

CASE REPORT

Open Access



# Effective erector spinae plane block for postoperative analgesia in a pyothorax patient who underwent emergency re-open thoracotomy—a case report

Izumi Kawagoe<sup>1\*</sup> , Daizoh Satoh<sup>1</sup>, Mariko Fukui<sup>2</sup>, Kenji Suzuki<sup>2</sup> and Eiichi Inada<sup>1</sup>

## Abstract

**Background:** The appropriate choice of postoperative analgesia for pyothorax surgery is unclear since local infection could contaminate the catheter used for regional blocks and bacteremia can lead to disordered coagulation. We performed erector spinae plane block (ESPB) in a pyothorax patient undergoing emergency re-open thoracotomy.

**Case presentation:** An 81-year-old male with internal jugular vein stenosis on aspirin therapy was scheduled for pyothorax drainage and residual middle lobectomy 14 days after he underwent open right lower lung lobectomy for lung cancer.

ESPB was performed with injection of 20 ml of 0.375% levobupivacaine at the Th5 transverse process of the right side under ultrasound guidance.

Although he needed intravenous pentazocine for pain on postoperative day 0, no more analgesics were required postoperatively. NRS score ranged from 0 to 1 thereafter.

**Conclusions:** ESPB provided effective postoperative analgesia following emergency re-open thoracotomy for our pyothorax patient. ESPB might be the appropriate choice for postoperative analgesia following pyothorax surgery.

**Keywords:** ESPB, Pyothorax, Postoperative analgesia

## Background

Thoracic epidural analgesia (TEA) is the gold standard of regional anesthesia for thoracic surgery (Joshi et al. 2008), since it reduces sympathetic tone and postoperative pulmonary complications (Bauer et al. 2007). In the last decade, thoracic paravertebral block (TPVB) under ultrasound guidance was introduced as a safe and easy alternative to TEA. The efficacy and major complications of TPVB are similar to TEA, although the incidence of perioperative hypotension is lower with TPVB (Yeung et al. 2016).

Both TEA and TPVB by catheter insertion are performed for postoperative analgesia following common thoracic procedures (Davies et al. 2006), reducing hospital

stay and the incidence of chronic pain. However, both techniques can cause complications, such as pneumothorax, hematoma, and infections. Several alternatives, more superficial and safer blocks of the thoracic trunk are available for thoracic and breast surgery, including pectoral (Pecs) nerve block and serratus plane block (SPB) (Kamiya et al. 2018).

Pyothorax is a serious postoperative complication of thoracic surgery. It can occur secondary to pneumonia, retrograde infection, or prolonged air leakage from a bronchopulmonary fistula. Pyothorax, which sometimes requires surgical treatment by open-window surgery, often causes slight coagulation abnormalities due to the infection. Hence, pyothorax is a contraindication for TEA or TPVB catheter insertion due to the infection and coagulation issues. The potential risk of epidural abscess (Hung et al. 2011) and epidural hematoma (Gulur et al. 2015) formation following TEA catheter insertion

\* Correspondence: [ikawago@juntendo.ac.jp](mailto:ikawago@juntendo.ac.jp)

<sup>1</sup>Department of Anesthesiology and Pain Medicine, Juntendo University School of Medicine, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan  
Full list of author information is available at the end of the article

makes TEA contraindicated in pyothorax patients. Epidural abscess after epidural catheter is a rare but serious complication. As patients with empyema s have a high probability of systemic sepsis, risk-benefit analysis must be given due consideration for each individual patient before insertion of thoracic epidural catheter. And Intercostal nerve block and a paravertebral catheter might be alternatives (Walters et al. 2011).

Erector spinae plane block (ESPB) is a relatively new technique (Forero et al. 2016) of thoracic trunk blockade, providing analgesia for thoracic or chest wall surgery, such as lung, mediastinal, or breast surgery. It is a more superficial procedure than even classical intercostal block.

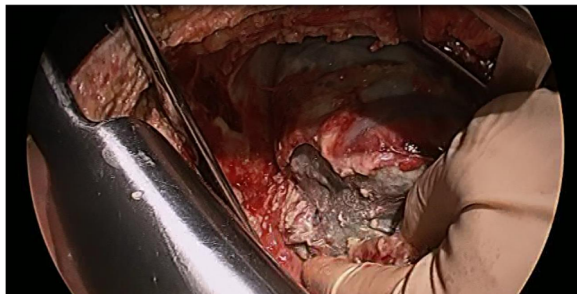
Here, we report our experience with ESPB for a pyothorax patient undergoing emergency re-open thoracotomy.

We obtained our institutional ethics committee approval for this work (approval number JHS 18-026) and the patient's written informed consent for publishing this report.

### Case presentation

An 81-year-old male, 165 cm tall, weighing 66 kg, suffered from diabetes mellitus (HBA1c, 8.0%) and had a history of internal jugular vein stenosis on treatment with aspirin since 10 years. He had undergone right lower lobectomy for lung cancer via open thoracotomy 14 days earlier. The epidural catheter inserted via the Th6-7 intervertebral space at the initial surgery had already been removed on the second postoperative day (POD), before his discharge on POD 6.

On POD 12, he visited the hospital complaining of fever and severe cough. Chest X-ray revealed pyothorax with effusion, and CT revealed a postoperative bronchopulmonary fistula (BPF) in the surgical stump. He was readmitted for chest drainage and the remaining middle lobectomy to control empyema based on BPF (Fig. 1).



**Fig. 1** Re-operation for postoperative empyema due to bronchopulmonary fistula (BPF) after right lower lobectomy for lung cancer. Residual right middle lobectomy was done 2 weeks after the initial surgery to control the postoperative empyema based on the BPF

Preoperative biochemical parameters indicated acute inflammation with well intact coagulation status.

Standard monitoring, including noninvasive blood pressure, electrocardiogram, and pulse oximetry, were applied and right-sided ESPB was performed approximately 20 min before induction of general anesthesia with the patient in the prone position. He was administered 3 l/min oxygen with nasal cannula from his ward. No additional administration of oxygen was performed during block procedure. After skin preparation with 0.5% chlorhexidine alcohol solution, the ultrasound probe, covered with a sterile cover, of a high frequency 6–15-MHz linear array transducer (S-Nerve, Sonosite Inc., WA) was placed in a longitudinal orientation 2.5 cm lateral to the T5 spinous process. A 22-G, 50-mm, insulated needle (B. Braun Sonoplex, Melsungen, Germany) was inserted 2 cm from the short edge of the transducer, in-plane with the ultrasound beam, at a less than 30° angle to the skin in a cranial to caudal direction. When the tip of the needle was positioned over the tip of the Th5 transverse process below the erector spinae muscle, 1 ml of normal saline was injected to confirm lifting of the erector spinae muscle resulting from linear spread of the liquid. After an aspiration test to prevent inadvertent intravascular injection, 20 ml of 0.375% levobupivacaine was injected. About 15 min later, loss of cold sensation around the T5 vertebral level was achieved without any hemodynamic changes. The vital signs of pre- and post-block procedure were 150/90 and 140/ 86 in blood pressure, 100 and 100 in heart rate, and 94% and 95% in SpO<sub>2</sub>, respectively.

Next, general anesthesia was induced and maintained with propofol (target controlled infusion of 1.5–2.7 µg/dl) and remifentanyl (0.1–2 mg/kg/min), targeting a bispectral index (BIS) of 40 to 60, assessed using a BIS™ monitor (Quatro sensor and Brain monitor QEM solutions, Medtronic, MA, USA). At induction, 40 mg rocuronium was given for muscle relaxation, with additional 10 mg doses given as needed during surgery. One hundred micrograms fentanyl and 1000 mg acetaminophen were administered at induction of anesthesia and at the end of surgery, respectively. The intraoperative period was uneventful, with no remarkable hypotension or any other complications. Systolic blood pressure remained stable between 90 and 150 mmHg, and HR between 90 and 120 beats/min during the anesthesia period of 239 min. The incision for the second surgery was located at Th5 and was made by extending the original incision posterolaterally by 20 cm. A chest drainage tube was inserted in the 7th intercostal space at the end of the procedure. Although the patient had no pain or discomfort in the recovery room, he needed 15 mg of pentazocine intravenously 6 h postoperatively, with no more supplemental analgesics for 24 h postoperatively. He

could change his position and cough freely after pentazocine. His pain score ranged between 0 and 1 on a numerical rating scale of 0 to 10 until discharge. His CRP, WBC, and PT-INR levels had decreased from 19.7 to 10.24 mg/dl, 16.0 to  $12.5 \times 10^3 / \mu\text{g}$ , and 1.21 to 1.2, respectively, at his discharge on POD 14.

## Discussion

TEA and TPVB are common analgesic techniques for post-thoracotomy patients, which are equal in terms of the incidence of major complications, such as pneumothorax (Bauer et al. 2007; Yeung et al. 2016), although TEA has a higher failure rate than TPVB (Scarci et al. 2010; Kosiński et al. 2016).

ESPB is a more superficial thoracic block compared to both TEA and TPVB, and its technique is simpler and safer, especially under ultrasound guidance. It can also be used in patients on anticoagulant therapy. According to the guideline for interventional Spine and Pain procedure for anticoagulant patients provided by ASRA (Narouze et al. 2018), ESPB may be classified as a low-risk procedure. Almost all anticoagulant patients can undergo ESPB if clinically needed, though several hours resting of drug is defined.

David Rosenblum, MD performed bilateral ESPB at the beginning of cardiac surgery and reportedly resulted in excellent postoperative analgesia, along with shortening of the duration to postoperative extubation compared to IV paracetamol and tramadol administration (Krishna et al. 2019). Reportedly, ESPB also remarkably decreases morphine consumption within 24 h after breast cancer surgery (Gürkan et al. 2018).

The choice of postoperative analgesia for patients undergoing pyothorax surgery is controversial. Anesthesiologists and surgeons usually perform local anesthetic infiltration around the incision site in clinical practice, since bacterial infection in the thoracic cavity is a relative contraindication to catheter insertion for TEA or TPVB, although the efficacy of the local anesthetic could be reduced by the acidic local environment secondary to infection. In particular, in open-window surgery for pyothorax, the frequent washing required increases the risk of contamination of the catheter by the liquid used for washing. Typically, postoperative pain following a second surgery is different from that of the first incision even if the incision is the same as the initial operation, since the additional incision might cause further tissue damage and severe neuropathic pain. Excessive use of opioids in pyothorax patients can be relatively contraindicated (Zhang et al. 2018) because of their poor respiratory function and potential for disordered consciousness. Hence, the choices for postoperative analgesia in pyothorax patients are limited (Hung 2011).

Shimizu et al. (2018) presented the anesthetic management of pyothorax surgery in patients with interstitial pneumonia under only epidural anesthesia. They recommended epidural anesthesia rather than general anesthesia for patients with severe respiratory dysfunction.

Other reports (Hung et al. 2014; Pompea et al. 2018) state that intercostal nerve block (ICB) is convenient and safe for non-intubated video-assisted thoracic surgery (VATS), especially in patients with poor respiratory function.

ESPB blocks the intercostal nerve (ICN) more proximally than does ICB. Although ESPB is similar to ICB as to act to intercostal nerves, it is different in terms of the point of infiltration into the paravertebral space, the effect site of ESPB is more widespread and deeper than ICB, probably because it affects not only the ICN, but also the paravertebral space, and spreads not only to the chest wall, but also to the intrathoracic cavity (Vidal et al. 2018).

Moreover, the tissue environment in the thoracic cavity in pyothorax tends to be acidic, reducing the efficacy of local anesthetics. Since the puncture site for ESPB is closer to the transverse process rather than the infection site, it is unlikely to be affected by acidosis and infection. Hence, ESPB may be possible to be more effective and suitable than ICB in pyothorax patients (Ueno et al. 2008).

ESPB for postoperative analgesia in our pyothorax patient provided adequate analgesia through the postoperative period. The fact that his second incision was an extension of the previous incision and hence, would be less painful, could also have contributed to this. However, ESPB would not have been effective for an incision on the anterior chest wall, since its effect does not provide sufficient spread anteriorly (Taketa et al. 2018).

Our experience suggests that while ESPB might be the first choice for postoperative analgesia in high-risk patients such as ours, the risk of contamination and the additional risks in patients on anticoagulant therapy should be carefully considered.

Further, the types of thoracic surgical incisions for which ESPB would be effective have not yet been clarified. In the future, the indications and limitations of ESPB for specific thoracic procedures should be assessed in consideration of their invasiveness.

## Conclusions

ESPB provided effective postoperative analgesia for re-open thoracotomy for pyothorax and might become the appropriate choice of analgesia for such surgeries.

## Abbreviations

BPF: Bronchopulmonary fistula; ESPB: Erector spinae plane block; ICB: Intercostal nerve block; ICN: Intercostal nerve; TEA: Thoracic epidural analgesia; TPVB: Thoracic paravertebral block

**Acknowledgements**

We thank all the staff associated with thoracic surgery for their assistance in presenting this case report.

**Authors' contributions**

IK contributed to anesthesia management of the present case, conceptualization of the case report, and writing of the original draft; DS contributed to anesthesia management; KS and MF contributed to conduct of the present surgery and review of the surgical terms; and EI was the overall supervisor. All authors read and approved the final manuscript.

**Authors' information**

Izumi Kawagoe is an Associate Professor at the Division of General Thoracic Anesthesia, Department of Anesthesiology and Pain Medicine. Daizoh Satoh is a Professor at the Division of Intensive Care Medicine, Department of Anesthesiology and Pain Medicine. Mariko Fukui is an Assistant at the Department of General Thoracic Surgery. Kenji Suzuki is a Professor and Chairman at the Department of General Thoracic Surgery. Eiichi Inada is a Professor and Chairman at the Department of Anesthesiology and Pain Medicine.

**Funding**

This report received no specific grants from any funding agency in the public, commercial, or not-for-profit sectors.

**Availability of data and materials**

Not applicable

**Ethics approval and consent to participate**

Juntendo University Hospital Institutional Review Board (IRB) approved the publication of the present case report (approval number JHS18-026).

**Consent for publication**

The patient provided written informed consent for the publication of his case history.

**Competing interests**

The authors declare that they have no competing interests.

**Author details**

<sup>1</sup>Department of Anesthesiology and Pain Medicine, Juntendo University School of Medicine, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan.

<sup>2</sup>Department of General Thoracic Surgery, Juntendo University School of Medicine, Tokyo, Japan.

Received: 28 March 2019 Accepted: 21 October 2019

Published online: 15 November 2019

**References**

- Bauer C, Hentz JG, Ducrocq X, Meyer N, Oswald-Mammosser M, Steib A et al (2007) Lung function after lobectomy: a randomized, double-blinded trial comparing thoracic epidural ropivacaine/sufentanil and intravenous morphine for patient-controlled analgesia. *Anesth Analg* 105:238–244
- Davies RG, Myles PS, Graham JM (2006) A comparison of the analgesic efficacy and side-effects of paravertebral vs epidural blockade for thoracotomy—a systematic review and meta-analysis of randomized trials. *Br J Anaesth* 96: 418–426
- Forero M, Adhikary A, Lopez H (2016) The erector spinae plane block; a novel analgesic technique in thoracic neuropathic pain. *Reg Anesth Pain Med* 41: 621–627
- Gulur P, Tsui B, Pathak R, Koury KM, Lee H (2015) Retrospective analysis of the incidence of epidural haematoma in patients with epidural catheters and abnormal coagulation parameters. *Br J Anaesth* 114:808–811
- Gürkan Y, Aksu C, Kuş A, Yörükoğlu U, Kılıç C (2018) Ultrasound guided erector spinae plane block reduces postoperative opioid consumption following breast surgery: a randomized controlled study. *J Clin Anesth* 50:65–68
- Hung MH, Chen JS, Cheng YJ (2011) Epidural catheterisation for empyema thoracis: risk of epidural abscess. *Eur J Cardiothorac Surg* 39:145
- Hung MH, Hsu HH, Chan KC, Chen KC, Yie JC, Cheng YJ et al (2014) Non-intubated thoracoscopic surgery using internal intercostal nerve block, vagal block and targeted sedation. *Eur J Cardiothorac Surg* 46:620–625

- Joshi GP, Bonnet F, Shah R, Wilkinson RC, Camu F, Fischer B et al (2008) A systematic review of randomized trials evaluating regional techniques for post thoracotomy analgesia. *Anesth Analg* 107:1026–1040
- Kamiya Y, Hasegawa M, Yoshida T, Takamatsu M, Koyama Y (2018) Impact of pectoral nerve block on postoperative pain and quality of recovery in patients undergoing breast cancer surgery: a randomised controlled trial. *Eur J Anaesthesiol* 35:215–223
- Kosiński S, Fryźlewicz E, Wilkojć M, Ćmiel A, Zieliński M (2016) Comparison of continuous epidural block and continuous paravertebral block in postoperative analgesia after video-assisted thoracoscopic surgery lobectomy: a randomised, non-inferiority trial. *Anaesthesiol Intensive Ther* 48: 280–287
- Krishna S, Chauhan S, Bhoi D, Kaushal B, Hasija S, Sandgud T et al (2019) Bilateral erector spinae plane block for acute post-surgical pain in adult cardiac surgical patients: a randomized controlled trial. *J Cardiothorac Vasc Anesth* 33:368–375
- Narouze S, Chauhan HT, Provenzano D, Buvanendran A, De Andres J, Deer T, Rauck R, Huntoon MA (2018) Interventional spine and pain procedures in patients on antiplatelet and anticoagulant medications (second edition): guidelines from the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anaesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neuromodulation Society, and the World Institute of Pain. *Reg Anesth Pain Med* 43:225–262
- Pompeoa E, Rogliani P, Atinkayac C, Guerrerad F, Ruffinid E, Garciae M et al (2018) Nonintubated surgical biopsy of undetermined interstitial lung disease: a multicentre outcome analysis. *Interact Cardiovasc Thorac Surg* 28: 744–750
- Scarci M, Joshi A, Attia R (2010) In patients undergoing thoracic surgery is paravertebral block as effective as epidural analgesia for pain management? *Interact Cardiovasc Thorac Surg* 10:92–96
- Shimizu K, Ohtaki Y, Nakazawa S, Obayashi K, Nagashima T, Yajima T et al (2018) Minimally invasive open-window thoracostomy using wound edge protectors. *Ann Thorac Surg* 107:e371–e373
- Taketa Y, Irisawa Y, Fujitani T (2018) Ultrasound-guided erector spinae plane block elicits sensory loss around the lateral, but not the parasternal, portion of the thorax. *J Clin Anesth* 47:84–85
- Ueno T, Tsuchiya H, Mizogami M, Takakura K (2008) Local anesthetic failure associated with inflammation: verification of the acidosis mechanism and the hypothetical participation of inflammatory peroxynitrite. *J Inflamm Res* 1:41–48
- Vidal E, Giménez H, Forero M, Fajardo M (2018) Erector spinae plane block: a cadaver study to determine its mechanism of action. *Rev Esp Anestesiol Reanim* 65:514–519
- Walters J, Foley N, Molyneux M (2011) Empyema pus in the thorax: management of empyema and lung abscess. *Contin Educ Anaesth Crit Care Pain* 11:229–233
- Yeung JH, Gates S, Naidu BV, Wilson MJ, Gao Smith F (2016) Paravertebral block versus thoracic epidural for patients undergoing thoracotomy. *Cochrane Database Syst Rev* 21(2):CD009121. <https://doi.org/10.1002/14651858.CD009121.pub2>
- Zhang R, Meng J, Lian Q et al (2018) Prescription opioids are associated with higher mortality in patients diagnosed with sepsis: a retrospective cohort study using electronic health records. *PLoS One* 13(1):e0190362

**Publisher's Note**

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.