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A PROSPECTIVE STUDY TO COMPARE THE EFFICACY AND SAFETY BETWEEN MODIFIED SUPINE LITHOTOMY PERCUTANEOUS NEPHROLITHOTOMY VERSUS PRONE PERCUTANEOUS NEPHROLITHOTOMY

Urology

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ABSTRACT

Background: Kidney stone is one of the most common reasons to visit urologist around the globe. Percutaneous nephrolithotomy is the treatment of choice for nephrolithiasis. **Methods:** The aim of this study was to compare the efficacy and safety between modified supine lithotomy percutaneous nephrolithotomy and prone percutaneous nephrolithotomy(PCNL). This was a hospital-based Prospective study conducted at Rajiv Gandhi Government General Hospital(RGGGH) in Madras Medical College(MMC), Chennai, Tamil Nadu, India. This study was carried out for a one-year duration, on 50 patients with renal and upper ureteric calculi. **Results:** The mean operative time in modified supine lithotomy PCNL was 55 ± 20 minutes, and in prone PCNL was 90 ± 40 min(p0.01). The tubeless rates were 75% and 55% in modified supine lithotomy and prone PCNL, respectively (p 0.03). Stone-free rate(SFR) was 85% in modified supine lithotomy PCNL and 80 % in prone PCNL when assessed with Fluoroscopic and visual images. **Conclusions:** Modified supine lithotomy was found to be superior to prone PCNL with reduced operative time, better tubeless rate, stone-free rate, and intra and post-operative complications.

KEYWORDS

Modified supine lithotomy percutaneous nephrolithotomy(PCNL) , Prone PCNL, Renal and ureter calculi, Stone free rate (SFR), Supine PCNL.

BACKGROUND

The burden of renal stone disease, also known as nephrolithiasis, is estimated with a prevalence of 7% in adults, and with a recurrence rate of ≥30% within ten years. The incidence of kidney stones is globally increasing, with an estimated prevalence ranging up to 15%. During their lifetime, approximately 7% of women and 13% of men will develop a kidney stone(1)(2). Stone removal can improve renal function by eradicating obstruction and, in some instances, an underlying infection. Most patients with small kidney stones pass them spontaneously(3). Those who are symptomatic and not able to do so may be subjected to a number of stone-removing procedures, most commonly, shock wave lithotripsy and ureteroscopy. Percutaneous nephrolithotomy (PCNL) is considered the treatment of choice for large urinary tract calculi and staghorn renal nephrolithiasis. The approach for this surgery may be either supine or prone, and different access techniques are described in the literature using ultrasound, fluoroscopy, or both combined. According to the EAU and AUA guidelines, the main indications for PCNL are renal stones greater than 20 mm, which include total staghorn and partial staghorn calculi (4). PCNL in the prone position has been considered the gold standard for treating kidney stones >2 cm. Presently modified supine lithotomy position has been proposed with the purpose of simplifying the procedure and improving its efficacy. In contrast, the prone position is the old way to perform PCNL as some urologists are still reluctant to consider the supine position. (5). This prospective study was conducted to compare the efficacy and safety of modified supine lithotomy PCNL versus prone PCNL at RGGGH and Institute of urology, Madras Medical College(MMC), Chennai.

METHODS

This is a prospective study done for a period of one-year duration. Patients with Renal and Upper ureter calculi were included and patients with uncorrectable bleeding disorders, active urinary tract infection, and pregnancy were excluded, a total of 50 subjects were selected. They were divided into two groups, Group A and Group B. 25 patients in Group A underwent modified supine lithotomy PCNL, and 25 patients in group B underwent prone PCNL, respectively. The preoperative patient evaluation included history, clinical examination, routine laboratory investigations and evaluation of the anaesthesia risk before surgery. All patients had an unenhanced computed tomography (CT) scan if RFT was raised, Contrast-enhanced CT scan if RFT was Normal, and a plain film of the abdomen. The patient's demographic profile is shown in Table 1.

The Institute ethical Committee approved the study. Consent was taken from the study subjects, and data was entered and analysed using SPSS version 23.

Table 1: Demographic profile of patients.

Particulars	Modified supine Lithotomy PCNL	Prone PCNL
No. of patients (Male/ Female)	25 (15 / 10)	25 (13 / 12)
Age (Years)	50 ± 15	55 ± 13
BMI (mean range)	28 (24-30)	26 (23-30)
Stone diameter (cm)	3.4 (2.5-5.1)	3.3 (2.7-4.5)
Calyx puncture (%)		
Lower	80	78
Middle	17	18
Upper	3	4
ESWL (%)	8.0	9.0

In modified supine lithotomy PCNL , the patient was in supine position with one leg ipsilateral to the stone held in extension and the other leg was kept in flexion position .The position of arm was such that the ipsilateral arm was crossed at the chest and the lumbar region next to the stone was raised to 20º as shown in Fig 1.

Fig 1 : Patient in modified supine lithotomy position .

Fig 2: Patient in Prone Percutaneous nephrolithotomy (PCNL) position

The Prone PCNL (Fig-2) technique followed these classic steps: patients were placed in a lithotomy position and a ureteral catheter was inserted through a rigid cystoscope to perform a retrograde pyelogram. The ureteral catheter was fixed to a Foley catheter, and then the patient was repositioned to the prone position with pads under their shoulders.

Surgical procedure

The kidney with calculi, under fluoroscopic control, was punctured with an 18-gauge puncture needle, corresponding to position of the stone and its largest bulk puncture of a posterior lower calyx is done. Through this puncture, 2 guide wires were inserted into the collecting system - one acts as working and the other as the safety guide wire. Following it the tract was dilated with the dilators of the nephrostomy to 8F which was equipped with a peel-away access sheath. The dilator was then removed, leaving the access sheath in the collecting system. A second, Teflon-coated guide wire was introduced into the renal pelvis through the access sheath. This second "safety" guide wire was attached to the skin. The nephrostomy was loaded on the Sensor guide wire. This nephrostomy is equipped with a hollow metallic stylet. Pulling or pushing the stylet allows modification of the loop curvature of the nephrostomy, helping to direct the guide wire into the bladder. Once the guide wire had successfully descended into the bladder, the second surgeon exteriorized the tip of the wire through the urethra with the help of a cystoscope. This manoeuvre permitted obtaining through-and-through guide wire passage the tract dilation systematically performed with balloon device, diameter of the Amplatz sheath selected according to the size of the calyx and calyceal infundibulum. The use of Amplatz sheath is according to patient's anatomy.

Postoperatively, the nephrostomy and the bladder catheter were removed the first day after surgery. A full CBC was run and serum creatinine checked on the first postoperative day. Radiologic examination was undertaken on the first postoperative day and was individually tailored. For patients with strongly radio-opaque calculi and normal body, a kidney-ureter-bladder was performed. In obese patients, especially those with low-density, bulky, or complex calculi, we preferred nonenhanced CT scans. If no complications occurred, patients were routinely discharged on the second postoperative day. If the patient had no residual stones, the urethral catheter was removed before the patient left the hospital. In patients with a double-J stent, if no residual stones were present, the stent was removed 1 week after surgery in the outpatient department. Patients having a double-J stent and residual fragments underwent extracorporeal shock wave lithotripsy(ESWL) 2–3 weeks after PCNL.

RESULTS

Both the groups were comparable regarding the age, male/female ratio, stone size, Hounsfield unit(HU) and site, BMI and ASA score between the two groups. Stone-free rate (SFR) defined as complete clearance of calculi were assessed with fluoroscopic and visual images. SFR was 85% in modified supine lithotomy and 80 % in prone PCNL respectively when assessed with Fluoroscopic and visual images. The mean operative time in modified supine lithotomy PCNL was 55 ± 20 min and in prone PCNL was 90 ± 40 min respectively (p 0.01).

Tubeless rate were 75% in modified supine lithotomy PCNL and 55% in prone PCNL respectively (p0.03). Complications in prone group were bleeding requiring transfusion (3%), post op sepsis (2%) and pyelocaliceal perforation (2%) while in modified supine PCNL group bleeding requiring transfusion (1%), transient urine leak (2%) and post-op sepsis (1%) were noted. Colonic injuries were 0.4% in prone which was 0% in modified supine lithotomy group.
Results and Findings are given in Table 2.

Table 2: Results

	Modified supine Lithotomy PCNL	Prone PCNL	p value
Stone Free Rate (SFR)(%)	85	80	0.90
Mean Operative time (minutes)	55 ± 20	90 ± 40	0.01
Tubeless rate (%)	75	55	0.03
Complications			
Bleeding requiring transfusion(%)	1	3	0.71
Post op sepsis(%)	1	2	0.65
Colonic injuries (%)	0	0.4	0.50

DISCUSSION

In this study the operative time is significantly reduced with a better stone-free rate and significant tubeless rate in modified supine lithotomy percutaneous nephrolithotomy than prone percutaneous nephrolithotomy. Anaesthetic, respiratory and cardiovascular problems are less in modified supine lithotomy percutaneous nephrolithotomy compared to prone percutaneous nephrolithotomy. The findings of this study are similar to study from Australia[6] where the supine group had a shorter mean surgical time, shorter mean length of stay and higher stone-free rate. There is no difference in bleeding and septic complications but the prone group had a higher rate of overall complications. The result of present study also aligns with studies[7,8]. This study shows lesser operative time for modified supine PCNL than prone position. Similar findings are given by another author[5] who tells about saving 30 mins in supine over prone position. Routine and more accepted position for Anaesthetist similar to another study [9] for obese and high-risk cases. The finding of this study was dissimilar to study [6] where stone clearance rate was significantly lower in modified supine than in prone position group with mean operation time being lower in prone than modified supine.

CONCLUSIONS

In our study modified supine lithotomy PCNL has significantly reduced operative time of 55 ± 20 minutes, 75% tubeless rate and with better stone clearance of 85%, less anaesthetic, respiratory and cardiovascular problems and comparable complications implies that modified supine lithotomy should be considered better position for carrying out PCNL.

This position also provides ample space for placing and dilating tracts, easy access under fluoroscopy, a relatively horizontal tract allowing low Intra - renal pressures and easy washout of fragments and simultaneous access to the lower urinary tract for ureteroscopy and stent placement which has helped with complete stone clearance.

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