

Results and Complications of Spinal Anesthesia in Percutaneous Nephrolithotomy

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Introduction: Percutaneous nephrolithotomy (PCNL) is the treatment of choice for large kidney calculi, staghorn calculi, and calculi that are multiple or resistant to shock wave lithotripsy. In many centers, PCNL is performed under general anesthesia. However, complications under spinal anesthesia can be less frequent. We evaluated the impact of spinal anesthesia on intra-operative and postoperative outcome in patients undergoing PCNL.

Materials and Methods: The intra-operative and postoperative anesthetic and surgical outcomes were evaluated in 160 consecutive patients who underwent PCNL under spinal anesthesia in the prone position.

Results: The mean age of the patients was 40.0 ± 14.3 years, and the mean operative time was 95.0 ± 37.8 minutes. The mean calculus size was 34.2 ± 9.8 mm. Ten patients had staghorn calculi (mean size, 4.2 ± 1.1 cm; mean operative time, 140 ± 40 minutes). Return of sensory and motor activity took 140.0 ± 19.7 minutes and 121.0 ± 23.8 minutes, respectively. During the first part of anesthesia, 18 patients developed hypotension, which was controlled by ephedrine, 10 mg, intravenously. Ten patients (6.3%) needed blood transfusion and 6 complained of mild to moderate headache, dizziness, and mild low back pain for 2 to 4 days after the operation, which improved with analgesics and bed rest. Seventy percent of the patients had complete clearance of calculus or no significant residual calculi larger than 5 mm on follow-up ultrasonography.

Conclusion: Spinal anesthesia is safe and effective for performing PCNL and is a good alternative for general anesthesia in adult patients.

Keywords: percutaneous nephrolithomy, spinal anesthesia, complications

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INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is now a popular method for removal of kidney and ureteral calculi and the treatment of choice for kidney calculi greater than 2 cm to 3 cm in diameter, multiple kidney calculi, staghorn calculi, and cases of failed shock wave lithotripsy (such as those with calcium oxalate monohydrate and cystine calculi).^(1,2) Anesthesia for PCNL can be general or regional. Regional anesthesia has the

advantage of general anesthesia in the abdomen and extremities and avoidance of anaphylaxis due to the use of multiple drugs.^(1,3) Spinal anesthesia has been proven to reduce the anesthesiologist charge on patients undergoing lower abdominal and limb surgery.⁽⁴⁾ Complications of general anesthesia such as pulmonary (athlectasia), vascular, and neurologic disorders (brachial nerve injury or spinal cord injury), especially during change of the position are more likely than

of spinal anesthesia.⁽²⁾ There are limited studies regarding the efficacy of regional anesthesia in PCNL. Therefore, the aim of this study was to evaluate the intra-operative and postoperative outcomes in patients undergoing spinal anesthesia during PCNL.

MATERIALS AND METHODS

We reviewed a series of 160 PCNLs for treatment of urinary calculi in patients older than 16 years old who underwent spinal anesthesia between December 2006 and July 2008. The ethics committee of Yasuj University approved the study.

The patients' pre-operative characteristics were recorded. The hemodynamic and anesthetic variables were recorded before, during, and after the operation. Spinal anesthesia was induced with bupivacaine, 15 mg, and fentanyl, 25 μ g, injected intrathecally at the L3-L4 interspaces, and the head of the bed was tilted down for 5 to 10 minutes, while checking the level of anesthesia. The patients underwent cystoscopy and a ureteral catheter was placed under direct vision whilst in the lithotomy position. Conscious sedation during PCNL was obtained with intravenous diazepam, 2.5 mg, or midazolam, 1 mg to 1.5 mg. Replacement of the sedative drug was then performed to maintain adequate anxiolysis and parallel protective airway reflexes during the surgery.

Following the induction of spinal anesthesia, the patients were helped to be rotated to the prone position in order to obtain the best position for percutaneous access to the affected renal system. Percutaneous nephrolithotomy was done under the guide of fluoroscopy with 1-shot technique by an Amplatz dilator, holding a 28-F to 30-F Amplatz sheath, and the use of a 24-F nephroscope according to the standard methods of access. For kidney elevation in the prone position, only a small gelatinous bolster or a rolled towel was held under the flank of the patient. Severity of pain during the operation and 1 hour after return of sensory blockage was checked by visual analogue scale (VAS), and the results and complications were recorded. All of the patients received 10 mg of metoclopramide,

2 mg to 4 mg of dexamethasone, and prophylactic antibiotics. They were advised to have complete bed rest for at least 12 hours, postoperatively.

On the first postoperative day, presence of any complications and postoperative pain were checked. On the 2nd postoperative day, the nephrostomy tube was clamped for at least 3 hours in case there was not any obstructive calculus in the pelvis or the ureter on plain abdominal radiography. If there was no fever, urinary leak, or flank pain, the nephrostomy tube would be removed and the patient would be discharged from the hospital. For 1 week, if the patient had any problem including headache, backache, lower limb pain, and weakness, or cardiopulmonary impairment, they were referred to the emergency room and standard treatment was started on. Two weeks after the operation, all of the patients underwent an ultrasonography for evaluation of the efficacy of operation and detection of any residual calculi.

RESULTS

The mean age of the patients was 35.0 ± 12.7 years. Seventy-five percent of the patients ($n = 120$) were men. The mean operative time, from the beginning of anesthesia to termination of the operation, was 110 ± 40 minutes. The mean calculus size was 3.2 ± 1.6 cm. Twelve patients had staghorn calculi with a mean calculus size of 4.1 ± 1.3 cm, and the operative time was 138 ± 45 minutes in this group. The mean time for return of sensory and motor activity was 140.0 ± 19.7 minutes and 121.0 ± 23.8 minutes, respectively.

In all of the patients, PCNL was successful. In 8 patients (5.0%), supracostal access was required, which was tolerated well without pulmonary complications.

According to the VAS, 1 patient (0.6%) had moderate to severe pain and 8 patients (5.0%) had mild pain during the operation. One of the patients with a staghorn calculus complained of local pain in the site of the operation after 130 minutes, which was controlled by 1 mL (50 μ g) of fentanyl and ketamine.

Major intra-operative or postoperative

Complications of Percutaneous Nephrolithotomy With Spinal Anesthesia Among 160 Patients

Minor Complications*	Patient (%)
Blood loss requiring transfusion	10 (6.3)
Hypotension	18 (11.3)
Local peri-operative pain	1 (0.6)
Headache	6 (3.8)

*There were no major complications.

complications such as visceral, vascular, and neurologic injury or unusual bleeding did not occur in any of the patients. Eighteen patients developed hypotension 3 to 10 minutes after the regional anesthesia that was controlled by injecting 10 mg of ephedrine intravenously. The mean hemoglobin decrease during the 24 postoperative hours was 2.1 ± 0.4 g/dL. Eight patients (5.0%) required transfusion of 1 to 2 units of packed cell. Six patients younger than 30 years old complained from moderate postsubarachnoid puncture headache and dizziness and also mild low back pain, 3 to 7 days after the operation, all of which improved by bed rest and conventional analgesics such as acetaminophen and nonsteroid anti-inflammatory drugs (Table).

On the follow-up ultrasonography, 115 patients (71.8%) had complete clearance of their calculus or no significant residual calculi larger than 5 mm. In the 12 patients with staghorn calculi, complete clearance of calculus was 66.6%, and 4 patients had residual calculi larger than 10 mm.

DISCUSSION

Percutaneous nephrolithotripsy is used for the fragmentation and removal of large or multiple calculi from the renal pelvis and renal caliceal systems.⁽¹⁾ It has been shown that PCNL under assisted local anesthesia is safe and effective in selected patients.⁽⁵⁾ General anesthesia can be a challenge in some situations such as PCNL for staghorn calculi, because of the possibility of fluid absorption and electrolyte imbalance. Therefore, regional anesthesia may be a good alternative.⁽⁶⁾ Maintaining a good postoperative quality of life may be achieved in most patients regardless of the anesthesiologic technique used. However, anesthesia can influence the early postoperative recovery of patients, and because the aim of all urologists is to discharge the patient from the

hospital in a safe condition as early as possible, the choice of anesthesia matters.⁽⁷⁾

In this study, we assessed the impact of spinal anesthesia on the most critical intra-operative and postoperative parameters during PCNL. Acute anemia due to blood loss or dilution is a potential complication of PCNL that needs transfusion of blood products.⁽⁸⁾ Stoller and coworkers showed that the incidence of blood transfusion in uncomplicated single puncture PCNL reached 14%, with an average decrease of 2.8 g/dL in hemoglobin concentration.⁽⁹⁾ Recently, the same investigators reported a lower decrease in hemoglobin levels after PCNL with a transfusion rate of 7%.⁽¹⁰⁾ Several studies have also shown that spinal anesthesia results in less intra-operative bleeding compared with general anesthesia.⁽¹¹⁻¹³⁾ Although the reported rate of transfusion during PCNL is about 5% to 12%, in our series, only 6.3% of the patients required blood transfusion. Overall, these data confirmed that spinal anesthesia is safe and comparable in terms of intra-operative bleeding during PCNL.

Salonia and colleagues⁽¹⁴⁾ evaluated the impact of general anesthesia versus spinal anesthesia on intra-operative and postoperative outcome in patients undergoing radical retropubic prostatectomy. They found that spinal anesthesia allowed good muscle relaxation and a successful surgical outcome in these patients. Moreover, spinal anesthesia resulted in less intra-operative blood loss, less postoperative pain, and a faster postoperative recovery than general anesthesia. Also, despite a small amount of mild and transient side effects, spinal anesthesia was associated with significantly reduced blood loss, allowing a good hemodynamic and respiratory safety profile both intra-operatively and preoperatively.⁽¹⁴⁾ Although we did not have a control group of general anesthesia and we did not require muscle relaxation for PCNL, the patients tolerated the operation and were satisfied with it. The exception was 1 patient who had a staghorn calculus and developed local pain during the operation.

In a study by Maurer and coworkers,⁽¹⁵⁾ blood loss, operative time, and complications were compared in 606 patients undergoing primary

unilateral total hip arthroplasty with either spinal anesthesia or general anesthesia. The patients were followed for 2 years after the surgery. Compared with general anesthesia, spinal anesthesia resulted in a mean reduction of 12% in the operative time, 25% in estimated intra-operative blood loss, 38% in the rate of operative blood loss, and 50% in intra-operative transfusion requirements. Compared with patients receiving general anesthesia, those receiving spinal anesthesia had higher hemoglobin levels on postoperative days 1 and 2 and a 20% lower total transfusion requirement. Spinal anesthesia appeared superior to general anesthesia for this procedure.

In one study by Plaja and colleagues for comparing duration of spinal block by prilocaine or bupivacaine in transurethral resections, the mean duration of sensory and motor blockade were 145.83 ± 35.81 minutes and 133.16 ± 42.21 minutes, respectively.⁽¹⁶⁾ We used fentanyl with bupivacaine for spinal anesthesia, and our results were similar to the above-cited study in returning of sensory and motor blockade. Spinal anesthesia is easy to perform and allows the operation to be performed under the best possible conditions.

CONCLUSION

Our data showed that spinal anesthesia combined with sedation could be an attractive method of anesthesia for PCNL with trivial pain and blood loss and without major complications. Thus, it will be a good alternative for performing PCNL in adult patients. Future research is needed to evaluate the impact of spinal anesthesia versus general anesthesia on intra-operative and postoperative outcome in patients undergoing PCNL.

CONFLICT OF INTEREST

None declared.

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