

General Anesthesia with Thoracic Paravertebral Block for Modified Radical Mastectomy

Preeyaphan Arunakul MD*
Acksara Ruksa RN**

*Department of Anesthesia, Faculty of Medicine, Thammasat University, Pathumthani, Thailand

**Thammasat University Hospital, Pathumthani, Thailand

Objective: To evaluate the effect of single-injection paravertebral block (PVB) combined with general anesthesia on 24-hour postoperative morphine requirement in patients undergoing modified radical mastectomy (MRM).

Material and Method: 20 patients were randomly assigned into 2 groups. Patients in the control group were given only general anesthesia. Patients in the PVB group received 0.3 ml/kg of 0.5% plain bupivacaine at T4 paravertebral space followed by general anesthesia. Both groups received intravenous morphine patient-controlled analgesia (PCA) device postoperatively. All patients were evaluated at 1 and 24 hours for pain, nausea and vomiting. Twenty-four hour morphine consumption, antiemetics requirement, and overall satisfaction were recorded.

Results: Patients with PVB had lower incidence and severity of postoperative pain, nausea and vomiting and other serious complications. No patients were unsatisfied with anesthetic techniques.

Conclusion: PVB can reduce postoperative opioid requirement, pain, and severity of nausea and vomiting in MRM.

Keywords : Modified radical mastectomy, Paravertebral block, General anesthesia

J Med Assoc Thai 2010; 93 (Suppl. 7) : S149-S153

Full text. e-Journal: <http://www.mat.or.th/journal>

Currently in Thailand, modified radical mastectomy (MRM) is mostly performed under general anesthesia. MRM includes total mastectomy and axillary lymph node dissection. Even though the incision size, is equal to total mastectomy axillary lymph node dissection, causing more severe postoperative pain. In previous studies, the incidence of moderate to severe pain after mastectomy under general anesthesia was 70-80.9% on the first postoperative day, and reduced to 53% and 33% on the second and the third postoperative day, respectively^(1,2). The incidence of postoperative nausea and vomiting (PONV) in breast cancer surgery under general anesthesia was higher than other operation, the overall incidence was 59%^(2,3), due to the use of opioids for pain control and some anesthetic agents. In addition, previous studies showed that the incidence of PONV is greater in patients undergoing general anesthesia, female patients, patients

experiencing postoperative pain, and patients undergoing breast surgery⁽⁴⁻⁶⁾. When thoracic epidural analgesia was used, the incidence of pain, nausea, vomiting and length of hospital stay was reduced⁽¹⁾. However, possible serious complications of continuous epidural analgesia including hypotension, respiratory depression, infection, or even catheter migration to the subarachnoid space, may occur.

For over a decade, thoracic paravertebral block (PVB) has been used in thoracic and breast surgeries with minimal complications⁽¹⁾, but is not yet popular in Thailand. Previous studies, comparing general anesthesia alone with thoracic PVB and sedation, found that PVB could significantly decrease postoperative pain, nausea, and vomiting^(1,7-9), and also seem to have shorter recovery times⁽⁹⁾ the possibility of serious complications from PVB has been studied in multicenter; hypotension (4.6%), vascular puncture (3.8%), pleural puncture (1.1%), and pneumothorax (0.5%)^(7,8,10,11).

None of the randomized studies on PVB in MRM has been placebo controlled; thus the patients given PVB undergoing MRM might have expected effective intraoperative and postoperative analgesia.

Correspondence to:

Arunakul P, Department of Anesthesia, Faculty of Medicine, Thammasat University, Pathumthani 12120, Thailand.
Phone: 0-2926-9489, Fax: 0-2926-9497
E-mail: preeyaphan@hotmail.com

Material and Method

The study was approved by the Thammasat University Institutional Ethics Committee and written informed consent was obtained from the patients. Twenty patients, ASA physical status I-II scheduled for elective modified radical mastectomy were included in the study. The exclusion criteria were bleeding disorders, allergy to local anesthetics, infection at the thoracic paravertebral injection site, pregnancy or breast feeding mother, severe obesity (body mass index $> 35 \text{ kg/m}^2$) and Parkinson's disease.

At the preoperative visit, patients were randomly allocated into either the control or the PVB group. They were instructed by nurse anesthetist to use the verbal rating scale (VRS; 0-10) and patient-controlled analgesia (PCA) device. The general anesthetic technique was also explained. During intraoperative period, standard monitoring included electrocardiography, pulse oximetry, noninvasive arterial blood pressure, end-tidal carbon dioxide, endtidal inhalational agent and body temperature.

Patients in PVB group were placed in the lateral position on the side to be blocked. The 25-gauge needle was inserted 2-5 cm lateral from the cephalic edge of the 4th thoracic vertebral spinous process. The skin, subcutaneous tissue and periosteum of the transverse process were anesthetized with 5 ml of 2% plain lidocaine. The PVB was performed by using the 18-gauge Tuohy needle and the loss-of-resistance technique, seeking contact with the lateral process of the 4th thoracic vertebra as a landmark before advancing the needle into the paravertebral space⁽⁷⁾. The 0.5% plain bupivacaine 0.3 ml/kg was slowly injected into the paravertebral space with repeated aspiration. The patient was then turned supine and prepared for general anesthesia. In the control group, the patients were given only general anesthesia.

General anesthesia was induced with either thiopental 5 mg/kg or propofol 1.5-2 mg/kg followed by atracurium 0.6 mg/kg or succinyl choline 1.5 mg/kg to facilitate endotracheal intubation. Anesthesia was maintained with 1 MAC isoflurane in 50% N₂O in O₂. Atracurium 0.2 mg/kg was given every 30 minutes throughout the operation. An intravenous bolus of either fentanyl 1 µg/kg or morphine 0.05 mg/kg was given if blood pressure or heart rate increased more than 20% from baseline values. Ephedrine 6 mg or norepinephrine 4 µg was given if blood pressure decreased more than 20% from preoperative baseline values.

All patients were intubated and ventilation

was controlled by using volume-controlled ventilator. Total consumption of thiopental, propofol, isoflurane, fentanyl and morphine during anesthesia were recorded. The amount of fentanyl consumption was converted to mg of morphine (10 µg of fentanyl = 1 mg of morphine). Recovery from anesthesia and tracheal extubation was assessed by testing the patients' ability to open their eyes and to squeeze their hands on verbal command.

After extubation the patients were transferred to a postanesthetic care unit (PACU) for a one-hour observation period. Analgesia in the PACU and during a 24-hour postoperative period was provided by intravenous morphine PCA. The PCA bolus dose was of 1 mg with a 5-minute lockout period and 20 mg four-hour limit. The patients were instructed to alert the PCA device if their VRS for pain was > 3 . Antiemetics were administered if VRS for postoperative nausea and vomiting (PONV) were > 3 . Incidence of moderate to severe pain, pain needed to be treated and PONV needed to be treated was indicated by VRS > 3 . First-line antiemetic was 10 mg of intravenous metoclopramide. Ondansetron 0.1 mg/kg was given if the symptoms were not improved within 15 minutes.

Pain intensity at rest and in motion on the VRS and intravenous PCA morphine consumption were recorded by a nurse anesthetist who was blinded to the anesthetic technique in the PACU. PONV and the degree of sedation were assessed on a VRS (0-10 cm) every 15 minutes for 1 hour. All patients were interviewed for their pain VRS and PONV scores as well as any other problems or complications by the same nurse anesthetist at 24 hours after surgery. They were asked about their overall satisfaction with the postoperative analgesia technique by using the VRS scale (0 = dissatisfied; 10 = most satisfied).

Postoperative IV morphine consumption was used to calculate the statistical power. A sample size estimate indicated that 8 patients per group would give a power of 80% at a level of 0.05 for detecting a difference of at least 30% in morphine consumption. The study size was then prospectively set to 20 patients with 10 assigned to each group. Statistical analyses were performed with SPSS for windows, Release 16.0 (SPSS Inc., Chicago, IL).

The results are presented as mean \pm SD or number of patients. Normally distributed data was analyzed by using unpaired student's t-tests, whereas for analysis of categorical and skewed data, Mann-Whitney U-test for continuous data or X² tests were used as appropriate. $P < 0.05$ was considered statistically significant.

Results

The patients in both groups were not different in respect to demographic characteristics and duration of anesthesia (Table 1). No vital signs changed during surgical incision in all patients who received a PVB.

The patients given PVB with 0.5% bupivacaine had less postoperative pain, as indicated by lower VRS scores (Fig. 1) and less morphine consumption in the first 24-hour postoperative period (mean PVB group 2.90 ± 1.96 mg, mean control group 9.15 ± 6.67 mg, $p = 0.029$). Reduction of total morphine consumption is statistically significant ($p < 0.05$) in all

patients who received PVB (mean PVB group 6.60 ± 2.97 mg, mean control group 20.75 ± 8.40 mg, $p = 0.000$). Number of patients who experienced moderate to severe pain during the 1-hour postoperative period was significantly lower in the PVB group, with no different at 24-hour period. Intraoperative morphine requirement was significantly lower in the PVB group (mean \pm SD; 3.70 ± 2.97 mg) than the control group (mean \pm SD; 11.65 ± 5.43 mg) (Table 2). The patients with PVB had lower incidence of PONV (Fig. 2) and received fewer doses of antiemetic medication than the control group (Table 2). There was no serious complication. The patients were satisfied with the anesthesia technique, and pain management, as indicated by the VRS scores.

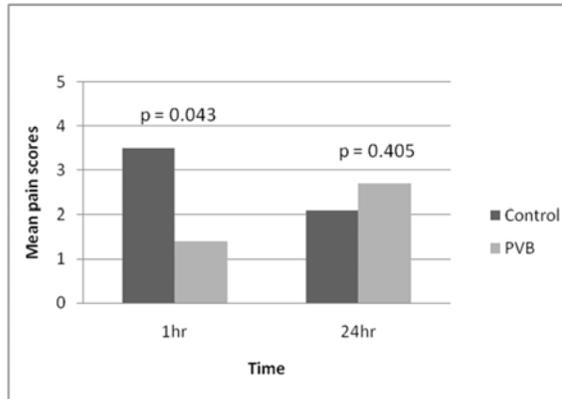


Fig. 1 Mean VRS for pain reported by patients at 1 and 24 hours postoperative period. P-values are for intergroup comparisons at each measurement interval.

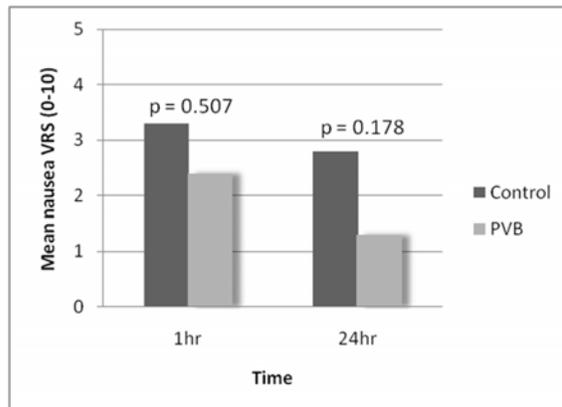


Fig. 2 Mean VRS for nausea (0 = no nausea to 10 = vomiting) reported by patients at 1 and 24 hours postoperative period. P-values are for intergroup comparisons at each measurement interval.

Discussion

This study showed that thoracic PVB with 0.5% bupivacaine 0.3 ml/kg in patients scheduled for MRM, resulted in lower requirement for intraoperative and postoperative opioid analgesia. The patients in the control group received significantly higher amount of morphine than the PVB group, with higher incidence of moderate to severe pain. The lower amount of opioid required by the PVB patients, in comparison with control patients, in the first 24 hour postoperative period could be an explanation of less antiemetic requirement in the patients in PVB group.

The incidence of PONV is quite high in the patient undergoing mastectomy and mastectomy with lymph node biopsy⁽⁴⁾. In this study, a PVB lowered the severity of PONV and antiemetic requirement, explained by smaller amount of opioid consumption. The patients receiving PVB required less antiemetic for PONV on the first postoperative day. One of the patients in control group received more than one antiemetic and dexamethasone, another patient in this group had severe PONV immediately after surgery.

Although there is evidence of vertical spread of paravertebrally injected local anesthetic over several adjacent dermatomes, the interindividual variation in range of sensory analgesia spreading is large. Some of the patients who had received bupivacaine for the PVB needed morphine early in the PACU, which was probably because of the individual variation of paravertebral spreading of local anesthetic. Thus, the reliable estimation of the quality of the PVB during surgery could not be exactly documented., the unilateral spread of sensory analgesia from 1-8 dermatomes after a single injection of 0.5% bupivacaine 15 ml for thoracic PVB is noted⁽¹²⁾. Whether a multiple injection PVB is superior to a single-injection technique for MRM, has

Table 1. Demographic characteristics (mean \pm SD)

Variable	Control	PVB	p-value
Age (years)	50.3 \pm 7.87	49.4 \pm 6.32	0.837
Weight (kg)	63.25 \pm 11	60.9 \pm 11.91	0.995
ASA I/II (number of patients)	6/4	6/4	0.371
Duration of anesthesia (hr)	2.59 \pm 0.75	2.48 \pm 0.39	0.992

Table 2. Opioid requirement during anesthesia and 24 hours postoperative period

Variable	Control	PVB	p-value
Number of patients with moderate-severe pain at 1 hr postoperative	5 (50%)	1 (10%)	0.043
at 24 hrs postoperative	4 (40%)	3 (30%)	0.405
Intraoperative opioid requirement	11.65 \pm 5.44*	3.70 \pm 2.97*	0.000
24-hour postoperative morphine requirement	9.15 \pm 6.67*	2.90 \pm 1.96*	0.029
Number of antiemetic needed (times)	9	3	

not been evaluated. Although the incidence of pneumothorax and intravascular injection in PVB is small, the risk of serious complications per patient increases when multiple injections are performed.

Some previous studies showed that PVB reduced the length of hospital stay^(1,7,13) but did not prove in this study because some institutions in Thailand had postoperative MRM patients stay in the hospital until the drain was removed (about 7-10 days). But in other institutions, postoperative MRM patients could be discharged from hospital with the drain.

Conclusion

In our study, we demonstrated that single-injection thoracic PVB at the level of the 4th thoracic vertebral space could reduce both intraoperative and postoperative opioid requirement, postoperative pain and PONV in patients undergoing MRM. With the low possibility of serious complications and the high efficacy of analgesia, PVB should be brought into our practice, especially for MRM or other types of mastectomy besides thoracic surgery.

Acknowledgements

We would like to acknowledge the assistance of Dr. Tawanchai Jirapramukpitak for statistical consulting. This study was supported by the Thammasat University Research Fund.

References

1. Coveney E, Weltz CR, Greengrass R, Iglehart JD, Leight GS, Steele SM, et al. Use of paravertebral block anesthesia in the surgical management of breast cancer: experience in 156 cases. *Ann Surg* 1998; 227: 496-501.
2. Doss NW, Ipe J, Crimi T, Rajpal S, Cohen S, Fogler RJ, et al. Continuous thoracic epidural anesthesia with 0.2% ropivacaine versus general anesthesia for perioperative management of modified radical mastectomy. *Anesth Analg* 2001; 92: 1552-7.
3. Lynch EP, Welch KJ, Carabuena JM, Eberlein TJ. Thoracic epidural anesthesia improves outcome after breast surgery. *Ann Surg* 1995; 222: 663-9.
4. Miguel R, Rothschilder J, Majchrzak J. Breast surgery is a high risk procedure for development of nausea and vomiting [abstract]. *Anesthesiology* 1993; 79: A1095.
5. Hirsch J. Impact of postoperative nausea and omiting in the surgical setting. *Anaesthesia* 1994; 49(Suppl): 30-3.
6. Sinclair DR, Chung F, Mezei G. Can postoperative nausea and vomiting be predicted? *Anesthesiology* 1999; 91: 109-18.
7. Kairaluoma PM, Bachmann MS, Korpinen AK, Rosenberg PH, Pere PJ. Single-injection paravertebral block before general anesthesia enhances analgesia after breast cancer surgery with

- and without associated lymph node biopsy. *Anesth Analg* 2004; 99: 1837-43.
8. Klein SM, Bergh A, Steele SM, Georgiade GS, Greengrass RA. Thoracic paravertebral block for breast surgery. *Anesth Analg* 2000; 90: 1402-5.
 9. Pusch F, Freitag H, Weinstabl C, Obwegeser R, Huber E, Wildling E. Single-injection paravertebral block compared to general anaesthesia in breast surgery. *Acta Anaesthesiol Scand* 1999; 43: 770-4.
 10. Linnqvist PA, MacKenzie J, Soni AK, Conacher ID. Paravertebral blockade. Failure rate and complications. *Anaesthesia* 1995; 50: 813-5.
 11. Karmakar MK. Thoracic paravertebral block. *Anesthesiology* 2001; 95: 771-80.
 12. Cheema S, Richardson J, McGurgan P. Factors affecting the spread of bupivacaine in the adult thoracic paravertebral space. *Anaesthesia* 2003; 58: 684-7.
 13. Greengrass R, O'Brien F, Lyerly K, Hardman D, Gleason D, D'Ercole F, et al. Paravertebral block for breast cancer surgery. *Can J Anaesth* 1996; 43: 858-61.

การทำ thoracic paravertebral block ร่วมกับการดมยาสลบสำหรับการผ่าตัด modified radical mastectomy

ปรียพรรณ อรุณากร, อักษรา รักษา

วัตถุประสงค์: ศึกษาผลของ thoracic paravertebral block (PVB) ร่วมกับการดมยาสลบต่อปริมาณมอร์ฟีนที่ใช้ใน 24 ชั่วโมงหลังการผ่าตัด modified radical mastectomy (MRM)

วัสดุและวิธีการ: ผู้ป่วยมารับการผ่าตัด MRM จำนวน 20 รายแบ่งเป็นกลุ่มควบคุม และกลุ่ม PVB ผู้ป่วยในกลุ่มควบคุมได้รับการดมยาสลบเพียงอย่างเดียว อีกกลุ่มได้รับการทำ PVB ก่อนดมยาสลบ หลังผ่าตัดมีการประเมินความปวด และคลื่นไส้อาเจียนที่ 1 และ 24 ชั่วโมง บันทึกปริมาณยาระงับปวด ยาแก้คลื่นไส้อาเจียน ภาวะแทรกซ้อนและ ความพึงพอใจโดยรวม

ผลการศึกษา: ผู้ป่วยกลุ่ม PVB มีอุบัติการณ์และความรุนแรงของอาการปวด และคลื่นไส้อาเจียนน้อยกว่ากลุ่มควบคุม โดยไม่มีภาวะแทรกซ้อน ผู้ป่วยในกลุ่ม PVB พึงพอใจในวิธีการระงับปวดมาก

สรุป: การทำ PVB สามารถลดอาการปวด และความรุนแรงของอาการคลื่นไส้อาเจียนหลังผ่าตัด MRM ได้
