The Mini Percutaneous Nephrolithotomy (mini-PCNL) Technique in Supine Position Using Semi-rigid Uretheroscope for Reno-ureteral Stones

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Abstract

Introduction and Objectives. The purpose of this study is to evaluate the efficacy and safety of supine mini percutaneous nephrolithotomytechnique for renal and upper ureteral stone treatment in adult population.

Materials and Methods. We retrospectively analysed 46 patients (p) who underwent mini percutaneous nephrolithotomy (mini-PCNL) in supine position for renal stone below 1.5 cm from January 2013 to March 2016. Operative instruments: semi-rigid 9.5 Fr Stortz uretheroscope, renal access sheet 14 Fr, ultrasonic stone fragmentation with Calcuson Stortz. Bipolar approach in 6 p was used.

Results. Mean age of patients was 43.9 years. There were 27 women (58.7%) and 16 men (32.3%). In 19 patients (41.3%) ureteral stenting was necessary, 27 (58.7%) cases were tubeless and stentless. The mean length of stay was 3.9 days. Blood loss was minimal, with no need of transfusion. Mean duration of procedure was 53 minutes (26 – 110 minutes). Stone-free rate was of 100%.

Conclusions. Supine position offers good renal and ureteral access, allows concomitant retrograde ureteroscopy and does not interfere with the diaphragmatic ventilation. "Mini-PCNL" techniquein supine is a safe procedure with low complications rate for patients with small to medium-sized stones.

Key-words: mini-perc, mini-PCNL, renal stone, semi-rigid ureteroscope, tubeless, nephrolithiasis

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Introduction and Objectives

The incidence and prevalence of kidney lithiasis is increasing throughout the world. Men are more affected than women in calculus formation at a rate of 2.5: 1 [1].

The development of minimally-invasive surgery devices (extracorporeal shock wave lithotripsy - ESWL), PCNL, retrograde intrarenal surgery (RIRS) has improved the results of reno-ureteral lithiasis treatment.

Percutaneous nephrolithotomy (PCNL) was first performed in 1976 by Fernström and Johansson [2] and represents the treatment of choice for renal stones greater than 2 cm, and a feasible option for stones between 1-2 cm. Mini percutaneous nephrolithotomy (mini-perc or mini-PCNL) was developed in order to decrease morbidity associated with larger instruments like blood loss, postoperative pain and potential renal damage associated with standard PCNL.

Although originally developed as an alternative to PCNL for the treatment of lithiasis in pediatric patients, mini-PCNL is increasingly used in the treatment of stones of less than 1.5 cm in adults. If the classical technique involves a working channel with dimensions between 26 Ch and 30 Ch, the mini-PCNL technique involves access to the kidneys through a smaller diameter working channel (between 11 and 20 Ch) [3,4].

Consequently, the use of nephrostomy at the end of the intervention becomes optional and the parietal and tissue trauma is low. The need for post-operative analgesics and hospitalization is also decreasing [5].

The purpose of this study is to evaluate the efficacy and safety of supine mini percutaneous nephrolithotomytechnique for renal and upper ureteral stone treatment in adult population.

Materials and Methods

We retrospectively analysed 46 patients (p) who underwent mini-PCNL in supine position for renal stones below 1.5 cm, from January 2013 to March 2016. Operative instruments were: semi-rigid 9.5 Ch Karl Stortz uretheroscope, renal access sheet 14 Ch, ultrasonic stone fragmentation with Calcuson Stortz. Mean age of patients was 43.9 years. There were 27 women (58.7%) and 16 men (32.3%). Bipolar approach was used in 6 p (13.04%).

Lithiasis was radio opaque (photo 1, 2) in 40 p (86.95), 5 p (13.05%) had radio transparent lithiasis visible on ultrasound. Lower calyx calculus – 11 p / 23.91%, middle calyx calculus – 3 p / 6.52% upper calyx calculus 4 p / 8.69%, pyelic calculus – 5 p / 10.86%, calculus obstructed in the ureteropelvic junction (UPJ) - 10 p / 21.74%, proximal ureteral calculus – 7 p / 15.21%, multiple lithiasis 6 p / 13.04%.

All patients received prophylactic antibiotic therapy with 1.5 grams of Cefuroxime with the continuation of treatment on the first day postoperatively. Laboratory tests were those standard, performed in all patients: blood count, coagulation test, urea, creatinine, urine and uroculture tests. The haemoleucogram was performed 1 hour postoperatively if considered necessary, depending on the surgeon's decision.

All interventions were performed under spinal anesthesia. The supine position involves a dorsal decubitus with ipsilateral elevation of the shoulder, a slight twist of 30 degrees of the chest, and the semiflexion of the inferior ipsilateral limb (photo 3).

Photo 1. Renal plain radiography

Photo 2. Intravenous urography

Photo 3. Supine position on operation table

Cystoscopy was used to introduce the 6 Ch open ureteral probe; puncture of the lower calyx (33 p / 71.74%) or middle (13 p / 28.26%) was performed under radiographic guidance with an 18 Ch puncture needle by injection of contrast agent and methylene blue into the ureteral probe (photo 4, 5). In 9 p (19.56%), the ultrasound guiding for the lower or middle calyx puncture was used, as the contrast medium did not reach the renal pelvis due to the lithiasis enclosed in the ureteropelvic junction (4 p / 8.69%) or in the proximal ureter (5 p / 10.87%).

Photo 4. Percutaneous renal puncture under fluoroscopy guidance

Photo 5. Extravasation of methylene blue through the 18 Ch needle, confirming the correct position into the renal pelvis

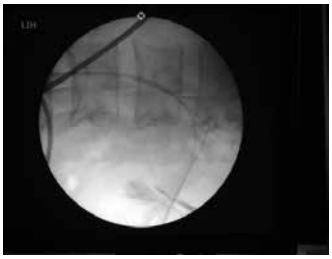

Photo 6. Fluoroscopic aspect of the two guided wire inserted through the percutaneous renal acces

Photo 7. Intraoperative aspect of the Amplatz Sheath, safety guide wire and ureteroscope

Subsequently, the position of the puncture needle was checked and corrected radiographically. A J-type guide wire of 0.035 Ch was inserted into the needle in the renal collector system or in the proximal ureter. The incision is applied to the parietal wall adjacent to the number 10-blade puncture needle. The dilatation of the working parietal tract was performed by screwing with progressive fascial dilators. A 14 Ch Amplatz sheath was inserted into the last dilator. The installation of the safety guide was practiced by removing the last fascial dilator from the working sheath and the insertion of two guide wires (photo 6). The working sheath was then retracted and re-inserted using one of the guide wires (photo 7). The semirigid ureteroscope was inserted onto the working sheath and the stone was identified and disintegrated using the ultrasonic lithotripter. Removal of stones or lithiasic fragments was performed with the ureteric grasping forceps or with a Dormia probe (photo 8). The intake of lavage solution (physiological saline solution) was made through the ureteroscope lavage channel and the ureteral probe to get a clearer working field. At the end of the intervention, renal cavities were inspected both endoscopically and radiographically.If the ureteropelvic junction or the proximal ureter has an edematous or bloody appearance on the ureteral probe, a guide wire is mounted and a double J stent is pushed onto it to ensure continuity of the urine. At the end of the procedure, the working sheath is extracted, without nephrostomy.

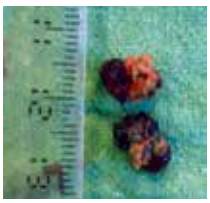

Photo 8. Renal stone specimen

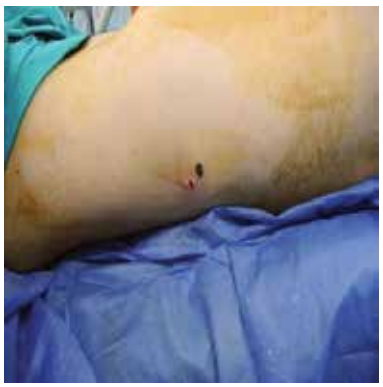

Photo 9. Skin scar after mini-perc

The remaining plaque is left open in order to drain postoperatively the lavage fluid which remained in the retroperitoneal space (photo9). Optional for aesthetic consideration a 3-0 polypropylene suture thread is mounted and left aside (to be bound 24 hours later), then dressing is applied. The ureteral and bladder probe is extracted 24 hours postoperatively. If the patient has a double J stent (19 p / 41.3%), it will be extracted 30 days postoperatively by cystoscopy under local anesthesia. The supine position allows simultaneously performing the retrograde ureteroscopy in the case of proximal ureteral calculi, thus achieving a bipolar approach (6 p - 13.04%).

Results

In 19 p (41.3%), ureteral double J 6 Ch stenting was needed, 24 (52.17%) cases were tubeless, stentless. The mean hospital stay was 3.9 days (between 2 to 5 days). Mean duration of procedure was 53 minutes (26 – 110 minutes). Blood loss was minimal, with no need of transfusion. Stone-free rate was of 100%.

In 3 p (6.52%), an intraoperative switch to the standard PCNL technique was required due to the blurred operator field as a result of bleeding. In these patients, an 18 Ch nephrostomy probe was mounted and was removed 48 hours postoperatively. The other patients (43 p / 93.47%) did not need the nephrostomy probe at the end of the intervention. There were no postoperative complications.

Discussions

Sgueldolce et al. appreciate that the supine position allows the treatment of lithiasis in patients with comorbidities and high ASA score too, in whom the standard ventral decubitus position is not possible due to possible ventilatory and cardiovascular disorders [5]. Access to the airways is highly superior in the supine position without interfering with diaphragmatic ventilation [6].

Gamal et al. has shown that the supine position is comfortable for the surgeon, anesthetist and patient. The disadvantage is that urologists are not too familiar with the supine position and the operative field is smaller [7]. We appreciate that the position of the surgeon is better if he is sitting on a chair.

Access through the lower calyx of the working sheath (Amplatz sheath) allows the fragmentation of lower calyceal calculi, pyelic and upper calculi, and through the middle calyx of the middle calyceal, pyelic calculi and the proximal ureteral calculi.

The lack of nephrostomy at the end of the mini-PCNL intervention has multiple advantages. Although in the standard PCNL technique, nephrostomy provides haemostasis at the end of the intervention and good drainage of the urinary tract, it can cause discomfort, pain, prolonged urinary leakage, and prolonged hospital stay [8].

Jackman et al. were the first who reported mini-PCNL in adults using Amplatz sheath less than 20 Ch. The aim was to decrease the diameter of the working channel and consequently, the renal trauma. However, they used nephrostomy at the end of the interview but with consecutive consequences of smaller diameter [9].

In our group, we considered it necessary to place the double J stent at the end of the intervention in 19 p (41.3%) due to trauma to the ureteropelvic junction or to the ureter after the extraction or fragmentation of the calculus. Bellman et al. showed that placing a double J stent at the end of a tubeless intervention for 2-4 weeks could cause abdominaldiscomfort, dysuria or fever requiring another procedure for stent ablation [10].

According to Ni et al., the operative time for the mini-PCNL technique in the supine position is lower than in the standard prone position (ventral decubitus) [11]. In the supine position, both cystoscopy and the fixation of the urethral probe and the main operative time are performed in the same position of the patient; in the standard (prone) technique, the patient should be repositioned in ventral decubitus after fixing the urethral probe. Consecutively, the costs increase because the patient must be disinfected and prepared again with other operative fields.

Blood losses are lower in the mini-perc technique than in the standard technique. Several authors reported that no blood transfusion secondary to blood loss was required according to the haemoleucogram [12,13,14]. Shaoma et al. showed that the decrease in haemoglobin and the risk of bleeding is not reduced by the positioning of nephrostomy at the end of the intervention but by the body's haemostatic capacity, unless a major kidney trauma or a coagulopathy persists [15].

In this study, analgesics used in the patients operated by the mini-PCNL technique were paracetamol and ketoprofen.

Zsong et al. showed, on a comparative study between PCNL and tubeless PCNL, that the need for analgesics is lower for the tubeless procedure [16].

Length of stay in our study group was 3.9 days. Length of hospitalization is an important parameter for assessing the effectiveness and safety of the intervention. Ni et al. reported a shorter hospitalization time for tubeless PCNL than for standard PCNL [11].

Concomitant retrograde ureteroscopy is easy during the mini-PCNL technique in the supine position for calculi or lithiasis fragments migrated to the proximal or lower ureter.

Conversion from mini-PCNL to PCNL technique can be done if the visual operative field is inadequate to explore the renal cavities due to bleeding or if the lithiasis fragments cannot be exteriorized on the working channel. We appreciate that choosing the surgical technique adequate to the lithiasic size and volume is very important for a good surgical outcome.

Ferafis et al. has appreciated that the stone-free rate in the mini-PCNL technique can reach a level comparable to the standard technique even for larger calculi [4].

Conclusions

Supine position offers good renal and ureteral access, allows concomitant retrograde ureteroscopy and does not interfere with the diaphragmatic ventilation. It is effective in patients with comorbidities and high ASA anesthetic score, being easy to supervise from the anesthetics point of view.

Choosing the surgical technique adequate to the lithiasic size and volume is very important for a good surgical outcome.

Mini-perc in supine position is a safe procedure with low complications rate for patients with small to medium-sized stones.

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