nurse-led surgical bookings team. All surgeons who perform PCNLs were included in this study. The adopted method was due to allocated surgeon's standard preference and all surgeons were well experienced the position of choice. Patient demographics were collected from scanned medical records. Maximum stone diameter was used to assess stone burden.

All those who had secondary procedures during the same admission or later for stone clearance were counted as having residual stones. All patients had postoperative X-Ray or computed tomography scans at 3 months to determine stone-free rates. Measured data included radiation dose, radiation time, stone free rate, patient body mass index (BMI), stone size, operative time, length of stay in hospital and postoperative complications.

RESULTS

Patients characteristics are mentioned in (Table 1). In our study many patients with higher BMI were included in modified supine group. Stone burden was almost same in both groups.

Table 1 – Patient Characteristics

| Characteristics | Prone position | Modified Supine position |
|-----------------|----------------|--------------------------|
| No. of patient | 90 | 98 |
| Sex | | |
| Male | 41 | 58 |
| Female | 49 | 40 |
| Age | 40.4 +/- 10.5 | 45.2 +/- 12.6 |
| BMI | 23.2 +/- 2.5 | 28.4 +/- 5.2 |
| Stone burden | 21.1 +/- 6.8 | 21.4 +/- 8.8 |

Operation time was more in prone position than modified supine position (Table 2). Length of stay is almost same in both groups. Stone free rate is slightly better in modified supine position which is not statistically significant. Radiation time was more in modified supine position.

Table 2 – Surgical outcomes

| Variables | Prone position | Modified Supine position |
|-----------------------|----------------|--------------------------|
| Operation time (min) | 115 +/- 32 | 90 +/- 36 |
| Length of stay (days) | 3 +/- 1.5 | 3 +/- 1 |
| Stone free rate (%) | 70 | 72 |
| Radiation time (min) | 7.5 +/- 5.5 | 8 +/- 6.1 |

In Prone position 3 patients suffered from sepsis and in modified supine position 4 patients, 2 patients required transfusion in prone position and 1 in modified supine position (Table 3). There is no statistically significant difference in complication rate when we have compared both groups.

Table 3 – Postoperative Complications

| Complications | Prone position | Modified Supine position |
|---------------------|----------------|--------------------------|
| Sepsis | 3 | 4 |
| Transfusions | 2 | 1 |
| Urine leak | 1 | 0 |
| Total complications | 6 | 5 |

DISCUSSION

We found a shorter operative time in the modified supine group compared with the prone group. This 30-minute difference can be accounted for by not repositioning the patient (and consequently repeat prepping and draping, as well as staff rescrubbing and gowning), as well as the modified supine position facilitating dual access to the area, assisting with stone clearance and saving time [11]. Our findings are consistent with those of a recent meta-analysis of PCNL positioning by Liu et al. [12], where the supine position was found to have a mean reduction of 25 minutes when compared with the prone position. However, the evidence for shorter operating time is not entirely in favour of the modified supine position, with a prospective randomized study by Wang et al. [13] reporting lower operation times in their prone group, as compared to modified supine. While familiarity with the procedure performed in the supine position may affect the success and efficiency of the operation, Wang et al. [13]’s study also had patients with a much lower mean BMI compared to our series.

We found that the PCNLs performed in the modified supine position had a higher stone-free rate but which was not statistically significant. De Sio et al. [14], in keeping with our results, found the supine position to have higher stone-free rates. However, a comparison of positioning by Valdivia et al. [2], which comprised the 5,803 patients from the Clinical Research Office of the Endourological Society’s (CROES) prospective PCNL database found that stone-free rates were significantly higher (77% vs 70.2%) for the prone group as compared with supine, though the vast majority of these cases would have been in the complete supine position.

The modified supine stayed on average same number of days in hospital as compare to prone group with most other studies showing no significant differences between the 2 groups

[2,12]. Increased BMI is one of the risk factors for renal calculi and associated with reduced stone-free rates [15]. The CROES prospective database of 5,803 patients found that obesity was associated with longer operative time, decreased stone free rate (and subsequent higher re-treatment rate) [16]. The modified supine position offers several advantages in this regard. Firstly, as the patient is lying supine for the duration of the procedure, there is less pressure placed on their lungs compared to when they are lying prone. This reduces difficulties associated with maintaining stable ventilation of patients while they are prone, particularly obese patients where the abdominal compression can cause decreased venous output [10]. Supine position also allows easier and faster access to the airway should the need for reintubation arise. Secondly, performing PCNL in the traditional prone position required the patient to be moved from a supine to a prone position partway through the operation needing repositioning and redraping together with staff rescrubbing and regowning partway through the procedure, which has added difficulties in obese patients which is minimised in the modified supine position [11]. Furthermore the prone position is associated with increased risk of postoperative visual loss [17], direct pressure injuries and peripheral nerve damage, particularly to obese patients [10]. A study by Mazzucchi et al. [18] found that the complete supine position offers significantly shorter operative times and postoperative length of stay in hospital, when performed in obese patients. These factors strongly favour performing PCNL in the modified supine position especially in the obese patients, particularly with patients presenting with cardiopulmonary comorbidities.

Our study found same overall complication rates in the prone position compared with the modified supine position. The meta-analysis by Liu et al, [12] which also found no significant difference in complication rates between their modified supine and prone cohorts.

CONCLUSION

This prospective study comparing the modified supine position with the standard prone position demonstrates reduced operative time in modified supine position but length of hospital stay, stone-free rates and complications were similar. Given the benefits of the modified supine position for the surgical and anaesthetic teams, particularly with obese patient groups, and should be considered by all surgeons performing PCNLs.

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