Percutaneous nephrolithotomy in the supine position: Initial experience at Yashoda Hospital

Priyank Salecha[1], Naveen Chandra Acharya[2] ,Vamsi Krishna[3]

[1]DNB Resident, [2,3]Consultant Urologist, Department of Urology, Yashoda Hospital, Somajiguda, Hyderabad, Telangana, India

Address for correspondence: Dr Priyank Salecha, DNB Resident, Yashoda Hospital,Somajiguda,Hyderabad,Telangana,India

email : p.salecha.ps@gmail.com

ABSTRACT

Objectives: To assess the feasibility of performing percutaneous nephrolithotomy (PCNL) with the patient supine. Although PCNL with the patient prone is the standard technique for treating large (>2 cm) renal stones including staghorn stones, we evaluated the safety and efficacy of supine PCNL for managing large renal stones(upto 2.5cm), with special attention to evaluating the complications.

Materials & Methods: In a prospective study between March 2015 and March 2016, 60 patients with large renal stones underwent cystoscopy with aureteric catheter inserted, followed by puncture of the collecting system while they were supine. Tract dilatation to 24 F was followed by nephroscopy, stone disintegration using pneumatic lithotripsy, and retrieval using a stone forceps. All patients had a nephrostomy tube placed at the end of the procedure.

Results: The median (range) operative duration was 120 (90–210) min, and the mean (SD) volume of irrigant was 18.2 (3.7) L. One puncture/two punctures were used to enter the collecting system and clearance was considered with fragments <5mm.We achieved total clearance in 54 out of 60 patients (90%).

Conclusion: Supine PCNL is technically feasible; it has several advantages to patients, urologists and anaesthesiologists. It gives stone-free rates and a low incidence of organ injury comparable to those in standard prone PCNL.

Keywords: Percutaneous, nephrolithotomy, supine position

INTRODUCTION

The first documented percutaneous nephrostomy (PCN) was by Thomas Hillier in 1865, but it was not until 1955 when Goodwin et al.[1] reported their work on PCN for the drainage of suppuration and urine in a hydronephrotic kidney that PCN gained widespread acceptance.

In 1976 Ferstrom and Johansson[2] reported the first percutaneous procedure for stone removal and since then percutaneous nephrolithotomy (PCNL) has been shown to be effective and safe for treating large renal stones (>2 cm), including staghorn stones.PCNL is usually done with the patient prone, as it is believed that for puncturing and dilatation of the kidney, which is a retroperitoneal organ, the posterior approach provides a large working space with a lower incidence of splanchnic and vascular injury. However, even in this position, major complications, including haemorrhage and organ injury, have been reported in 0.9–4.7% of cases [3,4]. The prone position is associated with patient discomfort, a compromised circulation and ventilation, especially in obese patients, and it is also time-consuming and increases the radiological hazards to the urologist [4].

Various modifications of patient positioning for PCNL were tried as urologists understood more of the surface anatomy of the kidney and related viscera.These included the reverse lithotomy [5], supine[6] and lateral decubitus[7] positions. These options were shown to be safe and effective compared with the conventional prone PCNL, yet were never popular. The complete supine PCNL is a tempting substitute for prone PCNL, with the potential advantages of less patient handling, a quicker operation, better drainage through the Amplatz sheath, and the ability to perform simultaneous PCNL and ureteroscopic procedures[6–8]. Although severe complications of anaesthesia are infrequently reported with the patient prone, the supine position is more comfortable for the anaesthetist, especially in obese patients at high risk during anaesthesia [6].

Thus we assessed supine PCNL to evaluate its safety and efficacy in managing large renal stones, with special attention to evaluating the complications.

MATERIALS AND METHODS

At our centre, between March 2015 and March 2016,supine PCNL was used in 60patients (median age39 years, range 19–62; 48 men and 12 women) with a median(range) body mass index (BMI) of 30 (17–42) kg/m^2.The preoperative evaluation included history, clinical examination and routine laboratory investigations. All patients had IVU or noncontrast-enhanced spiral CT of the urinary tract to evaluate the stone

location, burden and radiolucency. The stone burden was determined by measuring the longest diameter on the preoperative radiological investigations; if there were multiple calculi the burden was defined as the sum of the longest diameter of each stone. A preoperative sterile urine culture was mandatory and patients with a positive culture were treated for 48 hours before PCNL, and the treatment continued for 7 days afterwards. A third-generation cephalosporin was given as prophylaxis to patients with a sterile culture at the time of surgery, and was continued for 48 h afterwards.Stones included in the study were either single stone within the renal pelvis or within lower calyx/middle calyx with or without extension in pelvis. The average stone size was <25 mm, 47 patient had a pelvic stone, and 6 had lower calyx stone and 7 patients had stones within middle/lower calyx with extension to renal pelvis.

The procedure began with the patient in the lithotomy position, with insertion of an open-tip 7–8 F ureteric catheter, using a 20 F cystoscope. The operative duration was calculated from the time of ureteric catheter insertion until the nephrostomy tube was secured to the skin [Figure 1]. After inserting the ureteric catheter, the patient was placed supine with the ipsilateral arm secured to the chest, and a 1-L fluid bag under the flank. Under fluoroscopic guidance an 18 G needle was used to puncture the collecting system [Figure 2]. Unlike in the prone position, the needle must remain almost horizontal or slightly inclined upward towards the operating table. We marked the puncture site, which lies at the level of around 2cm above the tip of 12th rib anteriorly.

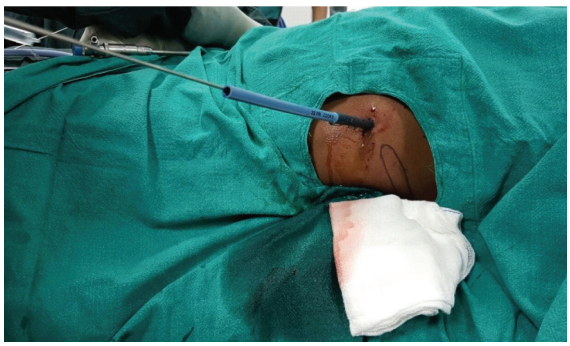
Figure1 : Patient in supine position while puncture

Figure 2:puncture site

A 0.9 mm (0.038 inch) guidewire was inserted, followed by dilatation of the tract using PTFE dilators up to 22F; using metallic telescopic dilators (Alkan's dilators), followed

by the insertion of a 22 F Amplatz sheath.The increased mobility of the kidney, due to the absence of support when supine, caused the guidewire to buckle, hindering tract dilatation. This was managed by an assistant supporting the patient's abdomen, pushing it backward during dilatation [Figure 3]. After tract dilatation we used a 20 F nephroscope with a ballistic energy source for stone disintegration.The volume of irrigant used and the duration of fluoroscopic exposure were recorded at the end of the procedure.

Figure 3: Showing insertion



Haemodynamic changes and any need for transfusion were evaluated and recorded during the first 24 h after surgery.A radiological examination was used to assess stone clearance on the first day after surgery, with either a plain film of the abdomen with USG abdomen or CT of the urinary tract.

RESULTS

The median operative duration was 120 min, and the median duration of X-ray exposure was 10 min. The mean (SD) volume of irrigant fluid was 18.2 (3.7) L. One puncture was used to enter the collecting system in 56 renal units , while 4renal units needed two punctures.We used a stone size of <5 mm as the protocol for there being no need for further treatment. Of the 60 renal units treated, 54 patients had no or <5 mm residual fragments,resulting in a stone-free (success) rate of 90%.Of the 6 renal units with residual stones, were treated by ESWL single sitting. All patients were stone-free at a 2-month follow-up.Any reduction in haemoglobin level, and the vital signs, were recorded.No patient within the study need blood transfusion.On the 1st postoperative day nephrostomy was removed and DJ stent was removed after 3 week duration.

DISCUSSION

PCNL is widely accepted as the treatment of choice for large renal stones, including staghorn stones. It is less invasive, effective, safer and has a lower complication rate than open renal surgery . PCNL is usually done with the patient prone, which carries several disadvantages to the patient, anaesthesiologist and urologist.

In 1987, Valdivia et al. reported the first study on the feasibility of PCNL in the supine patient, but it was 1998 before the same authors reported their 10-year experience of PCNL with the patient supine [6], and that this technique was then infundibulum. There was anteromedial renal displacement during tract dilatation, rendering the procedure more difficult, and this was managed by supporting the kidney while creating the tract.

In a recent review of the development of PCNL positions in the last 35 years [7], evaluating their safety,advantages and limitations, the authors concluded that there was no perfect position for PCNL, and that 'Urologists who perform PCNL should be familiar with the differences in the positions and be able to use the method appropriate for each patient'.The present study has several limitations; it included a relatively small sample, and although it included patients with staghorn stones, the stone burden was relatively low. This was a descriptive study lacking a comparative arm and was not randomised.

CONCLUSION

Supine PCNL is technically feasible, has several potential advantages, especially in patients at high risk when under anaesthesia, and can be used to treat stone of appreciable size . There is no apparent added risk in using this technique, and the stone clearance and complication rates are within the accepted values cited previously for the standard prone PCNL.

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