INTRODUCTION

Percutaneous nephrolithotomy (PCNL) has become the choice of modality for the treatment of large and complicated renal calculi (1). Prone position remains the standard method for positioning patients for PCNL and has several advantages including wide operation field, and a large room for instrument maneuvering. However a major inherent drawback associated with prone position is the poor tolerance by patients. When operation time is long, patients may experience difficulty in breathing; this is especially true in obese and old patients, or in patients with poor health or compromised respiratory function (2-5). To alleviate this drawback, several other methods of positioning patients for PCNL including supine, supine-oblique, and flank positions have also been used with varying results (6-8). Here we report a new positioning method called “flank suspended supine position” (FSSP) for PCNL and describe our experience with PCNL in this position for treating 150 cases of renal stones between June 2009 and July 2010.

PATIENTS AND METHODS

Between June 2009 and July 2010, 150 cases of renal stone patients were treated with FSSP PCNL. Detailed characteristics of the patients and stones are given in Table I. Pre-operative evaluation included history taking, physical examination, routine laboratory tests, ultrasound, intravenous pyelogram (IVP) or 3D CT image reconstruction. All patients received continuous epidural anesthesia.
When anesthesia was commenced, the patient was first put in the lithotomy position. A 5F or 6F indwelling ureteral catheter was inserted into the affected side through cystoscopy. The patient was then placed in the supine position with the shoulder and buttck of the affected side raised, using a 3-liter water bag or air cushion bag, suspending the flank of the diseased side. The body contour of the affected side was aligned to the edge of the table. At this point, the coronal plane of the patient was 30–35° to the horizontal plane. The operating table was then adjusted to the jackknife position, with the tip of the lower part of the table slightly lowered. The leg of the affected side of the patient assumed a straightened, dorsally flexed and slightly inner rotated position, while the hip of the other side outer rotated, the knee flexed, making the body of the patients assume an “opisthotonus” or arching position. The patients were then immobilized at the chest and pelvis with two adherent tapes, which crossed each other at the patient’s abdomen to form a “V” shape (Fig. 1). Once the patient was properly positioned, a renal puncture tract was established at the posterior auxiliary line under the guidance of ultrasound. This step was performed with one assistant injecting normal saline solution through the ureteral catheter to create artificial hydronephrosis, and another assistant pressing the anterior abdominal wall of the affected side to immobilize the kidney during puncture. After confirming access to the collecting system, a guide wire was passed into the collecting system through the cannula. The puncture tract was dilated with facial dilators from 6F up to 16F or 20F followed by placing a nephroscope in the established tract. Stones were visualized with a ureteroscope or nephroscope and fragmented with laser or the third generation of ultrasound. Larger stones were retrieved through ureteroscopy. At the end of the procedure, a 5F double-J and nephrostomy was placed routinely.

RESULTS

Puncture was successful in all 150 patients, 143 of which received single channel lithotripsy, 7 dual channel lithotripsy, and 6 simultaneous bilateral PCNL. All patients well tolerated the procedure, with no need to change to another position because of discomfort. Intra-operative blood pressure, heart rates and oxygen pressure remained stable for all patients. There were no significant differences in pre- and post-operative arterial gas analyses. Mean operation time was 78.29±26.13 min. The immediate post-operative stone-free rate was 83%, as determined by a KUB taken 4-5 days post-operatively. For those with residual stones (26 cases), 18 were stone-free after a second PCNL, 8 after extracorporeal shock wave lithotripsy (ESWL). Mean hospital stay was 7.63±2.39 days. Three cases developed severe bleeding that required blood transfusion after operation. Post-operative fever occurred in 12 cases and was treated with broad-spectrum antibiotics. Five patients required post-operative analgesic due to pain in the wound. Leakage surrounding nephrostomy occurred in 5 patients and stopped after adjusting the position of nephrostomy drainage. No injury occurred to pleural cavity and visceral organs.

DISCUSSION

Prone position has been used for over 20 years in PCNL and widely accepted by worldwide urologists. It was till 1998,
when the first large series of PCNL performed in supine position was reported by Valdivia et al. In this series, 577 patients underwent PCNL in supine position with a success rate of 93.1%, and average operation time of 85 min. There were 3 cases of severe bleeding while no colon injury occurred. The authors concluded that the supine position was comfortable for patients and also effective for PCNL (7).

It is now commonly accepted that supine position offers comfort to patients, has low incidence of colon injury, and minimal impact on cardiopulmonary function, is superior to other positions for obese patients and patients with compromised cardiopulmonary function (5). Additional advantages include that surgeons can operate in a sitting position, a near horizontal percutaneous tract. Modified supine position can even allow combined ureteroscopy (9-11).

Despite the advantages of different supine positions, several drawbacks prevent it from becoming a standard position for PCNL. First, the prone position has a longer history of application with established safety and effectiveness, and is familiarized by many surgeons who are reluctant to adapt to a new one, such as the supine position. Second, the prone position is not convenient for intra-procedural fluoroscopy. Third, the supine position has relatively less supportive clinical data (4,8). Fourth, existing supine positions require to raise the flank region, resulting in a smaller puncture area, restricted maneuvering space, difficulties in accessing upper calyx, establishing multiple channels, and managing taghorn stones. Fifth, during puncture, the kidney tends to be displaced medially and superiorly by the puncture needle and facial dilators, resulting in a deeper tract. These drawbacks have thus been attributed to higher residual stone rates compared to the prone position (12).

The FSSP position we proposed in this study avoids most inherent drawbacks of supine positions. First, we raise patients’ flank and align the affected body contour to the side of the table. These modifications provide bigger room for puncture and maneuvering of instruments, almost equivalent to what is provided by the prone position. Second, the jackknife position can immobilize the kidney and facilitate puncture. Third, FSSP position can lower the affected kidney, making all calices including the upper ones easily accessible. Fourth, immobilization of the chest and pelvis with V shaped tapes places pressure on the abdomen and results in a shorter percutaneous tract and a less mobile kidney, all of which make puncture less difficult.

The use of ultrasound for stone localization avoids difficulties of intra-operative fluoroscopy. In addition, the percutaneous tract in FSSP is almost parallel to the horizontal plane (Fig. 2), allowing easy drainage of stone fragments with low pressure irrigation and the surgeon to operate in a sitting position.

We carried out FSSP PCNL in 150 cases of renal calculi with satisfactory results. All patients tolerated this position very well throughout the procedure. Initial stone free rate was 83%, which is higher than the previously reported results with prone position (77.5%) (13). No major complications such as injury to other organs occurred.
CONCLUSION

Taken together, our initial experience reveals that the FSSP is a safe, effective and well-tolerated position suitable for most PCNL. It offers the advantages of both prone position and traditional supine position, while avoids some of their drawbacks. Randomized studies are needed to compare this position with the standard prone position to further validate its usefulness in PCNL.

REFERENCES


Disclaimers

The authors have no proprietary interest with regard to this article.

Corresponding Author:
Pan Tie-jun, MD
Department of Urological surgery,
Wuhan General Hospital of Guangzhou Command of PLA,
Wuhan - China