Erector Spinae Plane Block in Laparoscopic Cholecystectomy, Is There a Difference? A Randomized Controlled Trial

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Abstract

**Background:** The ultrasound (US)-guided erector spinae plane (ESP) block and oblique subcostal transversus abdominis plane (OSTAP) block are used to decrease postoperative pain and subsequently opioids consumption. **Aim:** The aim was to test the hypothesis that US-guided ESP blocks can produce more reduction in opioid usage during the first 24 h after laparoscopic cholecystectomy when compared to OSTAP block. **Settings and Design:** Seventy adult patients (20–60 years old) who were planned to undergo elective laparoscopic cholecystectomy were allocated in three groups in randomized controlled trial. **Materials and Methods:** The three groups received either port site infiltration, US-guided bilateral ESP block (ESP group), or OSTAP (OSTAP group) with bupivacaine hydrochloride 0.25%. **Statistical Analysis:** Postoperative 24 h Morphine consumption, visual analogue scale (VAS), the intraoperative fentanyl (μg) and equivalent morphine dose in the recovery unit were recorded and analyzed using one-way analysis of variance. **Results:** The mean 24-h morphine consumption was statistically significant between groups ($P < 0.001$), but it was insignificant between ESP and OSTAP ($P = 0.173$). Median (range) and interquartile range of intraoperatively consumed fentanyl showed significance between the three groups ($P < 0.001$). There was significance between ESP block Group II and OSTAP block Group III ($P = 0.95$) by post hoc analysis. The mean values of VAS at both rest and movement of the control group were significantly higher than the ESP block group at 6 and 12 h postoperative. **Conclusion:** Bilateral US-guided ESP block was found to be as effective as bilateral US OSTAP block. There was more decrease in intraoperative rescue fentanyl, PACU morphine analgesia, 24-h morphine, and pain assessment score in both groups than the control port-site infiltration group. Clinical trial registration number: NCT03398564.

**Keywords:** Analgesia, erector spinae plane block, morphine consumption, oblique subcostal transversus abdominis plane

Introduction

Laparoscopic cholecystectomy is a widely employed procedure in ambulatory surgery. Pain after laparoscopic cholecystectomy arises significantly from port-site incisions in the anterior abdominal wall and shoulder pain (referred from visceral pain). Sensory supply of the anterior abdominal wall is segmentally provided by nerves running in the fascial plane between transversus abdominis muscle and internal oblique muscle. Narcotic medications are utilized to manage postoperative pain, but its disadvantages include increased postoperative nausea and vomiting (PONV), ileus, sedation, and delayed hospital discharge.

Several techniques have been tried such as neuroaxial narcotics, intraperitoneal lavage of local anesthetic (LA), and transversus abdominis plane (TAP) block. These techniques successfully reduced opioids use and improved postoperative pain. Oblique subcostal TAP (OSTAP) block had been studied before and found to be effective in reducing postoperative morphine usage and produce good analgesia for about 24 h postoperatively.

The ultrasound (US)-guided erector spinae plane (ESP) block is a new technique which proved to produce unilateral analgesia at thoracolumbar dermatomes. Few case series reported the efficacy of US-guided ESP blocks in reducing postoperative pain and opioids’ consumption.

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To date, there were no controlled trials tested its efficacy in various abdominal or thoracic surgical procedures.

The aim of this study was to test the hypothesis that US-guided ESP blocks can produce more reduction in opioid usage during the first 24 h after laparoscopic cholecystectomy when compared to O斯塔P block.

**Materials and Methods**

This study was conducted at Al Jedaani Group of Hospitals and Ibn Sina Medical College Hospital, Jeddah, from January 2018 to October 2018. After approval of Institutional Review Board of Al Jedaani Group of Hospitals (IRB No.: 1/12-2017, approval date: December 20, 2017), informed written consent was obtained from 70 consecutive patients who were planned to undergo elective laparoscopic cholecystectomy. The study was registered at http://clinicaltrials.gov (registration number NCT03398564). This manuscript adheres to the applicable Equator guidelines.

**Study design**

The current study was designed as a double-blinded, randomized, and controlled trial. Blindness to the treatment group involves the patients, surgical and anesthesia teams and operating theater staff, and PACU and surgical ward nurses.

**Inclusion criteria**

Seventy adult (20-60 ys), American Society of Anesthesiologists (ASA) physical status classes I and II patients who were planned to undergo elective laparoscopic cholecystectomy with body mass index between 20-35, were included. Port (trocar) site must be at the level of T₁₀ dermatomes or above.

**Exclusion criteria**

Patients with known allergy to LAs, presence of bleeding disorders, infection at injection sites, prior addiction or analgesics abuse (opioid and nonsteroidal antiinflammatory drug medications), liver or renal insufficiency, history of psychiatric or neurological disease, deafness, and previous open surgery, patients who need to be converted to open surgery with more tissue trauma, and ASA physical status class above II patients were excluded.

Surgical procedures done by the same surgeon and general anesthesia was administered to all patients. Preoperative preparations and laboratory studies have been done as per the local protocol designed for preoperative evaluation of patients scheduled for elective surgery.

During the preoperative visit, patients were taught about the use of visual analog score (VAS) (10 cm marked line, in which 0 cm referred to no pain and 10 cm to the worst pain). Patients were instructed to put a mark on the line to express the severity of pain that they are feeling at a specific time. The distance between the end labeled “no pain” and the mark placed by the patient was measured in centimeters, to give a pain score between 0 and 10 cm.

**Allocation and randomization**

We utilized the sealed envelope method and computer-generated random numbers and then kept with a pharmacist. The original random allocation sequences were kept in a secure place and a copy was used instead. Both patients and anesthetist responsible for data collection were blinded to the treatment group. A nonparticipant nurse prepares syringes with the study drugs (bupivacaine and saline) and places them into opaque envelopes according to the allocation orders [Figure 1].

Sealed envelopes labeled with the following three groups: Group I (Control) – Patients allocated to receive trocar-site infiltration, Group II (ESP) – Patients allocated to receive US-guided bilateral ESP Block; Group III (OSTAP) – Patients allocated for US-guided bilateral OSTAP. Treatment allocation was revealed by opening the envelope at the beginning of the operation room list. The pharmacist makes two preparations, one with bupivacaine 0.25% (for the treatment group) and the second with isotonic saline for the other two groups.

- Group I (Control) – Patients allocated for trocar-site infiltration with bupivacaine 0.25% in two syringes each with 20 ml (40 ml total) plus both bilateral ESP and OSTAP with isotonic saline for blinding
- Group II (ESP) received US-guided bilateral ESP block with 20 ml of bupivacaine hydrochloride 0.25% (Marcaine, Astra Zeneca, UK) in each side (total volume of 40 ml) deposited equally on each side plus both port-site infiltration and bilateral OSTAP block with isotonic saline for blinding
- Group III (OSTAP) received US-guided OSTAP block with 20ml of bupivacaine hydrochloride 0.25% (Marcaine, Astra Zeneca, UK) in each side (total volume of 40 mL) deposited equally on each side plus both port site infiltration and bilateral ESP block with isotonic saline for blinding.

**Anesthesia**

All patients received preoxygenation with O₂ 100% for 5 min. General anesthesia was induced by propofol (2.5 mg.kg⁻¹), fentanyl (1 µg.kg⁻¹), and atracurium (0.5 mg.kg⁻¹); an additional dose (0.2 mg.kg⁻¹) of atracurium will be given if needed. Sevoflurane maintenance of anesthesia will be employed till 1.5–2.0 minimum alveolar concentration in N₂O/oxygen (fractional inspired oxygen of 0.4) to maintain bispectral index value 40–60. Standard intraoperative monitoring included electrocardiogram, pulse oximetry, noninvasive blood pressure, and capnograph tracing (EtCO₂). Analgesia was employed for all patients in all groups including paracetamol (1 g) and ibuprofen (400 mg) by intravenous (i.v.) infusion. Fentanyl boluses every 5 min (10 µg each) were administered if mean arterial pressure and heart rate is more than 15% of the baseline values taken after induction by 5 min. The total dose of fentanyl administered was documented.

Ventilator settings were adjusted to keep normocapnia of 35–40 mmHg and SpO₂ between 94% and 100%. At the end of the procedure, i.v. neostigmine 50 µg.kg⁻¹ and atropine 0.15 µg.kg⁻¹
Inclusion criteria: 70 ASA I-II adult patients (20-60 years old) who were planned to undergo elective laparoscopic cholecystectomy. Body mass index (BMI) is from 20 to 35 and trocar sites at or above the umbilicus (T10 dermatome). 63 patients were included for analysis. Three patients refused inclusion in the study, three patients excluded due to protocol violation and one canceled.

Exclusion criteria: Allergy to aminoamide local anesthetics, coagulopathy, local skin infection, chronic analgesics dependence, liver or renal insufficiency, history of psychiatric or neurological disease, deafness, conversion to open surgery with more tissue trauma, ASA class above II were excluded.

Enrollment n = 70
Randomization n = 63
Allocation
  Group I (control) n = 21
  Group II (ESB) n = 21
  Group III (OSTAP) n = 21

Follow up and outcomes
The primary outcome: Morphine consumption in the 24 hours postoperatively. Secondary outcome: The intraoperative fentanyl (µg) required during surgery, equivalent morphine dose in the recovery unit (PACU) and first analgesic dose. Visual analogue score every two hours after surgery for 24 hours. Extubation time, post-operative nausea and vomiting at PACU and 24 hours postsurgery. ESP and OSTAP block complications.

Figure 1: Flow chart showing inclusion and exclusion criteria, enrollment, allocation and outcomes.

were given to reverse the neuromuscular blockade. Extubation as per difficult airway society guidelines. Patients were discharged from PACU after achieving score >8 on Aldrete’s recovery score.[21]

Ultrasound-guided bilateral erector spinae plane block technique
After the patients being anesthetized and intubated (to avoid needle prick and procedural anxiety), they were placed in lateral position. Skin preparation with chlorhexidine solution and the high-frequency probe was disinfected with low-level disinfectant and sterile gel. A high-frequency linear US probe (7–13 MHz US transducer, MacBook Pro-based US machines Terason t3200 portable US system) was placed longitudinally lateral to the T8 spinous process by 3 cm. After identification of the two (trapezius, and erector spinae [ES]) muscles superficial to the hyperechoic transverse process (TP) shadow. An 85-mm, 20-G echoplex block needle, VYGON was introduced in a cephalo-caudal orientation. The needle is advanced until it gently hits the TP with the deposition of LA. Hydrodissection by 1–2 mL of normal saline to visualize the plane, and then, deposition of LA was done. The spread of LA fluid was visualized as seen in Figure 2. A total of 20 mL of 0.25% bupivacaine was injected here. Right location of the needle tip is confirmed by fluid spread (LA) under ES muscle, separating it from the TP. Rhomboid major is absent at this level. The same procedure was repeated on the other side. The trocar site incision was done 15 min after the block in the two groups.

Oblique subcostal transversus abdominis plane block technique
It is done by detecting the transversus abdominis muscle beneath the rectus abdominis near the costal margin by the US. For better visualization of the needle, the needle is advanced few centimeters from the US probe [Figure 2].

Postoperatively, patients were shifted to the postanesthesia recovery unit (PACU) for 1 h. In the PACU, recovery nurses who were blinded to patient’s groups and interventions gave the patients i.v. analgesia of either fentanyl 15–20 µg i.v. or morphine 1–2 mg i.v. or pethidine 15–30 mg i.v. boluses (calculated as equivalent morphine dose to the opioid analgesia consumed). Using opioid:
morphine equivalents of 100 µg i.v. fentanyl to 10 mg i.v. morphine; 75–100 mg i.v. pethidine to 10 mg i.v. morphine.\(^{(22)}\)

Analgesia was decided (according to pain intensity scale of mild, moderate, or severe) if pain described as moderate or severe by the patient. The patients were shifted from PACU if alert and responsive, no or mild pain, absence of PONV, and hemodynamically stable.

In the surgical ward, all patients received paracetamol (Perfalgan)\(^{®}\) 1 g q 6 h, and if the pain was expressed as moderate-to-severe pain by the patients, i.v patient-controlled morphine analgesia was started containing morphine 0.5 mg.ml\(^{-1}\) (device adjusted to deliver 1 mg bolus dose with 12 min lockout time), a maximum dose of 5 mg.h\(^{-1}\) with no basal infusion.

First time to ask for analgesia requirement and total consumption of morphine (mg) were reported in the first 24 h postoperatively. Antiemetic medications include i.v ondansetron 4 mg i.v. or metoclopramide 10 mg i.v if needed.

We assessed pain intensity at 0 (PACU), 2, 4, 6, 12, and 24 h postoperatively by VAS at both rest and movement (patient asked to flex leg against resistance). Outcome data were collected by hospital team members who were blinded to interventional procedures and groups.

**Primary outcome**

The primary outcome was morphine consumption in the 24 h postoperatively.

**Secondary outcome**

Secondary outcome includes the quality of analgesia as determined by comparing VAS at 0 (PACU), 2, 4, 6, 12, and 24 h postoperatively. The intraoperative fentanyl (µg) consumed during surgery, the equivalent morphine dose at PACU, and the first analgesic dose were also recorded. Extubation time and PONV at PACU and 24 h postoperative were recorded. ESP block and OSTAP block complications (including LA systemic toxicity, vascular injury, and intravascular injection of LA) and surgical time (defined as the time between the incision and the completion of the dressing) were also documented.

**Statistical analysis**

Statistical analysis was done using IBM-SPSS 20 software (Statistical Package for the Social Sciences, IBM Inc., Chicago). Twenty-one volunteers were calculated for the sample size per group. The calculation based on conservatively predicting a 30% reduction in opioid use (according to previous studies that revealed a reduction in postoperative opioids by 40%–50% after TAP block)\(^{[7,8,11]}\) to provide 90% power at a significance level of 5% (\(P<0.05\) is considered statistically significant). A drop-out rate of 10% was allowed. Hence, we planned to recruit a total of seventy subjects.

Data are presented as median, range, and interquartile range (IQR) or with mean and standard deviation (SD) as

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**Figure 2:** Technique of erector spinae plane block and oblique subcostal transversus abdominis plane block. (a) Longitudinal parasagittal placement of ultrasound probe. (b) Ultrasound anatomy and needle placement cranio-caudally till it gently hit the transverse process with deposition of local anesthetic. Right location of needle tip is confirmed by fluid spread (local anesthetic) under erector spinae muscle, separating it from the transverse process. Note: Rhomboid major is absent at this level. (c) Oblique subcostal transversus abdominis plane block, local anesthetic spread between transversus abdominis muscle and beneath the rectus abdominis.

**Figure 3:** Twenty-four hour morphine consumption is shown on the left-hand axis. The upper and lower limits of the box show the limits of the interquartile range between 25\(^{th}\) and 75\(^{th}\) percentiles (8–12 mg for control group, 5–7.5 mg for erector spinae plane block group, and 6–9 mg for oblique subcostal transversus abdominis plane block group), and the dark middle horizontal line represents the median value (approximately 10, 6, and 8 mg, respectively). The whiskers, extend to the extreme values of the sample.
appropriate. Normality of distribution was assessed by Shapiro–Wilk test and Q–Q plot. Morphine consumption was not normally distributed, so Kruskal–Wallis test was used to analyze it. Data that follow a normal distribution were analyzed using one-way analysis of variance (ANOVA) and post hoc analysis. Categorical data were analyzed using the Chi-square test.

**RESULTS**

A total of 70 patients were enrolled for appropriateness and 63 subjects completed the study. Three patients refused inclusion in the study, three patients excluded due to protocol violation, and one canceled. After randomization, the participants received US-guided bilateral ESP block, OSTAP block, or trocar-site infiltration with bupivacaine 0.25%. Patient characteristics were similar between groups [Table 1].

**Opioid consumption**

The mean 24-h morphine consumption [Table 2] was statistically significant between groups ($P < 0.001$) utilizing one-way ANOVA. Post hoc analysis revealed insignificance between ESP block and OSTAP block groups ($P = 0.137$). Significance confirmed by Kruskal–Wallis test ($P = 0.004$) due to abnormal distribution of data. Values of 24-h morphine consumption in the IQR between 25th and 75th percentiles and median values are illustrated in Figure 3.

Group I (control) required more intraoperative analgesia with fentanyl as compared to the ESP block group II and OSTAP block group III [Table 2]. Median (range) and IQR of intraoperatively consumed fentanyl were 30 (15−50) 20, 10 (0−25) 6.5, and 10 (0−20) 10 in the control group, ESP block, and OSTAP block groups, respectively ($P < 0.001$). There was insignificance between ESP block group II and OSTAP block group III ($P = 0.95$) by post hoc analysis.

The mean narcotic analgesics (equivalent morphine dose (22)) requirements in PACU [Table 2] were insignificant between groups ($P = 0.264$).

**Table 1: Demographic data (n=21)**

|                         | Group I (control) | Group II (ESP) | Group III (OSTAP) | $P$ |
|-------------------------|-------------------|----------------|-------------------|-----|
| Age (years)             | 38.2±10.19        | 36.7±9.34      | 37.5±7.54         | 0.76|
| Sex (female/male)*      | 14/7              | 15/6           | 14/7              | 0.82|
| ASA I/II*               | 11/10             | 12/9           | 10/11             | 0.93|
| BMI (kg/m²)             | 30.0±4.22         | 29.5±4.04      | 28.9±6.34         | 0.61|
| Duration of surgery (min)| 61.0±6.07        | 63.4±8.64      | 65.3±9.34         | 0.41|

Values are given as mean±SD. *Analysis done by using Chi-square test, $P<0.05$ is significant. SD=Standard deviation, ESP=Erector spinae plane, OSTAP=Oblique subcostal transversus abdominis plane, ASA=American Society of Anesthesiologists, BMI=Body mass index

**Table 2: Comparison of analgesic efficacy of erector spinae plane block to control group (n=21)**

|                         | Group I (control) | Group II (ESP) | Group III (OSTAP) | $P$ |
|-------------------------|-------------------|----------------|-------------------|-----|
| 24-h morphine*          | 9.85±0.49         | 6.23±0.42      | 7.4±0.42          | $<0.001$* |
| Intraoperative rescue fentanyl* (µg) | 30 (15-50) 20, 29.5±2.36 | 10 (0-25) 6.5, 12.6±1.26 | 10 (0-20) 10, 10.2±1.26 | $<0.001$* |
| PACU morphine analgesia (mg)* | 2.1±0.91         | 1.7±0.84       | 1.9±0.76          | 0.264|
| First morphine dose (min)* | 266±31           | 384±55         | 343±51            | 0.001* |

*Analysis between groups done using Kruskal-Wallis test, *Values are given as median, (range) IQR, mean±SD, *Analysis done by one-way ANOVA and post hoc analysis. $P<0.05$ is considered significant. ANOVA=Analysis of variance, SD=Standard deviation, IQR=Interquartile range, ESP=Erector spinae plane, OSTAP=Oblique subcostal transversus abdominis plane, PACU=Postanesthesia recovery unit

![Figure 4](image-url) VAS at rest (a) and VAS at movement (b) change over time. ESP = Erector spinae plane, VAS = Visual analog scale. $P<0.05$ when comparing ESP block group and OSTAP groups with control group at rest. $P<0.05$ when comparing ESP block group and OSTAP groups with control group at movement.
**Pain assessment**

The mean values of VAS at both rest and movement [Figure 4a and b] of the control group were significantly higher than the ESP and OSTAP block groups at 6 and 12 h postoperative.

Extubation time was shorter (but lacks significance) in the ESP block and OSTAP groups when compared with the control group (9.8 ± 3.4, 10.4 ± 2.1, and 12.5 ± 2.4 min, respectively, P = 0.07).

We found nonsignificant differences between the three groups regarding the occurrence of postoperative morphine side effects. Despite higher incidence of postoperative nausea and vomiting (PONV) in the control group (11.2% and 12.5%) than in ESP (10.7% and 8.2%) and OSTAP block groups (9.7% and 9.2%) at PACU and 24 h, respectively. It did not reach a statistical significance (P = 0.23 and 0.15, respectively). Rescue ondansetron antiemetics were nonsignificant between groups (P = 0.43). Mean ± SD ondansetron dose was 4.12 ± 0.4, 3.82 ± 0.12, and 3.91 ± 0.22 in control, ESP block, and OSTAP groups, respectively.

We did not record any signs or symptoms of LA systemic toxicity or complications related to ESP and OSTAP block within the 24 h after the block.

**Discussion**

Pain is considered one of the most important factors, which affects the quality of recovery. Postoperative pain delays postanesthesia care unit and hospital stays, early ambulation, increases resource utilization, and negatively affects patient satisfaction. Postoperative analgesia improves outcome and patient satisfaction and reduces perioperative stress and most importantly opioid consumption with fewer adverse side effects.

In the current trial, we aimed to compare US-guided bilateral ESP block performed at the T8 TP with OSTAP block using bupivacaine 0.25% in patients planned to undergo elective laparoscopic cholecystectomy regarding the improvement of postoperative analgesia as well as the reduction in both intraoperative and postoperative narcotics consumption. We found that the mean 24-h morphine consumption was statistically significant between groups, but insignificance was found between ESP and OSTAP groups. Group I (control) required more intraoperative analgesia with fentanyl as compared to the ESP block Group II and OSTAP block Group III. The mean values of VAS at both rest and movement of the control group were significantly higher than the ESP block and OSTAP block groups at 6 and 12 h postoperative.

In laparoscopic cholecystectomy, pain is either due to visceral pain (caused by the trauma of gallbladder resection) or cutaneous, muscular pain (caused by the skin and muscle incision at trocar sites). The severity of visceral pain dominates over incisional pain (especially periumbilical), which dominates over shoulder pain. Visceral pain originates from (1) irritation of insufflated CO₂ gas that forms carbonic acid, (2) diaphragmatic muscle fiber stretching, and (3) residual pockets of gas in the abdominal cavity.

In a meta-analysis, OSTAP block was proved to be effective in reducing postoperative pain and subsequently postoperative morphine consumption.

ESP block recently described by Forero et al. for thoracic neuropathic pain. Some case series, later on, showed its analgesic efficacy in bariatric surgery, breast cancer surgery, and major abdominal surgery when done at the corresponding thoracic dermatomes.

The LA administered during ESP block is not spreading to the paravertebral space as proved by Ivanusic et al. In contrary to the previously mentioned cadaveric study, Adhikary et al. demonstrated spread of LA to the paravertebral space.

Our results come in agreement with Ivanusic et al. We found nonsignificance between ESP and OSTAP groups regarding 24-h morphine consumption.

Our results showed significant analgesic efficacy evidenced by a decrease in morphine consumption in both ESP and OSTAP blocks in comparison with port-site infiltration. Intraoperative fentanyl and PACU morphine consumption were not significant between groups.

Chin et al. demonstrated in a cadaver model that when 20 ml of fluid was deposited at the T, TP, the fluid spreads up to C₃–T₂ vertebra cranially and down to L₂–₃ vertebra levels caudally. This study proved that the action of ESP block is though spread cranially and caudally blocking the dorsal and ventral rami of the thoracic spinal nerves. This spread of LA, ventrally and caudally to the ES muscle fascial sheath, is similar to the spread of LA in the paravertebral block.

Enhanced recovery after surgery concept in laparoscopic cholecystectomy needs multimodal analgesia with paracetamol, NSAIDs, and dexamethasone together with opioids as rescue medication. Port-site local infiltration has been shown to provide some pain relief, as opposed to intraperitoneal LA.

From the ethical point of view, we implemented multimodal analgesia in the three groups, including paracetamol infusion, NSAIDs infusion, opioids at the induction of anesthesia, and trocar-site infiltration or ESP block or OSTAP block with bupivacaine 0.25%.

The mean values of VAS at both rest and movement [Figure 4a and b] of the control group were significantly higher than the ESP block group at 6 and 12 h postoperative.

These results come in agreement with previous case reports that performed ESP block in abdominal laparoscopic procedures and concluded that the block is a safe and effective analgesic technique in pain management.

Hannig et al. reported the effectiveness of the ESP block for
somato visceral pain management after upper abdominal laparoscopic cholecystectomy in three cases.

Classical lateral and OSTAP blocks have been proved to reduce opioid consumption and pain scores in the first 6–8 h similar to that of local port-site infiltration.[8-12,34] ESP block is assumed to be safe and away from major structures that may be injured (paravertebral space, pleura, or blood vessels).[14,28,55]

This trial presents one of the earliest studies that examine the analgesic efficacy of ESP block in comparison to other analgesics technique (OSTAP block). Although there was superiority of ESP block over OSTAP block regarding narcotics consumption and pain score, it did not approach significant values.

We found nonsignificant differences between the three groups regarding the occurrence of postoperative morphine side effects.

Our weak points are as follows: (1) We performed the block under anesthesia and did not wait to check the effectiveness of block before skin incision. Furthermore, not all opioids related side effects (e.g. respiratory depression, ileus, and pruritus) were monitored and analyzed. (2) Another limitation is that intraoperative fentanyl dose was significant and this in part might affect only equivalent morphine dose at PACU (insignificant). The duration of fentanyl is only about 90 min that is not expected to affect 24-h morphine consumption. (3) Some researchers may consider this study as comparative study, but we assumed the group of LA infiltration as control group from ethical point of view that prevent us from leaving patient to suffer from pain with larger doses of narcotics.

**Conclusion**

Bilateral US-guided ESP block was found to be comparable to OSTAP block. Both techniques decrease intraoperative rescue fentanyl, PACU morphine analgesia, 24-h morphine, and pain assessment score.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

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