Multiple-level retrolaminar block can provide effective analgesia in nipple-sparing mastectomy with latissimus dorsi flap reconstruction: a report of two cases

ABSTRACT

Aims: Nipple-sparing mastectomy with latissimus dorsi flap reconstruction (NMLR) may cause moderate to severe postoperative pain. Herein, two cases in which multiple-level RLB injections provided good analgesia for two patients who underwent NMLR are reported. Thoracic paravertebral block (TPVB) is recommended as the first-line regional analgesic technique for breast cancer surgery. Multiple-level TPVBs may provide effective analgesia for NMLR but may increase the risk of complications. A retrolaminar block (RLB), a known alternative to a TPVB, has a lower risk of complications and multiple-level RLB injections may be safely performed.

Presentation of cases: NMLR was planned for two patients with breast cancer. Multiple-level RLB injections were administered for postoperative pain management. In both cases, the numerical rating scale scores measured at rest were low postoperatively, suggesting that multiple-level RLB injections effectively managed postoperative pain. Adequate analgesia was achieved using multiple-level RLB injections without additional drug administration in both patients.

Discussion and conclusion: Multiple-level RLB injections may be widely used as appropriate dosages of local anesthetics are considered.

Keywords: retrolaminar block, postoperative pain, latissimus flap breast reconstruction, multiple-level injections

1. INTRODUCTION

Nipple-sparing mastectomy with latissimus dorsi flap reconstruction (NMLR) may result in moderate to severe postoperative pain [1]. Although opioids are often used for postoperative analgesia, they have many adverse effects, such as nausea, vomiting, and respiratory depression [2, 3]. Decreasing the use of opioids during the perioperative period may significantly contribute to reducing these side effects. Regional anesthesia techniques are the most crucial in opioid-sparing analgesia management [4, 5]. According to the guidelines for oncological breast surgery [6], a thoracic paravertebral block (TPVB) is recommended as the first-line regional analgesic technique in breast cancer surgery; however, the risk of pneumothorax remains [7]. A retrolaminar block (RLB), which has a lower risk of pneumothorax, is an alternative to TPVB [8]. We hypothesize that multilevel RLB may be an option for postoperative analgesia in NMLR and report two cases in which multiple-level RLB injections provided good analgesia for two patients who underwent NMLR.

2. PRESENTATION OF CASES

Written informed consent for the future publication of this report was obtained from both patients. This report has been approved by the Nagasaki Rosai Hospital Institutional Review Board (No.04011, 2022/12/06).

2.1 Patient 1

A 52-year-old woman (weight 61 kg; height 152 cm) underwent left-side NMLR. She had a history of myomectomy and postoperative nausea and vomiting (PONV). She was a non-smoker, and total intravenous anesthesia and peripheral nerve block were administered to prevent PONV. The RLB was planned as part of the multimodal analgesia protocol. The RLB was administered as described below in the “Block procedure” subsection. Before general anesthesia, 20 ml of 0.25% levobupivacaine was administered at the Th5 level. After mastectomy, when the size of the latissimus dorsi flap was established, RLB was administered at the Th8 and Th10 levels, and 15 ml of 0.25% levobupivacaine was administered. General anesthesia was induced and maintained with propofol, remifentanil, and rocuronium to maintain a Bispectral Index value between 40 and 60. During surgery, the patient remained nearly hemodynamically stable with six 0.1-mg boluses of phenylephrine to maintain a mean blood pressure > 60 mmHg without the need for continuous vasopressor administration. During skin closure, 0.625 mg of droperidol, 1000 mg of acetaminophen, and 50 mg of flurbiprofen were administered intravenously. After completion of the surgery, the administration of these agents was discontinued, and sugammadex (4 mg/kg) was administered. The total amount of fentanyl used was 350 µg. The numerical rating scale (NRS) was 0-0-1-1/10 at rest and at 0, 1, 6, and 12 h after surgery. There was no incidence of PONV. No serious adverse events, such as allergic reactions, local anesthetic systemic toxicity, pneumothorax, or uncontrollable persistent hypotension, were observed. No persistent pain and neither latissimus dorsi flap necrosis nor infection were observed at 1 week postoperatively.

2.2 Patient 2

A 64-year-old woman (weight 50 kg; height 150 cm) underwent left-side NMLR; 30 ml 0.25% levobupivacaine was administered at the Th5 level. The size of the latissimus dorsi flap was relatively small, and only one injection of 0.25% levobupivacaine (20 ml) was administered at level Th8. The anesthesia plan was the same as that for Patient 1. The total amount of fentanyl used was 600 µg. During surgery, the patient remained hemodynamically stable with only two 0.1-mg boluses of phenylephrine to maintain a mean blood pressure > 60 mmHg without the need for continuous vasopressor administration. During skin closure, 4 mg of ondansetron, 1000 mg of acetaminophen, and 50 mg of flurbiprofen were administered intravenously. The NRS was 0-0-1-1-1-0/10 at rest and at 0, 1, 6, 12, 24, and 48 h after surgery. There was no incidence of PONV. No serious adverse events were observed. No persistent pain and neither latissimus dorsi flap necrosis nor infection were observed at 1 week postoperatively.

2.3 Block procedure

The RLB was administered as previously described [9]. The patients were placed in the lateral decubitus position. Ultrasound scanning was started on the ribs approximately 5 cm lateral to the spinous process in the sagittal plane, counting from Th1 and corresponding to the rib level for block administration. A high-frequency 13–6 MHz linear transducer was used (Sonosite SII, Fujifilm Sonosite, Tokyo, Japan). The probe was moved laterally to medially to visualize the transition from the transverse process to the vertebral lamina. Under aseptic conditions, a 20-gauge Tuohy needle (Hakko, Nagano, Japan) was inserted in-plane at approximately 45° in a cranial-to-caudal direction with the needle tip aiming at the vertebral lamina. The criterion for successful puncture was establishment of a hypoechoic space between the lamina and the erector spinae muscles [10].

3. DISCUSSION

In this study, multiple-level injections of an ultrasound-guided RLB were administered for latissimus flap breast reconstruction. The multiple-level RLB provided effective analgesia in both patients. Unkart et al. reported that continuous TPVB did not provide a statistically significant benefit for pain control in patients who underwent latissimus flap breast reconstruction [1]. Buggy et al. reported that continuous TPVB at Th3 or Th4 levels significantly improved the dynamic visual analog scale in patients who underwent latissimus flap breast reconstruction [11]. Swisher et al. reported a case study in which continuous multilevel-TPVB provided optimal analgesia without causing postoperative hypotension in patients who underwent latissimus flap breast reconstruction [12]. TPVB at a single level does not seem to adequately cover the area needed for analgesia, and administration of multiple-level injections of TPVB was considered. Terkawi et al. reported that multiple-level injections of TPVB are associated with better analgesic pain at movement [13]. They also report that for multiple-level TPVB, the use of a single injection versus the continuous catheter technique did not have statistical significance in the efficacy for acute postoperative pain. In our study, a simpler technique was used — a single injection. On the other hand, they also reported that multiple-level TPVB increased the risk of pneumothorax and vascular puncture; therefore, in this study, an RLB was used as an alternative to TPVB. This was known as "paravertebral by proxy". The efficacy of an RLB has been confirmed by a comparison of postoperative analgesia after breast surgery [14].

The advantage of an RLB is that the endpoint of an RLB is the lamina, which is the bony structure easily visualized on ultrasonography, thereby reducing complications [15]. Onishi et al. reported that the RLB group had a longer time to initial analgesic administration than the control group; the NRS scores of the RLB group were significantly lower than those of the sham block group [16]. However, an RLB is not recommended in the PROSPECT guideline for oncological breast surgery due to a lack of evidence [6].

The disadvantage of an RLB is that the optimal dose required to achieve adequate analgesia remains unclear [17]. Diffusion of a local anesthetic into the paravertebral space may be crucial for achieving an adequate anesthetic effect on the anterior thoracic wall [18]. Higher volumes of local anesthetics are more likely to reach the paravertebral space. This was reported in both a human- and porcine cadaver study [8, 10]. In a pilot study by Murouchi et al., a 20-ml RLB was highly satisfactory compared to a 10-ml or 15-ml RLB, and no significant difference was observed between 25-ml and 20-ml RLBs [14].

Onishi et al. also reported that a local anesthetic may not reach the paravertebral space with a 15-ml dose [16]. In a cadaver study, the dye reaching the paravertebral space seemed related to the injection volume; dye was observed in 0% of the paravertebral space in the 10-ml group, 33% in the 20-ml group, and 83% in the 30-ml group [8]. Based on these results, 20–30 ml was administered for breast cancer surgery in this study. In Patient 1, two-level RLB procedures were performed at the level of the latissimus dorsi flap (Th8 and Th10). In Patient 2, only a one-level RLB procedure was performed at the level of the latissimus dorsi flap because its size was relatively small. Adequate analgesia was achieved without continuous administration in both patients. Further studies are needed to determine the optimal dose of local anesthetics for RLB and whether continuous administration is necessary for NMLR.

The main limitation of this report is that the patients were only evaluated for pain at rest. In addition, the dermatomal distribution after RLB was not assessed. This is only an observational finding with two cases; therefore, further studies are needed to consider the indication of multi-level RLB for NMLR. Our team is considering the evaluation of pain at movement and the dermatomal distribution after RLB in an additional case study.

4. CONCLUSION

Herein, two patients who were administered two or three ultrasound-guided RLBs as part of a multimodal analgesic technique for NMLR have been reported. Adequate analgesia was achieved without additional drug administration in both patients. Obtaining estimates for the optimal local anesthetic dose, and the best combination of injection level and timing are essential to establish an appropriate RLB method for NLMR.

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COMPETING INTERESTS

The authors declare that no competing interests exist.

AUTHORS' CONTRIBUTIONS

HA experienced cases 1 and 2. HA wrote the first draft of the manuscript. YT supervised and reviewed this study. YT, EF, MO, NO, HI, and TH advised and revised the manuscript. All authors read and approved the final manuscript.

CONSENT

Written informed consent was obtained from the patient (or other approved parties) for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. This report has been approved by the Nagasaki Rosai Hospital Institutional Review Board (No.04011, 2022/12/06).

REFERENCES

1. Unkart JT, Padwal JA, Ilfeld BM, Wallace AM. Treatment of post-latissimus dorsi flap breast reconstruction pain with continuous paravertebral nerve blocks: A retrospective review. Anesth Pain Med. 2016;6(5):e39476. [https://doi.org/10.5812/aapm.39476, PMID: 27847703]
2. Sahajanandan R, Varsha AV, Kumar DS, Kuppusamy B, Karuppiah S, Shukla V, et al. Efficacy of paravertebral block in "Fast-tracking" pediatric cardiac surgery - Experiences from a tertiary care center. Ann Card Anaesth. 2021;24(1):24–9. [https://doi.org/10.4103/aca.ACA_83_19, PMID: 33938827]
3. Bignami E, Castella A, Pota V, Saglietti F, Scognamiglio A, Trumello C, et al. Perioperative pain management in cardiac surgery: A systematic review. Minerva Anestesiol. 2018;84(4):488–503. [https://doi.org/10.23736/S0375-9393.17.12142-5, PMID: 29027773]
4. Coşarcan SK, Doğan AT, Gurkan Y, Erçelen Ö. Analgesic effect of dual injection technique for the erector spinae plane block in beating heart coronary by-pass surgeries. Cureus. 2021;13(3):e14122. [https://doi.org/10.7759/cureus.14122, PMID: 33927930]
5. Jiang T, Ting A, Leclerc M, Calkins K, Huang J. Regional anesthesia in cardiac surgery: A review of the literature. Cureus. 2021;13(10):e18808. [https://doi.org/10.7759/cureus.18808, PMID: 34804666]
6. Jacobs A, Lemoine A, Joshi GP, Van de Velde M, Bonnet F, PROSPECT Working Group collaborators#. PROSPECT guideline for oncological breast surgery: A systematic review and procedure-specific postoperative pain management recommendations. Anaesthesia. 2020;75(5):664–73. [https://doi.org/10.1111/anae.14964, PMID: 31984479]
7. Liu D, Zhang G, Zhu Y, Liu X, Xu S, He M, et al. Effectiveness of ultrasound-guided retrolaminar block and erector spinae plane block in retroperitoneal laparoscopic surgery: A randomized controlled trial. J Pain Res. 2022;15:815–26. [https://doi.org/10.2147/JPR.S349028, PMID: 35370419]
8. Aamir F, Cronin M, Lee P, Iohom G, Shorten G. A sono-anatomical and cadaveric study of ultrasound-guided retrolaminar block. Med Ultrason. 2021;23(4):418–23. [https://doi.org/10.11152/mu-2979, PMID: 33945595]
9. Voscopoulos C, Palaniappan D, Zeballos J, Ko H, Janfaza D, Vlassakov K. The ultrasound-guided retrolaminar block. Can J Anaesth. 2013;60(9):888–95. [https://doi.org/10.1007/s12630-013-9983-x, PMID: 23797663]
10. Damjanovska M, Stopar Pintaric T, Cvetko E, Vlassakov K. The ultrasound-guided retrolaminar block: Volume-dependent injectate distribution. J Pain Res. 2018;11:293–9. [https://doi.org/10.2147/JPR.S153660, PMID: 29445296]
11. Buggy DJ, KerinMJ. Paravertebral analgesia with levobupivacaine increases postoperative flap tissue oxygen tension after immediate latissimus dorsi breast reconstruction compared with intravenous opioid analgesia. Anesthesiology. 2004 Feb;100(2):375-80. [https://doi: 10.1097/00000542-200402000-00029., PMID: 14739814]
12. Swisher MW, Gabriel RA, Khatibi B. Two-Level Continuous Thoracic Paravertebral Nerve Blocks Providing Opioid-Free Postoperative Analgesia After Latissimus Dorsi Flap Breast Reconstruction: A Case Report. A A Pract. 2018 Sep 1;11(5):118-120. [https://doi: 10.1213/XAA.0000000000000759., PMID: 29634527]
13. Terkawi AS, Tsang S, Sessler DI, Terkawi RS, Nunemaker MS, Durieux ME, et al. Improving analgesic efficacy and safety of thoracic paravertebral block for breast surgery: A mixed-effects meta-analysis. Pain Phys. 2015;18:E757–80

14. Murouchi T, Yamakage M. Retrolaminar block: Analgesic efficacy and safety evaluation. J Anesth. 2016;30(5):1003–7. [https://doi.org/10.1007/s00540-016-2230-1, PMID: 26431130]
15. Nobukuni K, Hatta M, Nakagaki T, Yoshino J, Obuchi T, Fujimura N. Retrolaminar versus epidural block for postoperative analgesia after minor video-assisted thoracic surgery: A retrospective, matched, non-inferiority study. J Thorac Dis. 2021;13(5):2758–67. [https://doi.org/10.21037/jtd-21-238, PMID: 34164168]
16. Onishi E, Murakami M, Nishino R, Ohba R, Yamauchi M. Analgesic effect of double-level retrolaminar paravertebral block for breast cancer surgery in the early postoperative period: A placebo-controlled, randomized clinical trial. Tohoku J Exp Med. 2018;245(3):179–85. [https://doi.org/10.1620/tjem.245.179, PMID: 30012909]
17. Sugiyama T, Kataoka Y, Shindo K, Hino M, Itoi K, Sato Y, et al. Retrolaminar block versus paravertebral block for pain relief after less-invasive lung surgery: A randomized, non-inferiority controlled trial. Cureus. 2021;13(2):e13597. [https://doi.org/10.7759/cureus.13597, PMID: 33815997]
18. Yang HM, Choi YJ, Kwon HJ, O J, Cho TH, Kim SH. Comparison of injectate spread and nerve involvement between retrolaminar and erector spinae plane blocks in the thoracic region: A cadaveric study. Anaesthesia. 2018;73(10):1244–50. [https://doi.org/10.1111/anae.14408, PMID: 30113699]

DEFINITIONS, ACRONYMS, ABBREVIATIONS

NMLR: nipple-sparing mastectomy with latissimus dorsi flap reconstruction
TPVB: thoracic paravertebral block
RLB: retrolaminar block
PONV: postoperative nausea and vomiting
NRS: numerical rating score