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# THE ROLE OF ERECTOR SPINAE BLOCK IN UROLOGICAL SURGERIES AS A PROMISING ALTERNATIVE TO CONVENTIONAL ANALGESIA: A PROSPECTIVE OBSERVATIONAL STUDY

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## ABSTRACT

**Introduction**: The erector spinae plane block (ESPB) is a regional anesthesia technique that provides somatic and visceral analgesia by targeting the dorsal and ventral rami of the spinal nerves. It is performed under ultrasound guidance. ESPB is particularly beneficial in urological surgeries, which often require multimodal analgesia due to complex pain management needs and patient comorbidities. However, its efficacy in urological procedures remains insufficiently studied. Therefore, our aim was to assess the effectiveness and advantages of ESPB in urological procedures.

**Material and Methods**: This prospective observational study was conducted at a tertiary referral hospital. The study included all consecutive patients scheduled for urological surgery, classical approach, or laparoscopic surgery under general anesthesia. Patients were ASA I–III, aged ≥18 years. Exclusion criteria included coagulopathy, infection at the injection site, allergy to local anesthetics, and chronic opioid therapy. ESPB was performed under ultrasound guidance, and a 20G echogenic needle was used to administer 20–30 mL of 0.5% bupivacaine at the Th8–L2 vertebrae level, depending on surgical requirements. The primary outcome, postoperative pain, was measured using a visual analog scale at 2, 6, 12, and 24 hours. The incidence of postoperative nausea and vomiting (PONV), the total amount of opioids consumed in a 24-hour period, and intraoperative hemodynamic stability were the secondary outcomes. IV fentanyl and paracetamol were used for postoperative analgesia, and metoclopramide was used to control nausea.

**Results**: Fifty patients (42 males, 8 females, mean age 66±9.8 years) were analyzed. The majority were ASA II (44%) and ASA III (50%). Open surgeries were performed on 21 patients, while 19 underwent laparoscopic procedures. Primary Outcome: Pain scores (VAS) at 6h, 12h, and 24h were significantly lower in laparoscopic groups compared to open surgeries ($p<0.05$). Secondary Outcomes: Only three patients (6%) from the open classical approach surgery required rescue opioids. PONV occurred in two patients (4%): one from the open and the other from the laparoscopic approach surgery. Intraoperative hemodynamics remained stable, with no significant fluctuations in MAP or HR.

**Conclusion**: ESPB provided effective analgesia, reduced opioid consumption, and maintained hemodynamic stability in urological surgeries, supporting its role in multimodal pain management strategies.

**Keywords**: Erector spine plane block; multimodal analgesia; urological surgeries

## INTRODUCTION

The erector spinae plane block (ESPB) is a novel regional anesthesia technique that provides both somatic and visceral analgesia by targeting the dorsal and ventral rami of spinal nerves. The procedure involves the injection of a local anesthetic into the interfascial plane between the erector spinae muscle and the transverse processes of the vertebrae, resulting in a widespread segmental blockade of the thoracic and lumbar regions [1, 2]. This technique is performed under ultrasound guidance, ensuring precise deposition of the anesthetic while minimizing complications [3]. Regional Anaesthesia UK has recommended seven "Plan A" blocks, including the erector spinae plane block (ESPB), which addresses acute pain and frequently performed operations. The ESPB is considered the best Plan A block because, in contrast to the other six blocks, it may be used at all levels of the spine and offers analgesia to the majority of body parts [1, 4, 5].

On the one hand, urological surgeries encompass a diverse range of procedures, from minor interventions to more extensive surgeries like nephrectomies, radical cystectomies, and prostatectomies performed with a classical or laparoscopic approach. Postoperative pain management in these patients can be complex, as many require multimodal analgesia to reduce opioid consumption while maintaining adequate pain control [6–9]. ESPB block has emerged as a valuable adjunct, offering effective analgesia with minimal side effects [3, 10].

On the other hand, a significant challenge in urological patients is the high prevalence of comorbidities due to the advanced age of the patients. These comorbidities include chronic kidney disease, cardiovascular conditions, and metabolic disorders, often necessitating opioid-sparing approaches. Given the hemodynamic stability provided by ESPB, ESPB is particularly beneficial in this population [11, 12].

The use of a combination of pharmacological and non-pharmacological analgesic modalities to target various pain pathways is known as multimodal analgesia in the context of perioperative pain management. Regional blocks are a crucial component of this multimodal approach because they offer targeted, site-specific analgesia that enhances pain control while lowering opioid-related side effects [13].

Despite its increasing use in various surgical specialties, there are no conclusive results in the literature defining the role of ESPB in urological surgeries. The available data remain limited, particularly in terms of its efficacy across different surgical approaches, including open-classical, and laparoscopic procedures.

Acknowledging this deficiency, our research sought to assess the effectiveness and advantages of ESPB in urological procedures, with an emphasis on perioperative hemodynamic stability and opioid-sparing anesthesia.

## MATERIAL AND METHODS

The study was approved by the internal ethics committee of the tertiary university clinic for traumatology, orthopedic disease, anesthesiology, reanimation, intensive care medicine, and emergency department. The department of anesthesia, reanimation, and critical care carried out this prospective, randomized evaluation. This was a prospective observational study. Those in the study population were patients scheduled for open-classical or laparoscopic surgery. Inclusion criteria were ASA I-III patients, age $\geq$ 18 years, scheduled for elective urological surgery under general anesthesia, with the ability to provide informed consent. Exclusion criteria: coagulopathy, local infection at the injection site, known allergy to local anesthetics, patients on chronic opioid therapy. All included patients in the study received ESPB.

*Anesthesia Protocol*

General anesthesia was induced with intravenous fentanyl (1–2 mcg/kg) and propofol 1%, titrated to the loss of verbal response, following the establishment of standard monitoring, including electrocardiography (EKG), pulse oximetry, and non-invasive blood pressure (NIBP) measurement. After induction, invasive arterial pressure monitoring was initiated via radial artery cannulation. Neuromuscular blockade was achieved with rocuronium to facilitate tracheal intubation, followed by mechanical ventilation with a pressure control volume guarantee mode, using a tidal volume of 6 mL/kg ideal body weight, respiratory rate adjusted to maintain end-tidal $CO_2$ ($EtCO_2$) between 35–45 mmHg, and positive end-expiratory pressure (PEEP) set at 5 $cmH_2O$. Anesthesia was maintained with sevoflurane in air and supplemental oxygen, in combination with multimodal analgesia. Intraoperative analgesia included intravenous paracetamol (1 g) unless contraindicated. Postoperative analgesia consisted of paracetamol, NSAIDs, and rescue opioids if required. To prevent postoperative nausea and vomiting, intravenous ondansetron (4mg) and dexamethasone (0.1mg/kg) were administered.

*ESPB Technique*

Under sterile conditions, skilled consultant anesthetists performed the administration of erector spinae plane blocks (ESPB) in anesthetized patients. Following induction of anesthesia, patients were positioned in the lateral decubitus position, and the skin was prepared with ChloraPrep, containing 2% chlorhexidine gluconate in 70% isopropyl alcohol. Using a linear transducer (SonoSite HFL 50x; SonoSite, Inc., Bothell, WA, USA) and an ultrasound machine (SonoSite Edge; SonoSite, Inc., Bothell, WA, USA), we guided a 20-gauge, 0.9x100-mm echogenic needle (Stimuplex Ultra 360; B. Braun, Hessen, Germany) into the interfascial plane above the transverse process and deep to the erector spinae muscle. The block was performed at a level between the Th8 and L2 vertebrae level, depending on the primary diagnosis and surgical requirements. A total of 30 mL of 0.5% bupivacaine was administered bilaterally at the midpoint of the intended incision, or 20 mL if the block was unilateral.

*Outcome Measures*

The primary outcome was pain score measured with a visual analog scale (VAS) that was used to measure pain at 2, 6, 12, and 24 hours after surgery. Incidence of postoperative nausea and vomiting (PONV), postoperative pain scores, total opioid consumption within 24 hours, and hemodynamic stability during surgery (as determined by MAP and HR fluctuations) were secondary outcomes. A visual analog scale (VAS) was used to measure pain at 2, 6, 12, and 24 hours after surgery. Intravenous fentanyl 50 mcg was administered to patients in the post-anesthesia care unit (PACU) who reported pain levels higher than 3 on VAS. Intravenous paracetamol (1 g every 6 hours) was used for postoperative analgesia. To control nausea and vomiting, metoclopramide (10 mg every 12 hours) was given. In addition to the frequencies of postoperative nausea and vomiting and pruritus, we also examined the block problems and complications.

*Statistical Analysis*

A computer database was created. Analysis was carried out using IBM SPSS (20.0). Standard descriptive and analytical techniques were applied. Categorical data were stated as percentages, whereas numerical variables were given as medians and ranges. When p was less than 0.05, statistical significance was stated.

## RESULTS

A total of 65 patients were evaluated for eligibility in this observational study. Ten patients did not match the inclusion criteria, and five patients chose not to participate, resulting in the exclusion of fifteen individuals. Fifty patients who had either open or laparoscopic urological surgery with ESPB were part of the final trial cohort. One patient needed to have open surgery

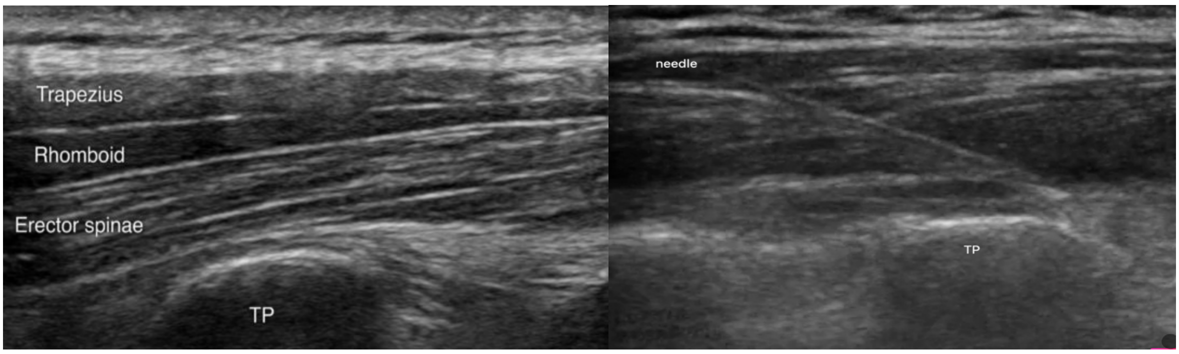


**Figure 1.** *A (anatomical ultrasonography view of all structures), B (needle insertion and position)*
**TP: transverse process of vertebra*

performed instead of the laparoscopic procedure that was originally planned and initiated. Figure 2 shows the procedure of enrolling and allocating patients.

A total of 50 patients were analyzed in the study, consisting of 42 males (84%) and 8 females (16%). The patients' ages ranged from 43 to 82 years (mean ± SD: 66±9.8).

According to the ASA Physical Status Classification, the distribution was as follows: ASA I: 3 patients (6%), ASA II: 22 patients (44%), ASA III: 25 patients (50%).

In terms of body mass index (BMI), patients were categorized as either normal weight 22 (44%) or overweight 28 (56%). The total surgery time ranged from a minimum of 105 minutes to a maximum of 325 minutes, with a mean duration of 157 minutes.

The primary outcome was postoperative pain assessment using the Visual Analog Scale (VAS) at 2h, 6h, 12h, and 24h postoperative-

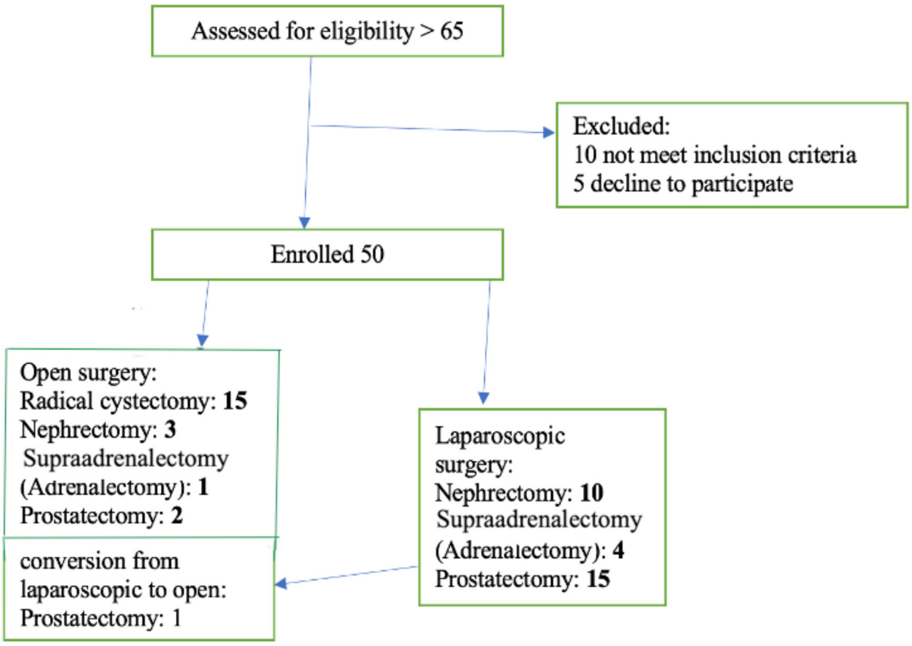


**Figure 2.** *Consort diagram of participant recruitment*

**Table 1.** *Patients and ESPB block characteristics*

| Surgical approach / procedures | Number of patients (N) | ESPB laterality | ESPB Bupivacaine 0.5%/ml | Level of the block |
|---|---|---|---|---|
| **Open surgery** | 21 | | | |
| Radical cystectomy | 15 | Bilateral | 30 | Th12/L1/L2 |
| Nephrectomy | 3 | Unilateral | 20 | Th9/Th10/Th11 |
| Suprarenalectomy (adrenalectomy) | 1 | Unilateral | 20 | Th10/Th11 |
| Prostatectomy | 2 | Bilateral | 30 | Th12/L1/L2 |
| **Laparoscopic surgery** | 19 | | | |
| Nephrectomy | 10 | Unilateral | 20 | Th8/Th9/Th10 |
| Suprarenalectomy (adrenalectomy) | 4 | Unilateral | 20 | Th10/Th11 |
| Prostatectomy | 15 | Bilateral | 30 | Th11/Th12/L1/L2 |
| Total | 50 | | | |

*ESPB – erector spine plane block

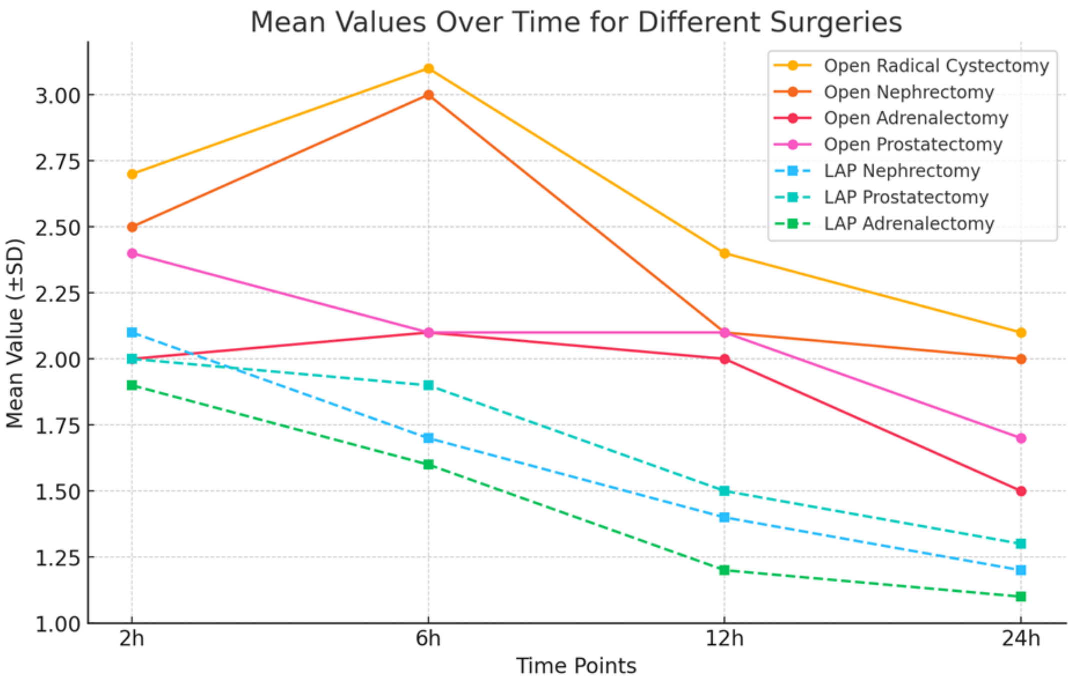


**Chart 1.** *Postoperative Pain Scores (VAS) at Different Time Points by Surgery Type*

**Table 2**. *The differences in Postoperative Pain Scores (p) at Different Time Points by Surgery Type*

| **Type of statistics** | **Timing** | | | |
|---|---|---|---|---|
| | **2h** | **6h** | **12h** | **24h** |
| Mann-Whitney U (Open vs. LAP) | 0.18 | <0.05 | <0.05 | <0.05 |
| Kruskal-Wallis (All groups) | 0.71 | <0.05 | <0.05 | <0.05 |

* p < 0.05 consider significant difference

ly. The results showed that patients undergoing laparoscopic procedures experienced lower pain scores compared to those undergoing open surgeries. Mann-Whitney U and Kruskal-Wallis tests were used for statistical analysis. Pain scores at 6h, 12h, and 24h were significantly lower in laparoscopic groups compared to open surgeries (p<0.05), while at 2h, there was no significant difference (p=NS).

The secondary outcomes measures were total opioid consumption within 24 hours postoperatively, hemodynamic stability during surgery, assessed by fluctuations in mean arterial pressure (MAP), heart rate (HR) (presented in Table 3), and incidence of postoperative nausea and vomiting (PONV). Only three patients (6%) required opioid consumption and rescue analgesia within 24 hours postoperatively. One patient underwent conversion from laparoscopic to open prostatectomy due to intraoperative bleeding, one patient following radical cystectomy, and one patient after open radical prostatectomy. PONV was observed in two patients (4%). One patient was the same laparoscopic-to-open conversion case due to intraoperative bleeding, and the second was a patient who underwent long-lasting laparoscopic radical prostatectomy with lymphadenectomy.

No participants required treatment for hypotension or pruritus. Additionally, no complications or technical difficulties related to the ESPB procedure were observed.

## DISCUSSION

In urological surgeries, we discovered that ESPB has room as a unique approach. When combined with multimodal analgesia,

**Table 3.** *Intraoperative hemodynamic parameters and characteristics of surgery*

| Timepoint | MAP (mmHg), Mean ± SD | HR (bpm), Mean ± SD |
|---|---|---|
| Baseline (pre-induction) | 73 ± 22 | 88 ± 12 |
| Post-induction | 67 ± 15 | 69 ± 20 |
| 15 min after incision | 66 ± 12 | 70 ± 15 |
| 30 min after incision | 65 ± 13 | 72 ± 12 |
| 60 min after incision | 68 ± 20 | 65 ± 22 |
| End of surgery | 69 ± 12 | 70 ± 17 |

intra-operative erector spinae block decreased discomfort for up to 24 hours following either open or laparoscopic urological surgery. Our primary outcome, postoperative pain evaluated by VAS at different time points (2h, 6h, 12h, and 24h), demonstrated that ESPB provided effective analgesia, with lower pain scores observed in laparoscopic procedures compared to open surgeries. The significant reduction in pain scores within the first 24 hours suggests that ESPB contributes to improved early postoperative recovery. Moreover, only three patients required rescue opioid analgesia within 24 hours. The overall opioid-sparing effect observed in our study aligns with findings from previous meta-analyses, reinforcing ESPB's role in reducing postoperative opioid requirements and minimizing the risk of opioid-related complications [1, 14–20]. An injection of erector spinae block at a single site limits the effect to approximately five dermatomes, which makes it suitable for more urological surgeries [21]. The ESPB block's versatility is demonstrated by its many uses in the treatment of acute pain. For hip surgery and upper limb amputation, respectively, ESPB blocks have been applied craniocaudally from the level of the sixth cervical vertebra (C6) to the fourth lumbar vertebra (L4) [10, 22, 23]. The analgesic efficacy of the ESPB block is comparable to older, previously employed regional methods, highlighting its extraordinary adaptability. After a day, we restricted the results to 24 hours of spinae block, which would have no direct or indirect impacts. In summary, we discovered that intraoperative erector spinae block, when combined with multimodal analgesia, enhanced recovery and decreased discomfort for up to 24 hours following surgery.

All subjects maintained hemodynamic stability during surgery, another important secondary outcome. No patient needed treatment for intraoperative hypotension, and variations in heart rate (HR) and mean arterial pressure (MAP) stayed within tolerable bounds. This implies that intraoperative hemodynamic stability, which is critical in surgical patients with diverse physiological responses, is not jeopardized by ESPB when administered as part of a multimodal analgesic strategy. Other surgical diseases have also been shown to benefit from the hemodynamic stability of the ESPB [24, 25]. The incidence of PONV was low, with only two patients experiencing nausea and vomiting postoperatively. One of these cases was the patient who required conversion from laparoscopic to open prostatectomy due to prolonged surgical time and increased intraoperative opioid use. The second patient underwent a long-duration laparoscopic radical prostatectomy with lymphadenectomy. These findings indicate that ESPB, by reducing opioid consumption, may contribute to lower PONV rates, thereby improving overall patient comfort and recovery [26]. The results of enhanced recovery after surgery (ERAS) programs may be further optimized by integrating ESPB with multimodal analgesia [7, 26]. Compared to paravertebral and epidural blocks, ESPB is relatively easy and safe to perform, with lower systemic absorption of local anesthetics and a reduced risk of complications [27–31]. Notably, in our study, no patient experienced complications related to ESPB, including hypotension, pruritus, or local anesthetic toxicity. This reinforces the safety profile of ESPB as a viable regional anesthetic technique for urological surgeries.

Urological procedures such as radical cystectomy, nephrectomy, and prostatectomy often have long operative times, sometimes exceeding 3–4 hours. The use of 0.5% bupivacaine, instead of 0.25%, ensures a longer duration of analgesia, reducing intraoperative and early postoperative pain. Studies indicate that higher-concentration local anesthetics provide a more sustained blockade, which is crucial for minimizing opioid requirements in the immediate postoperative period. A higher concentration (0.5%) results in deeper and more extensive sensory blockade, which is particularly beneficial for surgeries involving both somatic and visceral pain components [32, 33]. A more profound block lessens the nociceptive response, which promotes hemodynamic stability by reducing stress-related fluctuations in blood pressure and heart rate, which was also seen in our investigation. This is because many urological procedures (such as radical prostatectomy and nephrectomy) involve extensive tissue dissection.

There have been very few documented technique-specific contraindications for ESPB blocks, and the incidence of problems is essentially nonexistent [34]. Although pneumothorax, phrenic nerve palsy, and unintentional motor blockage are included in the published literature on ESPB block consequences, these are single-incidence case studies with a high potential for bias [34]. Since there are no significant structures nearby, the location of the ESPB block's local anesthetic administration needs to be highlighted. Accidental injections into the subarachnoid, subdural, or epidural area can result in complications from epidural nerve blocks and thoracic paravertebral block, including elevated spinal, phrenic nerve palsy, and epidural hemorrhage [35]. Quadriplegia is a potentially fatal consequence of accidentally injecting a local anesthetic into the spinal cord [34]. When paravertebral or epidural blocks are not recommended because of thrombocytopenia, antiplatelet or anticoagulant medications, or coagulopathy, ESPB blocks can be safely administered [1, 36]. Our evaluation revealed no complications to be reported.

It is important to recognize a number of our study's limitations. First, the fact that this was a single-center study may have limited how far our results may be applied. Second, the lack of randomization in the trial may have introduced selection bias into the distribution of patients. Third, we included patients with a variety of urological diseases, from open radical cystectomy to laparoscopic prostatectomy, which adds variation to the degrees of postoperative pain and surgical stress. Although ESPB showed effectiveness in all of these procedures, a more standardized population would allow for a more accurate evaluation of its effects. Furthermore, even though there was a decrease in opioid use, we did not measure long-term opioid needs that went beyond 24 hours. Lastly, even though ESPB was carried out by skilled anesthesiologists, operator skill may affect how effective it is. This highlights the necessity for additional multicenter, randomized controlled trials to confirm these results in other clinical contexts.

## CONCLUSION

In summary, as an inventive and adaptable instrument for regional anesthesia, the ESPB block has several uses. It should be taken into consideration as a substitute for more traditional regional techniques because it is simple to do and has a low risk of problems and contraindications. Intraoperative ESPB, when combined with multimodal analgesia, significantly reduced postoperative pain, minimized opioid requirements, and maintained hemodynamic stability in patients undergoing urological surgery. The low incidence of PONV and absence of ESPB-related complications further support its role in perioperative pain management. Given its simplicity, efficacy, and safety, ESPB represents a promising alternative to more invasive regional techniques and may contribute to improved recovery outcomes in ERAS protocols for urological surgery.

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**Резиме**

**УЛОГАТА НА БЛОКАДАТА НА ʻРБЕТНИОТ ЕРЕКТОР ВО УРОЛОШКИТЕ ХИРУРШКИ ЗАФАТИ: ВЕТУВАЧКА АЛТЕРНАТИВА НА КОНВЕНЦИОНАЛНАТА АНАЛГЕЗИЈА**

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**Вовед**: Блокадата на ʻрбетниот еректор (ЕСПБ) е техника на регионална анестезија што обезбедува соматска и висцерална аналгезија преку дејство врз дорзалните и на вентралните рамуси на спиналните нерви. Се изведува под ултразвучна контрола и се препорачува како водечки блок за управување со акутната болка. ЕСПБ е особено корисна кај уролошките хируршки интервенции, кои често бараат мултимодална аналгезија поради комплексното менаџирање на болката и коморбидитетите кај пациентите. Сепак, нејзината ефикасност кај овие процедури сѐ уште не е доволно проучена.

**Материјал и методи**: Оваа проспективна опсервациска студија беше спроведена во терцијарна универзитетска клиника и опфати пациенти подложени на уролошки хируршки зафати (радикална цистектомија, нефректомија, адреналектомија, простатектомија) и лапароскопски процедури (нефректомија, адреналектомија, простатектомија) под општа анестезија. Пациентите беа ASA I–III, на возраст ≥18 години. Критериуми за исклучување беа коагулопатијата, инфекцијата на местото на апликацијата, алергијата на локални анестетици и хроничната терапија со опиоиди. Блокадата на ЕСПБ беше изведена под ултразвучна контрола, при што со ехогена игла 22G беа аплицирани 20–30 mL 0,5 % бупивакаин на нивоа T8–L2, во зависност од хируршките потреби.

**Резултати**: Анализирани беа 50 пациенти (42 мажи, 8 жени, просечна возраст 66 ± 9,8 години). Најголемиот дел од нив беа ASA II (44 %) и ASA III (50 %). Отворени хируршки зафати беа изведени кај 21 пациент, додека 19 пациенти беа подложени на лапароскопски процедури. Примарен исход: Оценките за болка (VAS) на 6, 12 и 24 часа беа значително пониски кај лапароскопската група во споредба со отворените хируршки зафати ($p < 0,05$). Секундарни исходи: Само тројца пациенти (6 %) имаа потреба од дополнителни опиоиди. Постоперативно гадење и повраќање (PONV) се јави кај двајца пациенти (4 %). Интраоперативната хемодинамика остана стабилна, без значителни осцилации во MAP или во HR.

**Заклучок**: ESPB обезбедува ефективна аналгезија, намалена употреба на опиоиди и стабилна хемодинамика кај уролошките хируршки процедури, што ја поддржува нејзината улога во мултимодалните стратегии за управување со болка.

**Клучни зборови**: erector spinae plane block, мултимодална аналгезија, уролошки хируршки зафати