

Limitations of Spinal Anesthesia for Patient and Surgeon During Percutaneous Nephrolithotomy

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Purpose: To evaluate the intraoperative pain score of patients who undergo percutaneous nephrolithotomy under spinal anesthesia and to evaluate surgeons' and patients' convenience with this type of anesthesia.

Materials and Methods: PCNL cases who were performed by two endourology fellows under spinal anesthesia during June to July 2014 were included. Spinal anesthesia was performed using injection of 0.25mg/kg bupivacaine 0.5% in the intrathecal space. All procedures were performed with the patient in the prone position. Stone access was made by using fluoroscopic guidance, and the tract was dilated using a single-stage technique. Visual analogue pain score was used to assess patients' pain during operation, immediately after, and 2 hours later.

Results: 50 patients were enrolled during the study period. Visual analogue pain score of 10 and 8 were observed in 5 and three patients respectively. In two patients the operation was terminated because of patient anxiety and pain. In another patient a second access was not obtained to remove a staghorn stone because of patient's agitation. Gross agitation was observed in six patients. Apart from flank pain, intraoperative pain was felt in the flank, scapula, abdomen and/or chest.

Conclusion: Spinal anesthesia does not provide enough analgesia for the patient in a limited frequency of percutaneous nephrolithotomy operations. We could not find statistically significant predictors of insufficient analgesia based on patients' demographics, stone characteristics or access location.

Keywords: percutaneous nephrolithotomy; spinal anesthesia; pain perception; satisfaction.

INTRODUCTION

In the decades after introduction of percutaneous nephrolithotomy (PCNL), urologists have proposed modifications to the procedure to improve its safety and efficacy. Different positions (supine, prone, flank and flank-flexed), tubeless PCNL and regional anesthesia were introduced by several researchers.^(1,2)

Regional anesthesia has been used for PCNL by spinal and combined spinal-epidural (CSEA) methods.⁽³⁻⁸⁾ Both spinal and CSEA were reported to be as effective as general anesthesia by some researchers including one previous publication from our center.^(2,4,9-12) After this previous publication on the efficacy and safety of spinal anesthesia for PCNL, PCNL procedures were often performed under spinal anesthesia in our center. We encountered some cases in which the patient was restless during the procedure or in extraordinary pain. This study was designed to investigate patients' pain during PCNL under spinal anesthesia, surgeons' and patients' convenience during the procedure and to explore factors that can affect the above variables.

MATERIALS AND METHODS

All patients who were scheduled for PCNL operation under spinal anesthesia by two endourology fellows during June to July 2014 were included in this study. PCNL is typically scheduled in our center for renal stones larger than 2 cm, stones resistant to ESWL, large

upper ureteral stones and large stones in horseshoe kidneys. Preoperative evaluation included serum electrolytes and hemoglobin, ultrasonography of the kidney and urinary system and either intravenous pyelography or computed tomography of the kidney and urinary system.

Typically patients with any contraindication to spinal anesthesia (e.g. spinal deformity), renal anomaly, history of bleeding disorders, and anticoagulant or antithrombotic medication and addiction to opium and alcohol and those patients who were anticipated to have a long operation duration underwent general anesthesia and were excluded from the study.

Anesthesia specialists were unaware of the study objectives. Patients were explained about Visual Analogue Pain Score (VAS) before the operation in the waiting room by the operating surgeon. Patients who were selected for general anesthesia were excluded from the study. The protocol for spinal anesthesia has been defined previously and is summarized below.

Spinal anesthesia

The anesthesia protocol has been previously described and is summarized below.⁽²⁾ Patients were placed initially in the lateral position and then 0.25 mg/kg bupivacaine 0.5% (up to 40 mg) was injected in the intrathecal space (L3-L4). The induction of spinal anesthesia was achieved when at least the T6 dermatome was anesthetized; regression to T9 was considered as failure of

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Table 1. Patients' and operations' characteristics

| Variable | |
|---|-----------------|
| Age (years), mean \pm SD | 48.1 \pm 12.2 |
| Gender (Male), N(%) | 29(58) |
| Access, N | |
| Upper, Middle, and Lower pole | 11, 4, 35 |
| Anesthesia duration (minutes), mean \pm SD | 83.4 \pm 21.5 |
| Operation duration (minutes), mean \pm SD | 52.7 \pm 23.0 |
| Preoperative Hemoglobin (mg/dl), mean \pm SD | 13.9 \pm 1.5 |
| Postoperative Hemoglobin (mg/dl), mean \pm SD | 12.3 \pm 1.4 |

anesthesia. Then the patients were returned to the lithotomy position after 3 minutes. Drug fixation time was 13 to 15 minutes (3 to 5 minutes for drug administration in the lateral position and 10 minutes for repositioning to the supine position and then lithotomy).

PCNL procedure

All procedures were performed with the patient in the prone position. The details of PCNL is our center has been previously published^(13,14) and is summarized below. Stone access was made by using fluoroscopic guidance, and the tract was dilated using a single-stage technique until 28 F to 30 F. Stones were extracted by grasper after breaking them by pneumatic lithotripter. A Double-J stent was not inserted in patients routinely, and nephrostomy tube insertion was optional and depended on surgeon preference.

After transfer of the patients to recovery room, they were asked about their VAPS during the operation and VAS on entry to recovery room. The surgeon was also asked about his convenience with anesthesia during the operation period and any reason for inconvenience was recorded. VAS was also asked from the patient 2 hours after operation termination. Patient satisfaction with anesthesia during the operation was asked according to a likert type 5 scale questions on the 1st postoperative morning. Anesthesia duration was defined as from be-

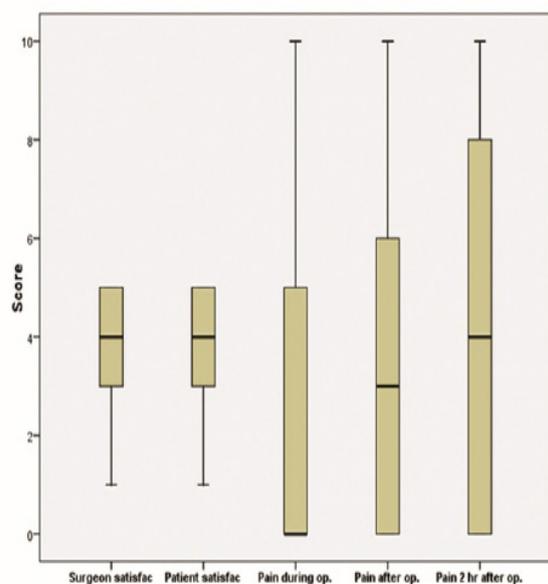


Figure 1. Boxplots for likert satisfaction scores for surgeons and patients plus visual analogue pain scores during operation, immediately after operation and 2 hours after operation.

ginning of spinal anesthesia to nephrostomy fixation. Operation duration was defined from the start of percutaneous access needle insertion to nephrostomy fixation.

Statistical analysis

Statistical package for social sciences Ver. 16 (Chicago, IL) was used for data entry and analysis. VAS and patient or surgeon satisfaction were compared by nonparametric Mann-Whitney or Kruskal-Wallis tests. The association of VAS and satisfaction scores with operation duration was analyzed by spearman r.

The ethics of this study have been approved by the ethics committee of the Urology and Nephrology Research Center and are in accordance with the 1964 declaration of Helsinki and its later amendments. Patients were explained about the study objectives and informed consent was obtained.

RESULTS

50 patients were enrolled during the study period. **Table 1** summarizes patients' demographic data and operation characteristics. There was one patient with malrotated kidney in the studied patients. **Figure 1** shows surgeons' and patients' satisfaction scores and intraoperative, immediately postoperative and 2 hours after operation VAS scores.

Five patients experienced intraoperative VAS of ten and in three of these five patients the following complications were observed. One patient experienced severe pain and agitation which caused leaving a residual fragment and no further try to remove it. Another patient experienced gross nausea and vomiting. In the third patient, the operation was terminated upon request of the anesthesia specialist. In all these three cases pain was associated with patient agitation.

Three patients experienced intraoperative VAS of 8 and in two patients pain was associated with patient's agitation. Intraoperative VAS scores of 5 to 6.5 were observed in seven patients and in one patient it was associated with patient's agitation. Intraoperative VAS scores of 1 to 4.5 were observed in eight patients and in one patient because of patient anxiety and agitation, the anesthesia specialist did not agree on obtaining a second access for complete removal of a staghorn stone. Excessive talking was observed in one patient during the operation. Intraoperative nausea and vomiting was observed in two patients (one patient with intraoperative VAS of ten described before and another patient with intraoperative VAS of zero). Intraoperative and postoperative headache were observed in one and one patient respectively.

Intraoperative pain was felt in areas other than the flank and consisted of scapula, abdomen and chest.

Moderate inconvenience of the surgeon was observed in six cases because of patients' pain, agitation and/or obligatory termination of the operation. Severe inconvenience of the surgeon was observed in three patients because of patients' pain and/or agitation during the operation.

Intraoperative and immediately postoperative VAS scores were associated with duration of anesthesia (rsp= 0.300, $P = .034$ and rsp= 0.285, $P = .045$ respectively). Two-hour postoperative VAPS score was not associated with duration of anesthesia (rsp = 0.222, $P = .12$). Operation duration was not associated with VAS scores. Surgeons' satisfaction scores were negatively

associated with patient's intraoperative VAS score (rsp = -0.73, $P < .001$). Patients' satisfaction scores were negatively correlated with intraoperative VAS (rsp = -0.597, $P < .001$), immediately postoperative VAS (rsp = -0.538, $P < .001$), and 2 hour postoperative VAS (rsp = -0.474, $P = .001$).

VAS scores and patient or surgeon satisfaction scores were not associated with access location (lower calyx, middle calyx or upper calyx; all $P > .05$).

DISCUSSION

PCNL was originally performed under general anesthesia. In general anesthesia there is risk of tube displacement during change of position from supine to prone. (8) General anesthesia is also less cost effective and is carried with a higher risk of pulmonary complications. (8) Therefore, some researchers were motivated to evaluate the role of regional anesthesia in PCNL due to the regional nature of the procedure. Use of spinal and CSEA were reported in some previous publications with satisfactory results. The use of analgesic medications and patient satisfaction were reported higher in CSEA relative to general anesthesia in the studies by Kuzgunbay et al.,⁽⁵⁾ Saeid et al.⁽⁷⁾ and Karacalar et al.⁽⁴⁾ Spinal anesthesia has also been reported to be associated with less postoperative pain and favorable operative factors by Mehrabi et al.^(11,15) and Nouralizadeh et al.⁽²⁾ Yet only one study has evaluated convenience of the surgeon with the anesthesia⁽⁴⁾ and up to our knowledge no study has evaluated the intraoperative pain score of the patients in spinal anesthesia or CSEA. Most studies focused on postoperative pain of the patients. Intraoperative convenience of the patient is of outmost importance because it provides a safe and stable condition in awake patient for successful operation. Furthermore, in some previous studies large exclusion criteria were applied. For example in a previous report from our center,⁽²⁾ patients with history of PCNL or open stone surgery were excluded from the study compromising the generalization of the results of the study to the population of PCNL patients.

The results of this study reveal that spinal anesthesia has been associated with intolerable pain or discomfort in some patients (5 patients, 10%). This has caused premature termination of the operation upon request of anesthesia specialist (1 patient) or gross inconvenience of the operating surgeon due to movement and/or anxiety of the patient (4 patients). In our opinion this is of outmost concern because the primary objective of anesthesia is to provide enough intraoperative analgesia during the operation and continuation of anesthesia into the postoperative period (that has been the concern of most previous studies) is a second less important purpose. As general anesthesia usually provides pain free operation, it was expected that regional anesthesia provides little and tolerable pain during the operation relative to general anesthesia. However, unfortunately the pain scores were severe⁽⁸⁻¹⁰⁾ in 5 patients (10%) and moderate in another 10 patients.

In this study, the duration of anesthesia was associated with increasing intraoperative VAS in patients. This observation has previously been reported by Karacalar et al. They reported insufficiency of spinal anesthesia for PCNL operations longer than 160 minutes.⁽⁴⁾

CONCLUSIONS

Spinal anesthesia does not provide enough analgesia for the patient in a limited frequency of percutaneous nephrolithotomy operations. Increasing anesthesia duration is associated with increasing pain during operation. We could not find other statistically significant predictors of insufficient analgesia based on patients' demographics, stone characteristics or access location.

CONFLICT OF INTEREST

The authors report no conflict of interest.

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