Efficacy of ultrasound-guided bilateral erector spinae plane block for pediatric laparoscopic cholecystectomy: Case series

Pediatrik laparoskopik kolesistektomi için kullanılan bilateral erector spina plan bloğun etkinliği: Vaka serileri

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Abstract

Postoperative opioid administration could cause various side effects such as drowsiness and respiratory distress, postoperative nausea and vomiting. Non-opioid medications as part of multimodal analgesia has been increasingly suggested in the management of acute postsurgical pain. Erector spinae plane block (ESPB) which is a regional anesthesia technique blocks both visceral and somatic nerve fibers. We have presented an ESPB case series for laparoscopic cholecystectomy which has little application in case of pediatric surgery. Ultrasound-guided bilateral ESPB was performed to four patient who underwent laparoscopic cholecystectomy. 0.25% bupivacaine was injected into the interfacial area on each side in the pre-incisional period, after anesthesia induction. (total anesthetic: 2.5 mg/kg) Postoperative pain control was planned at 10 mg/kg iv paracetamol every eight hours. NRS (numeric rating scale) pain scores was below three point at post-anesthetic care unit (PACU), 1, 2, 4, 8, 12 and 24. hours. No rescue analgesic (1 mg/kg tramadol) was needed. So, the complication such as drowsiness, nausea and vomiting was not encountered. No block-related complication was recorded. Bilateral ESPB that is a part of multimodal analgesia regimen provides effective analgesia in the first 24 hours postoperatively for pediatric laparoscopic cholecystectomy.

Keywords: Erector spinae block; laparoscopic cholecystectomy; pediatry; postoperative pain; ultrasound.

Introduction

Laparoscopic cholecystectomy is performed mostly in adults and less frequently in pediatric cases. Postoperative pain after laparoscopic cholecystectomy (LC) can be moderate in intensity. The etiology of the pain has been attributed to tissue injury, residual pneumoperitoneum, and stretching of the diaphragm with associated phrenic neuropraxia. Multimodal analgesia in laparoscopic cholecystectomy is usually provided with a combination of paracetamol, nonsteroidal anti-inflammatory drugs, opioids and regional anesthesia methods.

Erector spinae block is a suitable regional anesthesia method which has been observed to have character-
istics of postoperative analgesia in various thoracic and abdominal operations because it blocks both somatic and visceral pain. As a result of local anesthetic injection into the interfascial space between the transverse process of the vertebrae and the erector spinae muscle, erector spinae block is performed with the spreading of local anesthesia into multiple paravertebral spaces.[3]

We wanted to report the erector spinae block in pediatric patients. We performed pre-incisionally in laparoscopic cholecystectomy operations for cholecystitis as a case series study. In all of the cases, both the block to be applied and that the cases might be reported have been told to the legally responsible individuals and written consent was obtained.

**Case Series**

Four patients, ages of 10, 12, 14, 11 years and weights of 25, 30, 45, 25 kg respectively, planned laparoscopic cholecystectomy due to cholecystitis and recurrent attacks of cholecystitis. There were no features in the preoperative evaluations of patients 1, 3 and 4. Only patient 2 had a history of tonsillectomy at the age of 5. The laboratory findings of all the patients were normal. All patients underwent the same preoperative preparation. After electrocardiography, saturation oxygen and non-invasive blood pressure measurements, a 24-gauge peripheral venous line was opened for fluid replacement and drug administration. Ringer’s lactate/glucose (4:1) 5 ml/kg was given intravenously (IV) for fluid replacement. 2–3 mg/kg propofol, 1 µg/kg fentanyl and 0.6 mg/kg rocuronium were used and intubated after anesthesia induction. Afterwards, anesthesia was maintained by ventilation with 0.05 µg/kg remifentanil (IV) and oxygen mixture with 6% desflurane in 50% air. Depending on the hemodynamic parameters, the dose of remifentanil was increased to 1.5 µg/kg. Normocarbic ventilation was aimed. After intubation, patients were turned to prone position. The thoracic vertebrae region including the lower end of the scapula was sterilized with povidone iodine. With the help of the lower end of the scapula, the T7 vertebrae spinous process was determined. After the 5-13 MHz linear ultrasound probe (Fujifilm SonoSite, WA, USA) was coated with a sterile sheath, it was placed over the T7 vertebrae spinous process at the sagittal plane and then was slid by 1.5-2 cm laterally at the midsagittal region. After the trapezius, rhomboid major, erector spinae muscles and the transverse process of vertebrae were visualized, a 22-gauge 10 cm needle (Stimuplex A, B Braun, Melsungen, Germany) was inserted using in-plane cephal-to-caudal approach. The tip of needle was situated into the fascial plane on the anterior (deep) face of erector spinae muscle. The total dose of 0.5% bupivacaine used was designed to be 2.5 mg/kg. The local anesthetic was prepared as 0.25% bupivacaine for each side. Localization of the needle tip: bupivacaine was injected after separation with hydrodissection was confirmed by giving 0.5-1 ml of fluid to the deep fascia of the erector spinae muscle above the bone shadow of the transverse process of the T7 vertebrae. Spread of the local anesthetic was observed (Fig. 1). The same procedure was repeated on the other side. At the end of the operation, the pneumoperitoneum was evacuated. Patients were extubated after the wounds were sutured and closed and they showed adequate muscle strength, and they were transferred to postanesthesia care unit (PACU). The patients were sent to the wards when the Aldrete Score System was at least 9 in PACU. No nebulized local anesthetic was administered intraperitoneally to the wounds. The patients were discharged after 36 hours of follow-up.
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Pain management
The Numeric Rating Scale (NRS), which best reflects the severity of the pain of the patients at the PACU, 1st, 2nd, 4th, 8th, 12th and 24th hours was used to evaluate the postoperative pain. The 11-point numeric scale ranges from '0' respecting no pain to '10' respecting the worst imaginable pain. NRSs during movement and rest were evaluated and recorded. If NRS was ≥3, 1 mg/kg tramadol (IV) was planned to be administered.

Results
Age, sex, weight, height, body mass index and ASA scores, surgical and anesthesia durations was shown in Table 1. ESP block was successfully performed in 4 pediatric patients without any complications such as pneumothorax, bleeding or subcutaneous emphysema.

Looking at the pain assessments at the PACU, 1st, 2nd, 4th, 8th, 12th and 24th hours in the postoperative period, the NRS scores were observed to not be at 3 or above during both rest and movement (coughing/movement). No rescue analgesic was needed. None of the patients had shoulder pain, nausea or vomiting.

Discussion
Our case series have shown that ESP block provide long-term analgesia in pediatric laparoscopic cholecystectomy.

If acute postoperative pain after laparoscopic cholecystectomy is inadequate treatment, side effects and serious problems is encountered, which include: increased incidence of persistent postoperative pain; rehabilitation defect; hospital stay or recurrent hospitalization; intact quality of life; and excessive sedation, nausea, vomiting and itching due to opioid. In such cases, if analgesic treatment is initiated after a painful stimulus, treatment of postoperative pain may be difficult due to the possibility of peripheral hypersensitivity and central nervous system hyperexcitability. Postoperative effective pain control offers benefits such as earlier mobilization, increased patient satisfaction, lower hospital costs and shorter hospital stay.[4]

Although laparoscopic cholecystectomy has advantages over open surgery, acute pain caused by the procedure is common. The peak of pain intensity following laparoscopic cholecystectomy is between the first and eighth hours and usually decreases 2 or 3 days after surgery. Pain is usually seen in the back, shoulder and port incision regions. Sympathetic pain occurs in approximately 30–50% of patients and this can be difficult to cope with. Severe acute postoperative pain that may occur weeks or months after surgery may lead to chronic pain.[4] Therefore, the treatment of acute pain in especially pediatric patients is a very important issue.

Peripheral blocks form a part of the multimodal analgesic regimen. Regional blocks do not only reduce the use of other analgesics such as opioid, but also prevent their side effects. Studies have been conducted on the efficiency of transversus abdominis plane block (TAP) and ultrasound-guided oblique subcostal transversus abdominis plane block (OSTAP) for laparoscopic cholecystectomy;[3] however, both blocks have the ability to affect the cutaneous fibers and are therefore more effective on somatic pain. Ortiz et al. revealed that TAP block had no significant analgesic activity for this purpose.[5] Altiparmak et al. showed that ESP block was more effective on postoperative tramadol consumption and pain scores than OSTAP block in adult patients undergoing laparoscopic cholecystectomy. They also thought that the dermatomal extension of the local anesthetic in the ESP block is greater than the OSTAP block.[6] Because ESP block is targeted to ventral, dorsal ramie and ramie communicators of spinal nerves. On the other hand, OSTAP block affects somatic and parietal components of postoperative pain and has no effect on visceral component.[6, 7]

<table>
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<th>Table 1. Demographic characteristic of patients</th>
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BMI: Body mass index; min: Minute.
Another method is the paravertebral block which is a denser block. Although this block is performed under ultrasound, there are serious complications such as vascular, neuronal and pleural puncture, cardiac depression, epidural or intrathecal dissemination.[18] Visoiu et al. compared bilateral paravertebral block and local anesthesia to the port sites in pediatric LC. They showed that PVB has no significant superiority to local anesthetic infiltration.[9]

While Ueshima and Hiroshi block supported paravertebral extension of local anesthesia for ESP,[10] Forea et al. reported that the spinal nerves spread to both ventral and dorsal rami.[7] In a recent cadaveric study, Ivanusic et al. showed that local anesthesia did not spread to paravertebral space and ventral ramie.[11] On the other hand, in an magnetic resonance imaging and anatomical study have been reported epidural and intercostal spread.[12] In another study, when the ESP block was performed at the lower thoracic level, it was revealed that the local anesthetic extended to the anterior and entered the thoracic paravertebral space. So, it is stated that ramie communicants was also blocked.[13] Because author ESP block applied at lower thoracic and lumbar level, which local anesthesia is allowed to spread to the lumbar plexus.[16] Author did not encounter any complications related to block in any of the cases.

Pneumothorax and motor weakness were two complications reported for ESP block.[14, 15] Since the block is performed under ultrasound, it is difficult to encounter pneumothorax. However, it can occur as a result of carelessness. Motor weakness may occur when the block applied lower thoracic and lumbar level, which local anesthesia is allowed to spread to the lumbar plexus.[16] Author did not encounter any complications related to block in any of the cases.

Local Anesthesia Systemic Toxicity (LAST), which is caused by local anesthesia spreading and high volume application is also mentioned. Aksu and Gurkan applied 0.5 ml/kg 0.25% with a maximum bupivacaine dose of 20 ml/per side in ESP block for pediatric LC ve herhangi bir LSL ile karşılaşılmışlardır.[17] Thomas and Tulgar performed ESP block by applying 15 ml of bilateral, 30 ml of total 0.25% bupivacaine to a 23 kg pediatric patient exposed to laparoscopic cholecystectomy.[18] Although they did not observe LAST, the maximum dose of bupivacaine was seen to be exceeded in this volume. However, the maximum dose for bupivacain is 3 mg/kg.[19] Tulgar et al. applied 2.5 mg/kg for bupivacaine plus 4 mg/kg for lidocaine during ESP block performed and run across LAST related sentral nervous system toxicity such as aphasis/apthia, short-lasting loss of consciousness and tinnitus/vertigo.[16] The author performed a total of 2.5 mg/kg of 0.25% bupivacain to the bilateral ESP block. The complications related to the cardiovascular system such as hypotension, dysrhythmia and cardiac arrest during the peroperative period, and central nervous system complications such as disorientation, tinnitus and seizures during postoperative period were not encountered.

The ESP block can only act in the paraspinal area, but may also block the lateral side of the thoracoabdominal areas and the mid-abdomen. Therefore, block failure/lack of efficiency was defined the first time by Tulgar et al.[16] Author did not evaluate dermatom areas in the postoperative period. However, author indicated that the block was effective, due to the postoperative NRS scores <3 and the absence of any analgesics requirement.

Our cases needed no analgesic in the postoperative period either. Dissimilar to the literature, we found that sufficient analgesia was provided at 24th postoperative hour in pediatric patients exposed to LC as a result of total 2.5 mg/kg bupivacaine bilateral administration. ESP block is a safe and effective regional anesthesia method for multimodal analgesia. The results obtained from our case series will be useful for randomized studies.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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References


