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SURGERY

Application of Erector Spinae Plane Block in a Cognitively Disabled Scoliosis Adolescent Patient: a Case Report

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Abstract

Analgesic requirement for the patients undergoing posterior stabilization and instrumentation surgery is important during preoperative and postoperative periods. Erector spinae plane (ESP) block has come into question in recent years for opioid-free anesthesia and also for postoperative analgesia. In this paper, we present a bilateral bi-level ESP blocks practice for a 15-year-old phenylketonuric and cognitively disabled scoliosis adolescent boy, which is the first study in the open literature to the best of our knowledge. We planned a bilateral bi-level ESP block practice for the adolescent patient scheduled to undergo the posterior instrumentation surgery involving 12 vertebral level (T3-L2). Bilateral single-injection ESP block was performed at two levels (T5 and T7) prior to incision. Intraoperatively, patient received intravenous propofol and remifentanyl infusions which were administered as total intravenous anesthetic (TIVA) agents. FLACC (face, legs, activity, cry, consolability) scale was used to follow analgesic requirement postoperatively. The analgesic need was extremely low during postoperative 24-h follow-up, and a safe postoperative analgesia was provided for the opioid side effect-free patient. Bilateral bi-level ESP block is an easily applicable and a safe technique which could be chosen for cognitively disabled scoliosis adolescent patients as a part of multimodal analgesic regimen to avoid side effects of opioids and other invasive techniques.

Keywords Adolescent scoliosis · Erector spinae plane block · Postoperative pain · Multimodal analgesia · Phenylketonuria

Introduction

Analgesic requirement for the patients undergoing posterior stabilization and instrumentation surgery is important during preoperative and postoperative periods [1, 2]. Spinal catheter, epidural catheter, infiltration analgesia, and epidural patient controlled analgesia (PCA) techniques are often applied common procedures for postoperative analgesia [3, 4]. Because of the encountered side effects (pruritus, dizziness, vomiting, constipation, respiratory depression, etc.) of opioid analgesics, the search for new regional analgesia techniques is continued.

Erector spinae plane (ESP) block has come into question in recent years for opioid-free anesthesia and also for postoperative analgesia. ESP block is a fascial plane block applied between transverse process of the vertebra and erector spinae muscle. ESP block provides somatic and visceral analgesia. It was described in 2016 for neuropathic pain by Forero et al. [5].

To the best of authors' knowledge, the ESP block is not applied in cognitively disabled adolescents for scoliosis surgery. In this study, we target at sharing our experience of this procedure for this group of patients. In this report, we present a bilateral bi-level ESP blocks practice for a 15-year-old phenylketonuric and cognitively disabled scoliosis adolescent boy scheduled for T3-L2 posterior instrumentation surgery.

Written informed consent was obtained from patient's family for inclusion in this report.

Case

A 15-year-old male patient was scheduled for scoliosis correction surgery. He was diagnosed with phenylketonuria disease when he was 3 years old. He was also cognitively disabled and could not speak properly. It was noticed that he was developmentally delayed when his age was considered (height: 150 cm, weight: 33 kg).

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It is planned to make the posterior instrumentation surgery between T3-L2 vertebrae by orthopedic surgeons (please see Fig. 1). Patient was transferred to operating theater and placed 22 gauge intravenous (IV) cannula. After routine monitoring (electrocardiogram, noninvasive blood pressure, SaO2), 2 mg midazolam was administered. General anesthesia was induced by propofol (2 mg kg^{-1}), lidocaine (1 mg kg^{-1}), fentanyl (1 μg kg^{-1}), and rocuronium (0.6 mg kg^{-1}). Following intubation, patient was turned left lateral position to perform the block. ESP was performed with a high-frequency linear probe under ultrasound guidance (Esaote®, mylabseven, the Netherlands). ESP was done at T5 and T7 levels bilaterally. The procedure was applied in T5 and T7 levels due to the application difficulty in low thorocal levels.

After seeing the transverse processes of the vertebrae, block needle (Stimuplex, Braun Ag, Melsungen, Germany) was proceeded from cranial to caudal direction until touching the transverse process.

Out of 8 mL local anesthetic mixture (4 mL 0,5% bupivacaine + 2 mL 2% lidocaine + 2 mL of 0,09% NaCl), only 1 mL was given. Hydrodissection of the interfascial plane between the erector spinae muscle and the transverse process was confirmed by visualizing the local anesthetic spreading in a linear pattern which ensures correct localization.

Then, up to 8 mL was injected. We repeated the same process for each level (Fig. 2).

After these blocks, surgery was started. Propofol 30 μg kg^{-1} min^{-1} and remifentanyl 0,25 μg kg^{-1} min^{-1} infusions were administered as total iv anesthetic (TIVA) agents. Bispectral index (BIS complete 2-channel monitor, Medtronic®, USA), and somatosensory and motor-evoked potential monitorizations were also applied during operation. TIVA infusions were adjusted to keep bispectral index values between 40 and 60. The operation lasted around 5 h, and no complication or any other problem occurred (please see Fig. 3). Three milligram iv morphine was administered before completing the surgery. After extubation, patient was transferred to post-anesthesia care unit (PACU).

In postoperative follow-up, FLACC (face, legs, activity, cry, consolability) scale was used to evaluate pain status of the patient because of cognitively disability and communication problems. During the PACU period, FLACC scale of the patient was 0. After the PACU stay, patient was transferred to intensive care unit (ICU) for 1-day follow-up. Six hundred milligram iv acetaminophen was ordered as a routine analgesic for 12-h period. 1.5 mg of morphine was planned to be administered using IV PCA under doctor control if the FLACC scale is higher than 4. During the 24-h period, morphine was applied only once (at 12th h).

The next day, the patient was transferred to the normal service. Oral acetaminophen was given to the patient during service-stay, and no opioids were required. Patient was discharged to home on postoperative day 5.

Discussion

Scoliosis operations require significant analgesics [2]. Opioid containing IV PCA is used commonly for the patients operated for scoliosis surgery. However, it is still controversial to use

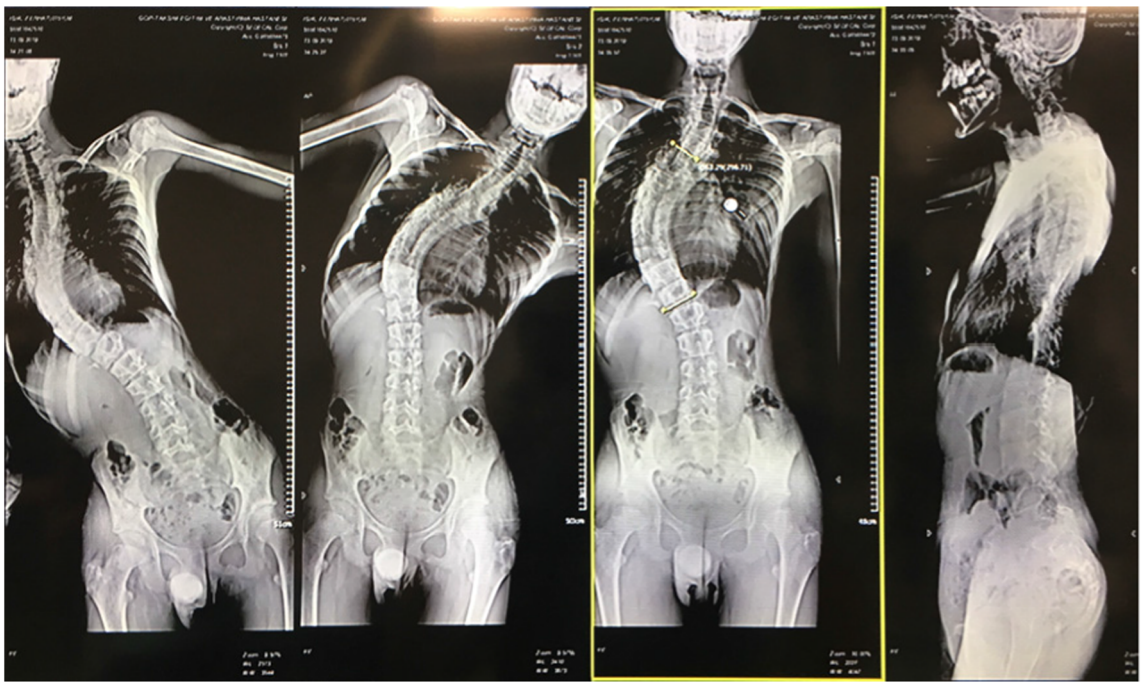

Fig. 1 Preoperative X-ray image

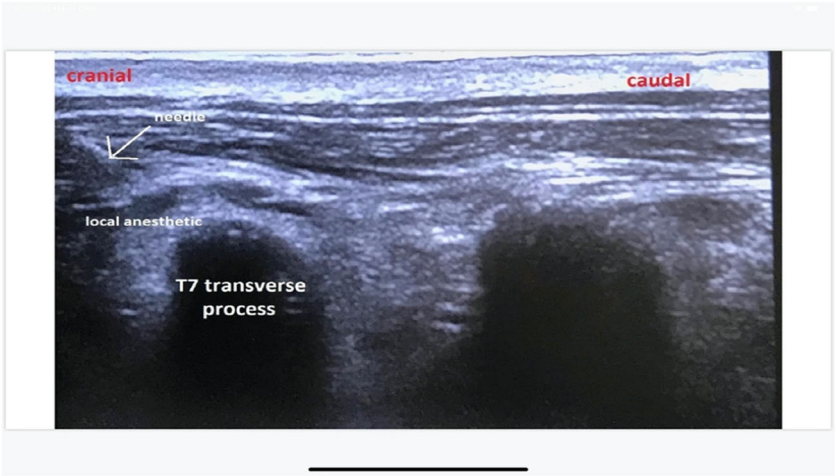

Fig. 2 Ultrasonographic image of the ESP block at T7 vertebra level. Note the elevation of the erector spinae muscle after local anesthetic injection

opioids because of the nausea, vomiting, constipation, and respiratory depression like side effects.

In these operations, thoracic epidural block is the gold standard [6]. This technique can be effective in relieving the pain, but it can cause hemodynamic instability and damage to the spinal nerve and can be difficult to be administered due to anatomical malformation. For our patient who was scheduled to stabilize the T3-L2 level, we did not consider epidural catheter for these reasons.

Paravertebral block was also not preferred due to the fact that there is an invasive intervention close to the pleura and the difficulty of applying in patient with anatomical structural disorders.

We did not choose surgical site local anesthetic infiltration technique because the incision line was too long which would require very high volume local anesthetic, and this technique provides analgesia only a few hours [7]. Our patient was a cognitively disabled child and that was the reason why we preferred to use a regional anesthesia technique which ensures analgesia especially for the thoracic region.

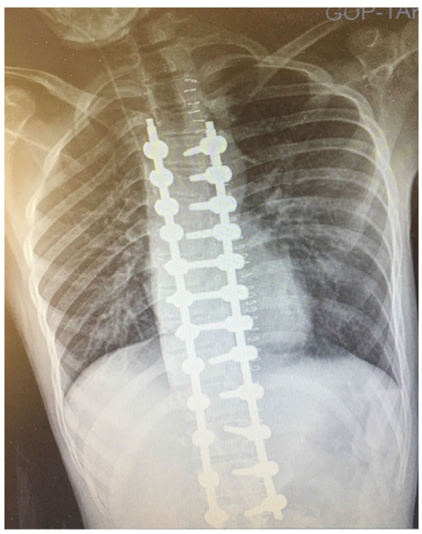

Fig. 3 Postoperative X-ray image

In our clinic for cases where posterior spine fusion surgery at lumbar and lower thoracic levels was required, we had a successful analgesic effect with epidural catheter from upper thoracic levels. In fusion operations at upper thoracic levels and in pediatric patients, we are providing analgesia with intravenous opioid-based PCA. Due to the side effects of opioids, we generally prefer ESP lately.

In adolescence scoliosis patients who are expected to undergo ESP block posterior fusion operation, all movements of the needle accompanied by USG and the distribution of local anesthesia can be clearly visualized because it is far from pleura and major vessels. As a result, the ease of this application and being a safer technique render it as a method which can be used as part of the multimodal analgesic regimen. Since the use of intravenous PCA due to the cognitive disability of our patient is not appropriate, the ESP block can also be considered an advantage.

Although there are no published studies on the safety of the ESP, it is regarded as a safe technique in publications since the risks of vascular and nerve injuries are low, it is far from the pleura, and the entire procedure can be clearly visualized in the USG [8, 9].

We planned a thoracic ESP block as part of multimodal anesthesia and analgesia in our patient with adolescence scoliosis, who underwent posterior stabilization operations from T3-L2 levels and required a significant amount of opioid analgesics in both preoperative and postoperative periods. Other invasive and risky methods such as epidural and paravertebral blocks were not considered both due to the very large incision area and for reasons due to the patient's anatomical disorder. Since our patient was cognitively disabled, he was not eligible for PCA use with postoperative intravenous opioids. We preferred ESP, thanks to its safer and easy-to-apply features which are based on the fact that the area of application is away from major vessels, nerve structures, and pleura. Moreover, USG clearly visualized all movements of the needle and local anesthetic distribution and bone landmarks.

In adolescence scoliosis operations, except the case study of Diwan et al. [10] (5 patients single block, 1 patient catheter application), there were no single-injection publications.

For the ESP we made from the T5-T7, we found that the 12 levels of posterior stabilization at the T3-L2 levels provided enough analgesia for stabilization. We would like to share that ESP provides adequate analgesia in cases with cognitively disabled adolescent scoliosis that is not suitable for intravenous PCA use.

It is shown by magnetic resonance imaging (MRI) and cadaveric studies that ESP block could spread to paravertebral space and intercostal space and affect multiple dermatomes through costotransverse foramen, ventral, and dorsal rami of the thoracic spinal nerve and sympathetic ganglia [11–13].

Ki Jinn Chin et al.[8] performed bilateral bi-level ESP blocks on T4-T10 levels on patients who underwent 12 levels of posterior instrumentation surgery. Due to scoliosis degree in lower throcal levels, we had difficulty in imaging. As a result, we applied the ESP block at T5-T7 levels.

We presumed that the local anesthetic will spread also to the lumbar region. Forero et al.[5] reported that an ESP block performed on T5 level may spread between T1 and T11 levels. T5-T7 bi-level ESP blocks assured good analgesia for postoperative 24-h period on the patient.

We preferred lidocaine (which is less cardiotoxic)-bupivacaine local anesthetic combination. We aimed a fast onset of the block and less opioid requirement preoperatively by using lidocaine [14].

In this study, while calculating the total dose we excluded the 1 mg kg^{-1} lidocaine dose applied to the patient for anesthesia induction from the lidocaine dose applied to the interfascial space. The reasoning behind such as choice was as follows. Considering the short duration of action of intravenous lidocaine used in induction, positioning of the patient by providing airway control until facial block is applied, and the time taken for block preparation, we thought that the effect of iv lidocaine would pass until the effect of local anesthesia applied to the inter-fascial area. We may have kept the dose of local anesthetic for ESP block high. Given that (i) the 12-level posterior fusion operation will require a large incision area and (ii) a significant amount of analgesic both in the intraoperative and postoperative periods will be required, the patient's analgesia was fully performed considering that the patient's intellectual disability in the postoperative period is not suitable for the use of PCA.

In ESP block studies in the literature, there are no studies containing clear data on local anesthetic absorption, but we have used a higher rate based on the facts that (i) the block spreads to a wide facial area, (ii) it is far from vascular structures, and (iii) there are publications on analgesic effects that last up to 12–16 h and sometimes up to 48 h [10]. However, since the absorption mechanism of local anesthetic in ESP block is not known exactly, the dose of local anesthetic could be kept lower. In the current literature, there are no studies on local anesthetic absorption, yet perhaps future studies may conclude that high doses are safe for ESP block. Therefore, we think our experience is important.

In this study, we used remifentanyl to maintain general anesthesia. We do not think that the ESP block alone will be sufficient in patients undergoing 12 levels of fusion operations like this. In the studies in the literature, the ESP is usually planned as part of multimodal analgesia. We also think that the intraoperative analgesic needs of the patient depending on the block we apply also decrease. Normally, the dose of remifentanyl to continue anesthesia is 0.50–20 (μg kg^{-1} min^{-1}) in the literature. Our patient was given very low-dose infusion, such as 0.25 (μg kg^{-1} min^{-1}). We could have tried to close the remifentanyl infusion. Maintaining anesthesia with very low-dose remifentanyl shows us the effectiveness of the ESP block in multimodal analgesia.

Before extubating the patient, we administered 3 mg of morphine iv. We wanted to guarantee analgesia in the first postoperative hours. We planned to follow-up the analgesia need in the following hours with the FLACC scale. The patient did not have pain until the 12th h. 1.5 mg of morphine was administered intravenously to the patient whose FLACC scale was 4. No additional morphine was required until the 24th h.

Motor and somatosensory-evoked potentials were used during surgery. Sensory and motor signal responses were low during surgery, and we attributed this situation to TIVA and phenylketonuria [15]. Melvin JP et al.[9] demonstrated in the case series study including six patients that ESP block does not affect motor and somatosensory evoked potentials.

Conclusion

ESP block is an effective analgesic technique for thoracic and abdominal surgeries. In our opinion the bilateral bi-level ESP blocks for scoliosis surgery is both safe and simple to perform, due to the visibility of bone landmark and the distance from the neuroaxis, pleura, and major vessels or nerves. As it is demonstrated in this study, ESP block could be chosen as a part of multimodal analgesia for cognitively disabled pediatric patients because of safety problems and side effect of opioids in invasive techniques. We achieved effective analgesia in this case, but still prospective randomized clinical studies are needed to understand the effectiveness of the ESP block on scoliosis surgery.

After the application of ESP procedure, for an accurate determination of the distribution of local anesthetic and its evaluation, detailed imaging and cadaver studies are needed.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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