

Tubeless Percutaneous Nephrolithotomy: Spinal versus General Anesthesia

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Purpose: Tubeless percutaneous nephrolithotomy (PCNL) with double-J stenting is a good option for large kidney calculi without increasing blood loss. In many centers tubeless PCNL is performed under general anesthesia. In the present study we evaluated the impact of spinal anesthesia in patients undergoing tubeless PCNL.

Material and Methods: Between February 2011 and February 2012, forty six patients with kidney calculi were treated with tubeless PCNL. Of these patients 26 were treated under spinal anesthesia (group 1) and remaining 20 were treated under general anesthesia (group 2). Groups were compared according to patient demographics, stone size, access number, operative time, presence of supracostal access, analgesic requirement, length of hospital stay, and complications.

Results: There were not any statistically significant differences between groups in terms of patient demographics, mean stone size, mean access number, operative time, presence of supracostal access, and length of hospital stay. However, the analgesic requirement was significantly less in group 1 (53 ± 39 mg vs. 111 ± 46 mg, intravenous tramadol in groups 1 and 2, respectively $P < .001$).

Conclusion: Tubeless PCNL under spinal anesthesia is a good alternative for general anesthesia in adult patients. Spinal anesthesia decreases analgesic requirement in patients that were performed tubeless PCNL compared to general anesthesia.

Keywords: kidney calculi; surgery; nephrostomy, percutaneous; adverse effects; anesthesia.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the standard treatment modality of large upper tract urinary stones. European urology guidelines on urolithiasis recommended PCNL as a first line treatment modality for renal stones over 300 mm².⁽¹⁾ PCNL is a highly effective method with over 90% success rate. Further modification of PCNL such as the tubeless method decreased the morbidity, but in the meantime maintained its efficacy.⁽²⁾ Anesthesia for PCNL can either be general or regional. Recently, PCNL performed under regional anesthesia was reported confer some advantages over general anesthesia, such as lower dose requirement of analgesic drugs.⁽³⁻⁶⁾ However, there is limited number of studies regarding the applicability and feasibility of spinal anesthesia in patients undergoing tubeless PCNL. In the present study, we evaluated the impact of spinal anesthesia in patients undergoing tubeless PCNL.

MATERIALS AND METHODS

We reviewed the records of 46 consecutive patients with renal calculi who had undergone tubeless PCNL by the same surgeon at our institution between February 2011 and December 2011. Twenty-six of these patients were treated under spinal anesthesia (group 1) and remaining 20 were treated under general anesthesia (group 2). In our routine clinical practice, we perform PCNL operations under spinal anesthesia with tubeless technique. We perform general anesthesia to patients who are not willing to be treated under spinal anesthesia and when the expected operation time is more than 2.5 hours.

PCNL procedures were performed in patients with sterile urine cultures. In all patients Cefazolin 1g was administered intravenously for antibiotic prophylaxis. Preoperatively non-contrast computerized tomography, serum creatinine, hemoglobin, prothrombin time and chest radiography were obtained from all patients. The PCNL procedure was begun with insertion of ureteral catheter under cystoscopic guidance in supine lithotomy position. Percutaneous access was achieved in prone position under the guidance of C-arm fluoroscopic examination using an 18-gauge access needle. After insertion of the guide-wire, the tract was dilated to 30 French (F) using Amplatz dilators and 30F Amplatz sheath was placed. Additional tracts were created when indicated. Nephroscopy was performed with rigid 26F nephroscope. Stone disintegration

was performed using a pneumatic lithotripter. Stone fragments were extracted with forceps. Nephroscopic views and fluoroscopic guidance were used to determine the stone-free status. After achieving stone-free status a double-J stent was placed antegradely under fluoroscopic guidance. Nephrostomy tube was not used. Operative time was calculated from the beginning of cystoscopy to the end of wound closures. The length of hospitalization was calculated from the day of operation until day of discharge. Stone size was calculated using two measurements (i.e., largest width and length) obtained from kidney ureter bladder (KUB) X-ray.

Lactated ringer solution 20 mg/kg was administered 30 minutes before the operation to prevent hypotension in the spinal anesthesia group. Midline or paramedian approach for spinal anesthesia was utilized. Whitacre 25 gauge needles were used. After successful dural puncture at the level of L2-L3 interspace, 8-15 mg of heavy bupivacaine was injected according to height of the patient in lateral decubitus position. Subsequently, the sensory and motor blocks were assessed. Pinprick testing was used to evaluate the level of anesthesia, which was performed using a sterile needle that did not need to pierce the skin. Patients were asked to compare the testing at the anesthetized part of the body with the non-anesthetized part of the body such as arm. The decision was made according to perceived the difference by the patient.

Thirty minutes before the operation general anesthesia group were premedicated with 2 mg intravenous midazolam. Moreover, induction was performed using 2 mg/kg propofol, 1 mg/kg fentanyl and 0.6 mg/kg rocuronium bromide. The 1.2 minimum alveolar concentration isoflurane with 40% oxygen air mixtures were used for maintenance.

For the management of postoperative pain tramadol was given intravenously. The KUB X-ray and hemoglobin measurements were obtained from all of the patients on the first postoperative day. Chest radiography was obtained only from the patients with supracostal access. Postoperatively, at 1 month, non-contrast computerized tomography was performed to all of the patients to determine the stone-free status. Our criterion for blood transfusion was postoperative hemoglobin level less than 10 g/dL with accompanying hemodynamic instability. The double-J stents were removed 2 weeks after the surgery as an outpatient procedure that was performed under local anesthesia.

Table 1. Patient characteristics.

| Variables | Group 1 (n = 26) | Group 2 (n = 20) | P |
|---------------------------------------|--------------------------|--------------------------|------|
| Age (years) (range) | 45.6 ± 13.6 (21-79) | 40.8 ± 12.9 (18-64) | .395 |
| Sex (Male/Female) | 18/8 | 13/7 | .414 |
| Stone size (mm ²) (range) | 558.6 ± 297.2 (250-1600) | 630.7 ± 486.2 (250-2000) | .227 |
| Stone side (Right/Left) | 17/9 | 14/6 | .771 |

The patient characteristics were shown in Table 1. The two groups were compared with regard to access number, stone size, presence or absence of supracostal access, operative time, analgesic requirement, length of hospital stay, blood transfusion, and the observed complications.

For statistical analysis Mann-Whitney *U* test was used and *P* values less than .05 were considered significant.

RESULTS

No differences were observed between the groups regarding age, gender, stone size, the duration of operation, blood transfusion rate, presence of supracostal access, number of access, and hospitalization time. Complete stone clearance was achieved in all patients intraoperatively by nephroscopic and fluoroscopic guidance. Stone clearance was also demonstrated with KUB X-ray on the first postoperative. However, non-contrast computerized tomography showed residual stones in one patient in group 1 and in one patient in group 2. The difference was not statistically significant. All residual stones were 4 mm or less in maximum diameter and no auxiliary procedures were performed. The analgesic requirement was significantly lower in spinal anesthesia group ($P < .001$). No major complications were observed intraoperatively related to spinal anesthesia. Postoperatively, one patient complained headache lasted up to 5 days, which was controlled by non-steroidal anti-inflammatory drugs. The results are also shown in Table 2.

DISCUSSION

PCNL is the procedure of choice for the treatment of large renal and upper tract urinary calculi. Several new techniques and modifications such as mini-PCNL, tubeless PCNL and PCNL under regional anesthesia have been reported to de-

crease morbidity, analgesic requirement and length of hospitalization.⁽²⁻⁶⁾ Tubeless PCNL was first introduced by Bellman and colleagues in 1997.⁽²⁾ Since then numerous studies have been reported regarding the safety and efficacy of the tubeless PCNL. Recently, Wang and colleagues⁽⁷⁾ and Shen and colleagues⁽⁸⁾ summarized the results of tubeless PCNLs and standard PCNLs in their meta-analyses.^(7,8) They reported that postoperative analgesic requirement and length of hospitalization were less in tubeless PCNL.^(7,8)

Anesthesia for PCNL can either be general or regional. General anesthesia (GA) has some disadvantages compared to regional anesthesia, which are increased incidence of anaphylaxis due to multiple drug usage and problems associated with endotracheal tube during positioning of patient from lithotomy to prone.⁽⁹⁾ In the English literature, the preferred method of regional anesthesia for PCNL is combined spinal-epidural anesthesia (CSEA). In our institute, we prefer mostly spinal anesthesia (SA) rather than CSEA for PCNL operations due to lower cost of SA.

Recently, Kuzgunbay and colleagues⁽³⁾ reported their experience of standard PCNL under CSEA versus GA in a prospective non-randomized study and they reported that complications and hospitalization times (2.7 ± 0.7 days for CSEA and 2.8 ± 0.7 days for GA) between groups were similar. And they concluded that PCNL under CSEA was effective and safe as PCNL under GA. The major limitation of their study was that postoperative analgesic requirements were not compared between groups.⁽³⁾

Karacalar and colleagues⁽⁴⁾ compared the results of 90 patients who underwent PCNL under GA with 86 patients under CSEA in a prospective randomized study. They concluded that the CSEA group had greater patient satisfaction with less postoperative pain scores and with less analgesic require-

Table 2. Outcomes variables in both study groups.

| Variables | Group 1 (n = 26) | Group 2 (n = 20) | P |
|---|----------------------|-----------------------|--------|
| Duration of operation (minutes)(range) | 72.4 ± 22.2 (30-130) | 81.9 ± 40.3 (35-160) | .109 |
| Access number (range) | 1.4 (1-5) | 1.6 (1-4) | .452 |
| Presence of supracostal access (%) | 6 (23.07) | 4 (20.0) | .909 |
| Bleeding requiring transfusion (%) | 1 (3.8) | 1 (5.0) | .792 |
| Length of hospitalization (days) (range) | 1.04 ± 0.2 (1-2) | 1.06 ± 0.2 (1-2) | .678 |
| Mean analgesic requirement (tramadol iv) (mg) (range) | 53.8 ± 39.8 (0-200) | 111.5 ± 46.3 (50-200) | < .001 |
| Stone-free rate (%) | 25/26 (96.2) | 19/20 (95.0) | .892 |

ment (119.9 ± 63.5 mg intravenous tramadol in CSEA group and 262.5 ± 76.9 mg intravenous tramadol in GA group, $P < .001$). Vomiting, itching, hypotension, and bradycardia were not different between the groups. The drawback of their study was hospitalization times that were not studied.⁽⁴⁾

Mehrabi and Shirazi reported the results of SA in 160 patients undergoing standard PCNL, and they concluded that SA was a good alternative method for adult patients undergoing PCNL.⁽⁹⁾ In their study they did not report major complications related to SA. The major drawback of their study is that it is not a controlled study.⁽⁹⁾

Recently, Singh and colleagues⁽¹⁰⁾ reported their experience with tubeless PCNL under SA on 10 patients. To best of our knowledge, their study is the only one in English literature and they concluded that SA plus tubeless PCNL synergism shortens length of hospitalization to an average of 40 hours without analgesic requirement.⁽¹⁰⁾ The limitations of their study were that it was not a randomized controlled study, had strict inclusion criteria, and a small sample size.⁽¹⁰⁾

Recently, Singh and colleagues⁽⁵⁾ compared the standard PCNLs under GA versus CSEA in a prospective randomized study. The study consisted of 32 patients in each group. And they found that the mean visual analog scale (VAS) (4.63 ± 0.87 in CSEA and 6.56 ± 1.44 in GA group, $P < .0001$) and analgesic use (100.0 ± 10.0 mg in CSEA and 158.6 ± 22.84 mg in GA, intravenous tramadol, $P < .0001$) was less in CSEA group. In this study length of hospitalization (4.0

± 0.9 days in CSEA and 4.56 ± 1.0 days in GA, $P = .02$) was also significantly less in CSEA group.⁽⁵⁾

Lojanapiwat and colleagues⁽⁶⁾ reported the results of standard PCNLs under CSEA and GA in a randomized prospective study. Mean VAS at the first post-operative hour was 3.12 in CSEA group and 6.88 in GA group ($P < .001$). They concluded that, in CSEA group patients required fewer analgesics. The major limitation of their study was that mean amounts of analgesic requirements were not clearly given. In the study of Lojanapiwat and colleagues⁽⁶⁾ hospitalization times between groups were not statistically different (5.04 ± 1.85 days in CSEA group and 5.46 ± 2.08 days in GA group, $P = .456$). Limitations of the present study are the small patient number and it is not prospective. However, this is perhaps the first study in English literature which compares the tubeless PCNL under SA versus tubeless PCNL under GA. Our results showed that SA did not influence hospitalization time in patients underwent tubeless PCNL (1.04 ± 0.2 vs. 1.06 ± 0.2 days, $P = .678$). However, patients in SA group required less analgesics than patients in GA group, with a mean of 53.8 ± 39.8 mg intravenous tramadol. This amount is nearly the lowest analgesic requirement in English literature for patients undergoing PCNL under regional anesthesia.⁽³⁻⁶⁾

CONCLUSION

Our limited experience demonstrated that the combined use of tubeless technique and SA in adult patients undergoing

PCNL decreases analgesic requirement.

CONFLICT OF INTEREST

None declared.

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