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Analgesic Efficacy of the Erector Spinae Plane (ESP) Block for Pneumothorax Surgery: A Retrospective Study

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Abstract

Background: Poor perioperative pain management during pneumothorax surgery leads to respiratory complications in the post-operative period. The erector spinae plane (ESP) block technique has been shown to be able to block the thoracic spinal nerves. Therefore, the ESP block may provide effective analgesic during thoracic surgery. We have retrospectively investigated the effectiveness of the ESP block for postoperative pain management in pneumothorax surgery. Patients and Methods: Patients who underwent pneumothorax surgery in 2017 were selected for the study. The primary outcome was assessed using the numeric pain rating (NRS) scales until the morning of the second post-operative day. The secondary outcomes were the cumulative amount of additional intravenous fentanyl administration until the morning of the second post-operative day. Results: This retrospective study included 29 patients who underwent pneumothorax surgery. Of these patients, 13 patients received only general anaesthesia (control group), while the other 16 patients received the ESP block in addition to general anaesthesia (study group). Compared to the control group, the study group did not show lower NRS scores at 1, 2, 4, 6, 12, and 24 hours post-surgery (P = 0.09, 0.17, 0.06, 0.36, 0.47, and 0.71). As for the cumulative amount of additional fentanyl, there were also no significant differences between the both groups. Conclusions: The ESP block could not provide effective analgesia for the 24 hours post-surgery period in patients undergoing pneumothorax surgery.

Keywords

Dorsal Rami, Pnumothorax Surgery, Perioperative Pain Management

1. Introduction

Poor perioperative pain management during pneumothorax surgery leads to respiratory complications in the postoperative period. Respiratory complications cause delayed recovery and decreased quality of life. The erector spinae plane (ESP) block, initially published in 2016, has been shown to block the thoracic spinal nerves, and is reported to be an effective analgesic for thoracic surgery [1]. In addition, the ESP block has been reported to be able to provide an effective analgesic for several surgeries recently [2]. However, to our knowledge, no cohort studies or randomized controlled trials have been conducted in 2016 and 2017 [3] [4] [5]. In the present study, we retrospectively investigated the effectiveness of the ESP block for postoperative pain management in pneumothorax surgery.

2. Methods

The university hospital institutional review board approved this retrospective study. In addition, the study was registered at the university hospital medical information network. Patients who underwent pneumothorax surgery in 2017 were included. Cases of secondary surgery and those undergoing regional anaesthesia other than the ESP block were excluded. Patients who could not manage intravenous patient-controlled analgesia (IV-PCA) with fentanyl were also excluded.

Age, height, weight, the american society of anaesthesiologist (ASA) physical status classification, operation time, anaesthesia time and amount of fentanyl and remifentanil administered during the perioperative period in preoperative data were collected. After the surgery, all patients were extubated in the operation room. The patients were then moved to the intensive care unit (ICU), where they stayed until the second postoperative day. Patients were divided into two groups: those who received only general anaesthesia (control group), and those who received an ESP block in addition to general anaesthesia (study group). The primary outcome measure was the numeric pain rating scales (NRS) scores (0 - 10; 0 = no pain and 10 = worst severe pain) until the morning of the second postoperative day. Each patient's pain level was measured by some nurses in the ICU at 1, 2, 4, 6, 12, and 24 hours and on the morning of the second postoperative day. Secondary outcomes measured included the cumulative amount of additional intravenous fentanyl administration required for analgesia and the number of patients complaining of postoperative nausea and vomiting until the morning of the second postoperative day. If some patients in either group were unable to control their severe pain, an attending anaesthesiologist was consulted in all days. After consultation, the patient was changed to continuous intravenous administration of fentanyl as necessary and withdrawn from this study. Metoclopramide 10 mg was administered intravenously in cases of nausea or vomiting. All patients were administered celecoxib 200 g orally twice a day for two days.

2.1. ESP Block Technique

Twenty ml of 0.375% levobupivacaine was injected into the interfascial plane between the erector spinae and the underlying transverse process at the level of the fifth or sixth thoracic vertebra by using a high-frequency linear probe.

2.2. Statistical Analysis

Statistical analysis in this study was performed utilizing JMP® 12 (SAS Institute Inc., Cary, NC, USA). The pain score and the amount of additional fentanyl were analyzed by using the mann-whitney's u-test. The number of patients complaining of complications was analyzed by Fisher's exact test. Data was expressed as a median (interquartile range). The level of significance for both tests was set at $P < 0.05$. Sample size was not calculated because of a retrospective study.

3. Results

During the study period, 46 patients underwent pneumothorax surgery. Of these patients, 13 patients received only general anaesthesia (control group), while the other 16 patients received an ESP block in addition to general anaesthesia (study group). A total of 17 patients were excluded from this study due to secondary surgery or performance of regional anaesthesia other than the ESP block. There were no patients who were unable to perform IV-PCA (Figure 1). Table 1 shows the comparison of patient's demographics data. There are no significance between the control group and the study group. Compared to the control group, the study group did not show lower NRS scores at 1, 2, 4, 6, 12,

Table 1. Patients' demographics data; Age, Height, Weight, ASA classification, surgery time, anaesthesia time and amount of fentanyl and remifetanil in perioperative period. Data were expressed as a median (interquartile range).

	Control group (n = 13)	Study group (n = 16)
Age (years)	31 (20 - 58)	22.5 (18 - 77)
BMI (kg/m^2)	19.0 (14.2 - 23.3)	18.45 (16.4 - 58)
ASA classification (1/2/3)	6/6/1	11/5/0
Anesthesia time (min)	165 (110 - 310)	172.5 (130 - 235)
Operation time (min)	95 (45 - 200)	100 (75 - 155)
An amount of fentanyl in perioperative period (μg)	200 (100 - 400)	200 (100 - 400)
An amount of remifentanil in perioperative period (mg)	1.0 (0.3 - 1.6)	0.95 (0.5 - 2.5)

Table 2. Postoperative pain scores at 1, 2, 4, 6, 12 and 24 postoperative hours during the rest: Data were expressed as a median (interquartile range).

NRS	Control group (n = 13)	Study group (n = 16)	P
1	3 (2 - 4)	2 (1 - 3.25)	0.09
2	3 (2 - 4)	2.5 (1 - 4)	0.17
4	4 (3 - 4)	2.5 (2 - 3.25)	0.06
6	3 (3 - 4)	3 (2 - 4)	0.36
12	3 (3 - 4)	3 (2 - 3.25)	0.47
24	3 (3 - 4)	3 (2 - 4)	0.71

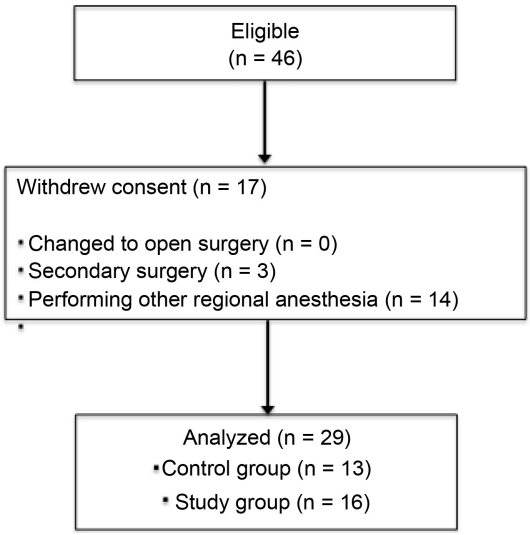

Figure 1. Flow chart of this study.

and 24 hours post-surgery (P = 0.09, 0.17, 0.06, 0.36, 0.47, and 0.71) (**Table 2**). With respect to the amount of fentanyl administered, there were no significant differences between the control group (80 [60 - 100]) and the study group (60 [40 - 60]) (mean [interquartile ranges]) (μg) (P = 0.12) (**Figure 2**). The two groups showed no significant difference in the number (control group: 6 patients, study group: 5 patients; P = 0.53) of complications, such as postoperative nausea and vomiting until the morning of the second postoperative day.

4. Discussion

The ESP block has been shown to be able to block the thoracic spinal nerves from Magnetic Resonance Imaging [6]. Nevertheless, this study showed that the ESP block could not provide effective analgesia for 24 hours post-surgery in patients undergoing pneumothorax surgery. Ivanusic *et al.* reported that a cadaveric study investigating the spread of local anaesthetic in ESP block showed not to spread to the paravertebral space, and the only dorsal ramus involvement was posterior to the costotransverse foramen [7]. It would seem that 20 mL of local anaesthetic for ESP block couldn't advance to the paravertebral space. If volumes

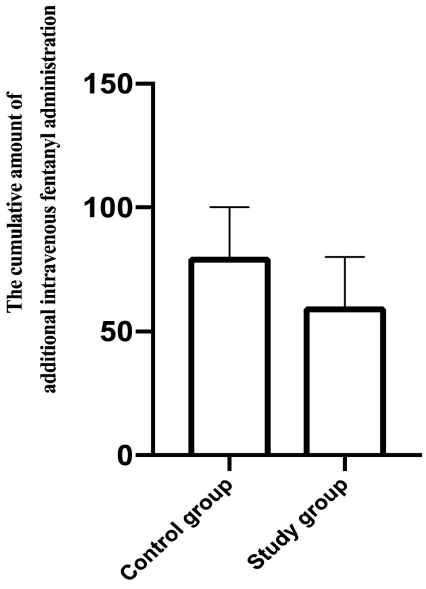

Figure 2. The cumulative amount of additional intravenous fentanyl administration analgesic drugs until the morning of the second post-operative day: Data were expressed as a median (interquartile range).

greater than 20 mL can be provided for ESP block, the local anaesthetic can spread to the paravertebral space to involve the origins of the ventral and dorsal branches of the spinal nerves [8] [9] [10].

There were some limitations to the present retrospective study. This study was not as reliable as a randomized and prospective study because of its retrospective study. In addition, sample sizes were small. Also, for all patients in the study group, the same volume and concentration of local anaesthetic was used (20 ml of 0.375% levobupivacaine) despite the differences in patient characteristics. This study also focused on only the first 24 h after surgery. However, we do not know about the efficacy of the ESP block for pain more than 24 h after surgery. A prospective study should be considered in the near future to address some of these limitations.

5. Conclusion

The ESP block could not provide effective analgesia for the first 24 hours post-surgery period in patients undergoing pneumothorax surgery.

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Availability of Data and Materials

The data availability statements used to support the findings of this study are included within the article.

Author's Contributions

Study design/planning: H.U., H.O.
Study conduct: all authors.
Data analysis: H.U., H.O.
Writing paper: H.U.
Revising paper: all authors.

Consent for Publication

Not applicable.

Ethics Approval and Consent to Participate

This retrospective study was approved by the university hospital institutional review board (approval number 2523).

Conflicts of Interest

The authors have no financial relationships to this study.

References

[1] Forero, M., Adhikary, S.D., Lopez, H., Tsui, C. and Chin, L.J. (2016) The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. *Regional Anesthesia & Pain Medicine*, **41**, 621-627. https://doi.org/10.1097/AAP.0000000000000451

[2] Chin, K.J., Malhas, L. and Perlas, A. (2017) The Erector Spinae Plane Block Provides Visceral Abdominal Analgesia in Bariatric Surgery: A Report of 3 Cases. *Regional Anesthesia & Pain Medicine*, **8**, 10. https://doi.org/10.1097/AAP.0000000000000581

[3] De la Cuadra-Fontaine, J.C., Concha, M., Vuletin, F. and Arancibia, H. (2018) Continuous Erector Spinae Plane Block for Thoracic Surgery in a Pediatric Patient. *Pediatric Anesthesia*, **28**, 74-75. https://doi.org/10.1111/pan.13277

[4] Hernandez, M.A., Palazzi, L., Lapalma, J., Forero, M. and Chin, K.J. (2018) Erector Spinae Plane Block for Surgery of the Posterior Thoracic Wall in a Pediatric Patient. *Regional Anesthesia Pain and Medicine*, **43**, 217-219.

[5] Munoz, F., Cubillos, J., Bonilla, A.J. and Chin, K.J. (2017) Erector Spinae Plane Block for Postoperative Analgesia in Pediatric Oncological Thoracic Surgery. *Download PDF Canadian Journal of Anesthesia/Journal Canadien D'anesthésie*, **64**, 880-882. https://doi.org/10.1007/s12630-017-0894-0

[6] Adhikary, S.D., Bernard, S., Lopez, H. and Chin, K.J. (2018) Erector Spinae Plane Block Versus Retrolaminar Block: A Magnetic Resonance Imaging and Anatomical Study. *Regional Anesthesia & Pain Medicine*, **43**. https://doi.org/10.1097/AAP.0000000000000798

[7] Ivanusic, J., Konishi, Y. and Barrington, M.J. (2018) A Cadaveric Study Investigating the Mechanism of Action of Erector Spinae Blockade. *Regional Anesthesia & Pain Medicine*, **43**. https://doi.org/10.1097/AAP.0000000000000789

[8] Gürkan, Y., Aksu, C., Kuş, A., Yörükoğlu, U.H. and Kılıç, C.T. (2018) Ultrasound Guided Erector Spinae Plane Block Reduces Postoperative Opioid Consumption Following Breast Surgery: A Randomized Controlled Study. *Journal of Clinical Anesthesia*, **50**, 65-68. https://doi.org/10.1016/j.jclinane.2018.06.033

[9] Forero, M., Rajarathinam, M., Adhikary, S. and Chin, K.J. (2017) Erector Spinae Plane (ESP) Block in the Management of Post Thoracotomy Pain Syndrome: A Case Series. *Scandinavian Journal of Pain*, **17**, 325-329. https://doi.org/10.1016/j.sjpain.2017.08.013

[10] Chin, K.J., Adhikary, S., Sarwani, N. and Forero, M. (2017) The Analgesic Efficacy of Pre-Operative Bilateral Erector Spinae Plane (ESP) Blocks in Patients Having Ventral Hernia Repair. *Anaesthesia*, **72**, 452-460. https://doi.org/10.1111/anae.13814