Supine PCNL: An alternative to prone PCNL.
Initial experience

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Abstract

The last decade has seen the emergence of a variety of positions for carrying out percutaneous nephrolithotomy (PCNL). An alternative position for PCNL consists of the modified supine position, in which patients are placed in a supine position with a water bag or specially designed cushion under the flank in order to ease of puncture under image guidance, operative field availability, ability to make and dilate multiple tracts and ease of combining retrograde intrarenal surgery (RIRS). We describe and illustrate our supine position, which we believe addresses a number of the issues. Our position allows easy percutaneous access under fluoroscopy (torso only tilted to around 15°), space for placing (flank free of support) and dilating multiple tracts (kidney lies in a fairly neutral position and hence less mobile), a fairly horizontal tract allowing low intrarenal pressures and easy washout of fragments. The study showed that PCNL in the supine position is an effective and
safe method for treating urinary stones. We would like to highlight the supine position as one of the standard positions for carrying out PCNL.

**Key words**

percutaneous nephrolithotomy, supine position, prone position

**Introduction**

Since the first successful removal of a renal calculus via a nephrostomy tract in 1976, percutaneous nephrolithotomy (PCNL) has become the preferred method of treating patients with large or complex stones. Traditionally, PCNL has been performed in the prone position which allows a wide field for kidney puncture, avoids abdominal visceral injuries, and makes the puncture pathway short and straight.

Multiple routes of access and the intraoperative use of C-arm fluoroscopy X-ray machines may contribute to the vertical positioning of the puncture. This position provides posterior access to the collecting system, which theoretically enables the surgeon to puncture a posterior calyx through Brodel’s avascular renal plane without significant parenchymal bleeding and peritoneal perforation.

![Figure 1. Examples of cases: On the right staghorn stone and 2.5 cm left renal stone](image)

However, the prone position also has some disadvantages. For example, abdominal pressure decreases end expiratory lung volume and lung capacity, reducing the ability of patients to tolerate prolonged surgery, contraindicating the prone position in morbidly obese...
patients and individuals with some respiratory diseases\textsuperscript{6}. An alternative position for PCNL consists of the modified supine position, in which patients are placed in a supine position with a water bag or specially designed cushion under the flank\textsuperscript{7}. The modified supine position has several advantages\textsuperscript{8-10}. Due to greater comfort, the position has a low impact on a patient’s blood circulation and respiratory system. This position makes it easier for the anesthetist to monitor the patient, and it may decrease the use of anesthetics\textsuperscript{11-13}. For high-risk patients, the modified supine position can be changed to facilitate endotracheal intubation anesthesia whenever needed. Moreover, the smaller angle between the horizon and the operating channel improves the removal of crushed stones\textsuperscript{14-16}. This position also facilitates simultaneous ureteroscope access when necessary, allowing for the combination of PCNL and the ureteroscope in the management of complex stone diseases. The major disadvantage of the modified supine position is that the kidney is more easily pushed forward by the puncture needle and the fascial dilators, leading to the establishment of a deeper channel\textsuperscript{17-20}.

Patients and method

Between June 2013 & January 2014, 21 patients underwent supine PCNL from start to finish (16 males and 5 females), age between 29 and 78 years old. 14 patients had renal stones in their left kidney and 7 of them in their right. 16 patients had a single stone and 5 multiple stones (Figure 1). The size of the stone were between 2-4cm (17 pts), 1-1.9cm (3pts) and 1 pt had a complete staghorn stone. Pyelocalyceal Access & tract dilatation performed by a urologist in 19 patients and in 2 a percutaneous nephrostomy was placed by a radiologist, before the procedure. In 2 pts concomitant procedures performed (TURBT & rigid URS / LASER-3.9 CM proximal ureteric calculus) All the pts had a ureteric stent post procedure and 5pts had nephrostomy as well.
Under GA patient was placed in Supine position with a gel cushion beneath the ipsilateral flank to elevate & expose the loin for percutaneous access and to reduce the possibility of pleural damage (Figures 2-4). Legs were supported on stirrups to have access to urethra for retrograde rigid / flexible ureteroscopy (Figure 2). All patients received IV Antibiotics at induction. Flexible ureteroscopy performed initially to identify the position of the stone and retrograde study performed. Under fluoroscopy guidance, puncture performed with 18-G coaxial needle, which was inserted into the desired calyx. Tract dilatation was performed using Nephromax balloon dilator. A nephrostomy balloon dilation catheter was inserted and a 30 Fr Amplatz sheath was placed in the proper position, allowing the introduction of a nephroscope. A Lithoclast Master [double lithoclast and ultrasonic system] was used to fragment and remove the stone. At the end of the procedure, all patients had ureteric stent insertion and removed about 3-4 weeks later in the out-patient clinic, and 5 had nephrostomy as well, opened for 24 hours and there was no extravasation, the tube was removed subsequently.
Results

A stone-free state was defined as no residual stones of diameter > 4 mm. Patients with residual fragments of diameter > 5 mm were treated with extracorporeal shock wave lithotripsy (ESWL) or Flexible uretero-renoscopy & Laser stone fragmentation or a repeat PCNL. Postoperative complications were classified according to the modified Clavien grading system.

We have not experienced any major complications. 1 pt had prolonged old haematuria, but stable and treated with prolonged staying with the nephrostomy tube, which has been removed 1 week later, after the urine became clear. None of the pts of this study needed blood transfusion, and 3 patients were treated for urinary tract infection and sepsis, and 1 pts had chest infection. No bowel or lung injuries encountered.

The rates of the stone clearance-stone free were 75% (15/20), 3 pts had fragments between 5-9 mm, treated with Flexible ureteroscopy and laser stone fragmentation in a later stage, and 3 pts had to come back for a repetition of PCNL. 16 pts discharged between 2nd and 4th postoperative day and 5 pts between 7th and 10th.

Discussion

PCNL has been traditionally performed in the prone position, with this position still being the most used. In the past decade, however, several variations in patient positioning for PCNL have been proposed.

Advantages of the supine position include less patient handling, better drainage of the Amplatz sheath, a combination of antegrade and retrograde approaches, the ability of the surgeon to sit, easier change from spinal or regional to general anesthesia and higher tolerance, especially in patients with pulmonary or cardiovascular disease. The earning curve for practising endourologist is minimal.
Every supine variation, however, also has inherent disadvantages. The complete supine position has several drawbacks, including reduced puncture space and difficulties in establishing multi-channels.

None of the patients in our study experienced major complications. Complications may occur during or after PCNL and may include extravasation, blood transfusion and adjacent organ injuries. In other studies, the rates of major complications, however, including septicemia, colonic or pleural injury and serious bleeding, have been found to vary from 0 to 4.7% \(^{20,21,22}\). Furthermore, there were no significant between groups (prone v supine) differences in mean blood loss, need for blood transfusion, and mean hospital stay, similar to previous results\(^{18}\), suggesting that operations performed in both positions are effective and safe. There were no significant differences in the complication rate and requirements for blood transfusions. However, another randomized study found that the transfusion rate was higher in the supine (27.5%) than in the prone (7.5%) group\(^{19}\). Differences between studies may be due to different transfusion thresholds between different centres. Apparently, PCNL in the prone position was thought to require a longer time, since patients require to be placed in prone position after ureteral catheterization and to roll back to the supine position after surgery. Supporting evidence has been provided. For example, randomized trials have reported that operation times were significantly shorter in the supine than in the prone group\(^{18,19}\).

**Conclusions**
The study showed that PCNL in the supine position is an effective and safe method for treating urinary stones. There are numerous advantages for PCNL, including decreasing operating time, evacuation of stone fragment, a more tolerable position for high-risk patients, and sitting position for the surgeon. We hope this paper encourage the stone teams to perform PCNL in the supine position.

Περίληψη

Την τελευταία δεκαετία έχουν προταθεί ποικιλία θέσεων της διαδερμικής νεφρολιθοτριψίας (PCNL). Μία εναλλακτική θέση για PCNL είναι ύπτια θέση που υπερτερεί έναντι της κλασσικής πρήνου, λόγω της ευκολότερης πρόσβασης στον αεραγωγό και στη μικρότερη επιβάρυνση των ασθενών υψηλού κινδύνου, αποτρέποντας τις αναπνευστικές και καρδιαγγειακές επιπλοκές και προσφέροντας ευκολότερη πρόσβαση στο αναπνευστικό σύστημα του ασθενούς αλλά και μείωση των επιπλοκών από το γαστρενετερικό λόγω της θέσης του εντέρου προσφέροντας τη δυνατότητα της ταυτόχρονης χρήσης εύκαμπτης ουρητηροσκόπησης. Η εμπειρία μας έδειξε ότι PCNL σε ύπτια θέση είναι μια αποτελεσματική και ασφαλής μέθοδος για την αντιμετώπιση ευμεγέθους νεφρολιθίασης.

Λέξεις ευρετηριασμού

διαδερμική νεφρολιθοτομή, ύπτια θέση, πρηνής θέση

References


