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## Research Communication

# The erector spinae plane block can facilitate outpatient stone surgery by reducing breakthrough pain

Pain after percutaneous nephrolithotomy (PCNL) is thought to arise from the dilated renal tract rather than from the skin incision, and the response to traditional analgesics is typically limited [1]. To address this problem, the erector spinae plane block (ESPB) has recently been identified as safe and effective method to target kidney pain. While both eighth thoracic vertebra (T8) and T11 have been reported to be effective in relieving renal colic and surgical pain after PCNL, T11 is hypothesised to have greater ureteric coverage [2–6].

These promising early results inspired us to examine the utility of the ESPB in the context of ambulatory PCNL: can it allow us to manage postoperative pain with oral analgesics alone? We hypothesised that patients who receive ESPB would have less breakthrough pain on oral analgesics and would thus be more willing to undergo same-day discharge. The present prospective study was designed to assess the effect of ESPB on opioid requirements and subjective pain within the first 24 h after PCNL.

We assessed 75 adult PCNL patients for eligibility, of which 19 were excluded due to history of pre-existing nephrostomy tubes, chronic pain, opioid use for more than 3 consecutive months prior to surgery, altered mental status, neurological condition resulting in an inability to communicate verbally, or a contraindication to local anaesthesia were excluded from the analysis. A total of 24 patients was assigned to the intervention group and 32 patients were assigned to the control group. There were no significant differences between the groups regarding demographics or preoperative stone characteristics (Table 1).

After informed consent was obtained, participants in the intervention group received a preoperative ESPB at the T11 level as previously described [6] and participants in the control group received no local or regional anaesthesia. One attempt to perform ESPB was aborted due to elevated patient anxiety. PCNL was performed for all patients in the typical fashion with *de novo* renal access achieved by the urology team. Postoperative drainage tubes including nephrostomy tubes and JJ stents were left routinely.

Study participants were admitted overnight. After discharge from the post-anaesthesia care unit (PACU), the patients were prescribed oral pain medications including acetaminophen, ibuprofen, and an opioid as part of our institutional standard admission order set unless contraindicated. One-time doses of intravenous (IV) opioids were prescribed only if explicitly requested by the patient to help manage breakthrough pain.

Verbal pain score on a 0 (no pain) to 10 (worst pain imaginable) scale and opioid administration were assessed at regular intervals during admission. Our primary outcome was 'breakthrough pain,' which we defined as any verbal pain score of ≥7 ('severe' pain at our institution) or any administration of an IV opioid after PACU discharge within 24 h of surgery. We found that patients who received ESPB had a greater than twofold reduction in breakthrough pain compared to control. This remained statistically significant even when controlling for age, sex, dilated tract size, and tract location in a multivariate logistic regression (odds ratio 0.21, 95% CI 0.05–0.78). Secondary outcomes included initial pain score, defined as the first verbal score the patient provided in the PACU upon waking up from anaesthesia, and the highest reported score within 24 h of surgery per nursing assessments (Table 1). Total opioid administration was further subcategorised by context: 'Operating Room,' 'PACU,' and 'Ward,' Opioid dosing was converted to oral morphine equivalents (OME) [7]. ESPB reduced the highest 24-h pain score but not the initial pain score, possibly due to the residual effects of general anaesthesia upon first waking up.

Of note, no serious adverse outcomes directly related to ESPB such as systemic toxicity, persistent paraesthesia, haematoma, infection, or injury to adjacent structures were observed. In the single case of aborted ESPB, the patient reported persistent irritation at the site several days later.

A blinded telephone survey was conducted 3–9 months after surgery. To avoid confounding from postoperative complications, only patients who were discharged within 24 h of surgery without any documented complications were included in the survey. Patients were asked to retrospectively rate their pain within the first 24 h of surgery (1–10 scale), estimate the number of days they were taking pain medications at home, and whether they would prefer same-day discharge or admission if they were to undergo surgery again.

We successfully contacted 12 of 15 eligible patients in the ESPB group and 14 of 15 eligible patients in the control group. While this sample size was not large enough to achieve statistical significance, patients who received ESPB retrospectively reported less perioperative pain (mean [SD] 3.9 [2.8] vs 5.0 [2.5]) and fewer days of analgesic requirement

**Table 1** Demographic, operative and outcome characteristics.

| Variable | ESPB (*N* = 24) | Control (*N* = 32) | *P* |
|---|---|---|---|
| **Preoperative characteristic** | | | |
| Demographic | | | |
| Age, years, mean (SD) | 59.6 (12.7) | 55.8 (18.6) | |
| Sex, *n* (%) | | | |
| Male | 13 (56.5) | 12 (37.5) | |
| Female | 10 (43.5) | 20 (62.5) | |
| Other | 0 (0) | 0 (0) | |
| Race, *n* (%) | | | |
| Asian or Pacific Islander | 2 (8.7) | 6 (18.8) | |
| Black | 3 (13.0) | 1 (3.1) | |
| Hispanic | 3 (13.0) | 9 (28.1) | |
| White | 15 (65.2) | 16 (50.0) | |
| Other | 0 (0) | 0 (0) | |
| BMI, kg/m$^2$, mean (SD) | 29.3 (5.1) | 27.9 (6.1) | |
| ASA score, *n* (%) | | | |
| I | 3 (13.0) | 5 (15.6) | |
| II | 12 (52.2) | 21 (65.6) | |
| III | 8 (34.8) | 6 (18.8) | |
| Stone burden, *n* (%) | | | |
| <1 cm | 0 (0) | 2 (6.2) | |
| 1–2 cm | 5 (21.7) | 12 (37.5) | |
| >2 cm | 18 (78.3) | 18 (56.3) | |
| Laterality, *n* (%) | | | |
| Left | 12 (52.2) | 23 (71.9) | |
| Right | 10 (43.5) | 8 (25.0) | |
| Bilateral | 1 (4.3) | 1 (3.1) | |
| **Intraoperative** | | | |
| Tracts dilatated, *n* (%) | | | |
| 1 | 20 (87.0) | 31 (96.9) | |
| 2 | 3 (13.0) | 1 (3.1) | |
| Upper pole puncture, *n* (%) | 2 (8.7) | 9 (28.1) | |
| Tract size, *n* (%) | | | |
| 16 F | 16 (69.6) | 16 (50) | |
| 24 F | 7 (30.4) | 16 (50) | |
| Estimate blood loss, mL, mean (SD) | 36.5 (25.3) | 37.5 (28.8) | |
| Operative time, min, mean (SD) | 109.4 (34.7) | 110.9 (38.5) | |
| **Outcome** | | | |
| Breakthrough pain (yes/no), *n* (%) | 5 (21.7) | 17 (53.1) | 0.03 |
| Verbal pain score ≥7 (yes/no), *n* (%) | 3 (13.0) | 13 (40.6) | 0.04 |
| IV opioid administration (yes/no), *n* (%) | 2 (8.7) | 12 (37.5) | 0.02 |
| Verbal pain score (0–10), mean (SD) | | | |
| Initial pain score | 3.3 (2.3) | 3.6 (3.2) | >0.9 |
| Highest 24-h pain score | 4.2 (2.6) | 6.0 (2.8) | 0.02 |
| 24-h opioid requirement (OME), mg, mean (SD) | | | |
| Intraoperative | 13.8 (7.1) | 18.7 (17.4) | 0.04 |
| PACU | 18.7 (17.4) | 18.1 (7.8) | >0.9 |
| Ward | 20.3 (24.7) | 19.8 (24.2) | >0.9 |
| Total | 55.7 (40.6) | 58.3 (39.1) | 0.8 |

*Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; ERAS, enhanced recovery after surgery; ESPB, erector spinae plane block; IV, intravenous; OME, oral morphine equivalents; PACU, post-anaesthesia care unit; PCNL, percutaneous nephrolithotomy*

(mean [SD] 2.0 [1.2] vs 3.8 [2.6]) compared to those in the control group. Patients who received ESPB were also twice as likely to prefer same day discharge over overnight admission (58% vs 29%) for a future procedure.

Taken together, the ESPB is a promising technique for renal analgesia after PCNL. Importantly, we demonstrate that ESPB allows postoperative pain after PCNL to be managed with oral analgesics alone, and patients are more willing to be discharged on same day. This is the first study to highlight this benefit, which is especially relevant in the effort to convert inpatient procedures to outpatient procedures in the coronavirus disease 2019 (COVID-19) era.

The present study does have several limitations. ESPB administration was not blinded to either the study participants or the surgeons and anaesthesiologists. All patients were aware they had received the ESPB, and more than half of the patients were awake during the ESPB. To mitigate the Hawthorne effect on pain assessments and opioid consumption, the parameters of the study were not revealed to the participants or the nursing staff. Furthermore, no strict

stipulations for pain management were established for study purposes. While this led to occasional aberrations, e.g. patients receiving IV rescue opioids for a reported pain level of 2 in the intervention group, these were tolerated by design in exchange for a more unbiased assessment.

We also acknowledge that the evaluation of pain in a hospital is not a perfect surrogate for the experience of pain at home. Frequency of assessments, unfamiliarity of environment, and disturbances to sleep are among many factors that can contribute to an overestimation of pain, whereas the availability of physician and nursing attention could alleviate anxiety and decrease subjective pain.

In closing, the ESPB is an important innovation for stone surgery. This line of investigation is also valuable in the context of the larger trend in urology and other surgical fields of expediting postoperative recovery. Enhanced recovery after surgery (ERAS) protocols have revolutionised postoperative care in various operations, leading to better patient experiences, shorter hospital courses, reduced costs, and improved outcomes. Reducing perioperative opioid use and its associated side-effects has been a major part of this effort. While ERAS protocols for PCNL remain in development, ESPB should become a critical component of a perioperative workflow that aims to eventually achieve opioid-free ambulatory surgery.

## Conflict of Interest

None declared.

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Abbreviations: ERAS, enhanced recovery after surgery; ESPB, erector spinae plane block; IV, intravenous; OME, oral morphine equivalents; PACU, post-anaesthesia care unit; PCNL, percutaneous nephrolithotomy.