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*CASE REPORT*

# Thoracal Paravertebral vs. Serratus Anterior Plane Block in Combination with COMBIPECS for Modified Radical Mastectomy

Wandito Gayuh Utomo[✉*], Calcarina Fitriani[**], Sudadi[**], Farhan Ali[**]

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Author's Affiliations:

[*]Specialist medicine academic program of Anesthesiology and Intensive Therapy Department, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada/Dr. Sardjito Hospital, Yogyakarta, Indonesia
[**]Anesthesiology and Intensive Therapy Department, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada/Dr. Sardjito Hospital, Yogyakarta, Indonesia

[✉]Correspondence:
wanditogayuh88@gmail.com

## ABSTRACT

**Background:** Breast cancer is one of the most common malignancies in women worldwide. Surgical options for breast cancer include modified radical mastectomy (MRM), in which the entire breast is removed but the pectoralis major muscle is spared. Routine anesthesia modalities for MRM include general anesthesia (GA), epidural blockade combined GA, and nerve blockade combined GA . Thoracic paravertebral block (TPVB) is still recognized as the gold standard analgesic procedure for breast surgery. However, TPVB is more difficult to perform with possible complications such as hypotension, pneumothorax, and unintentional spread of anesthetic agent to epidural space. Serratus anterior plane block (SAPB) is a promising new procedure that is relatively easier to perform and safer. Previous studies have reported its benefit in reducing the need of postoperative opioids and postoperative pain.

**Case illustration:** We describe the case of 2 females with left breast cancer undergoing unilateral MRM, both with ASA class II. First patient was given TPVB, PEC 1, and PEC 2 (COMBIPECS). Second patient was given nerve block and guided ultrasonography using SAPB, PEC1, and PEC 2 (COMBIPECS). Each patient was sedated with a dexmedetomidine loading dose of 1mcg/kg/10 minutes, titration 0.2-0.4mcg/kg/hour. Both types of blocks provide adequate anesthesia. Ketorolac 30mg/8 hour was given post-operative. Both patients showed normal vital signs, and the same post-operative NRS of 0. No block related complication was found in both cases.

**Conclusions:** TVPB and SAP combined with COMBIPECS have similar results in terms of post-operative pain score and minimal complication.

**Keywords:** COMBIPECS; Pectoralis nerve block; Radical mastectomy; Serratus anterior block; Thoracal paravertebral block.

## INTRODUCTION

Breast cancer refers to malignancy originating from breast tissue, commonly from the inner lining of milk ducts or lobules[1]. It is one of the most common cancers in women worldwide, approximately 1.5 million are diagnosed annually. Breast cancer has the capability of metastasis to distant organs such as bone, liver, lung and brain[2].

Breast tumor starts with ductal hyperproliferation progressing into benign tumor. When stimulated by various carcinogenic factors, carcinogenesis is promoted. Mutation and abnormal amplification of oncogenes and anti-oncogenes play key roles in the process of tumor development involving BRCA1/2, HER2, EGFR, c-Myc[2]. Factors influencing the formation of breast cancer are previous history of breast cancer, family history, genetic and hormonal factors (early age pregnancy, hormone replacement therapy, oral pills), lifestyle and dietary intake (alcohol), environmental cause such as exposure to radiation[1].

Classic symptom for breast cancer is lump found in the breast or armpit (30% of cases). Monthly breast self-exam is beneficial to detect changes in the breast texture, size, swelling and mass. Other complaints include nipple discharge, pain, inverted nipple, scaly or pitted skin, and unusual discomfort. In advanced stage, patient may present with other symptoms such as bone pain, shortness of breath, appetite drop, weight loss, headaches or weakness[1].

Mammography and ultrasonography are used as first-line imaging modalities, MRI may be used if needed to accurately identify breast cancer. Common findings of breast cancer imaging are irregularly shaped mass, spiculation, microcalcifications, anatomical distortion, posterior acoustic shadowing. Breast cancer is confirmed by tissue biopsy, preferentially with ultrasound guided large bore core needle biopsy. Surgical options for breast cancer include lumpectomy, mastectomy and bilateral mastectomy[3].

Modified radical mastectomy (MRM) is a procedure in which the entire breast is removed; skin, areola, nipple, most axillary lymph node, but the pectoralis major muscle is spared. Relative indications to MRM are prior radiation therapy, contraindicated radiation therapy, inflammatory breast cancer, malignant

appearing microcalcifications, widespread disease (located in more than 1 quadrant), and positive pathologic margin[4]. Routine anesthesia modality for modified radical mastectomy includes general anesthesia (GA), epidural blockade combined GA, and nerve blockade combined GA[5].

Thoracic paravertebral block (TPVB) is still recognized as the gold standard analgesic procedure for breast surgery[6]. Patients with TPVB had lower incidence and severity of postoperative pain, nausea, and vomiting[7]. However, because of the involvement of symphatetic fibers and challenging anatomical location of the target nerve, there can be consequences such as hypotension, epidural hematoma, pneumothorax, and unintentional vascular injection which makes this procedure unsuitable for ambulatory breast surgery[6]. Serratus anterior plane block (SAPB) is a new procedure that is relatively easier to perform and safer because no sympathetic fibers involved and no critical organs in proximity to the target nerves. Previous studies have reported its benefit in reducing the need of postoperative opioids and postoperative pain[8]. However, previous studies reported analgetic power of SABP was inferior to TPVB and it was assumed due to smaller area covered by targeted nerves in SABP[9]. Pectoralis nerve block (PECS) I and II (COMBIPECS) is relatively simple and effective, used in breast procedures with expanders which has marked postsurgical pain due to the stretching of pectoralis major muscle, it is used in combination to other peripheral anesthesia[10]. COMBIPECS targets nerves covering area uncovered by SABP such as axillary area[9]. A RCT trial reported that combination of pectoral block and SABP provided safer and more effective analgesia compared to SABP alone in MRM (11). Nevertheless, studies that investigate safety and effectivity of combination of several peripheral nerve blocks in MRM procedure are still very limited. This study aims to compare the effect of TPVB to SAPB in combination with COMBIPECS on reducing postoperative pain in MRM.

## CASE ILLUSTRATION

We describe the case of 2 female with left breast cancer undergoing left MRM. **Case 1** is a 58-year-old woman (height 151 cm, body weight 49 kg) with left breast cancer. The patient was admitted to the hospital for debulking surgery. The patient haven’t undergone

any chemotherapy or radiotherapy. Physical status was ASA classification class 2. Nothing remarkable was found on preoperative examinations. Hemodynamic state at the beginning of the surgery was blood pressure of 110/68 mmHg with a pulse rate of 66 bpm. Patient was sedated with dexmedetomidine loading dose 1mcg/kg/10 minutes, titration 0.2-0.4mcg/kg/hour. Regional anesthesia was conducted under the guidance of ultrasonography (USG), using a 38-mm 6 MHz linear transducer and a 22G 100-mm regional block needle. PECS 1 was done with patient in supine position, then coracoid process was positioned on ultrasound in the paramedian sagittal plane. The caudal border of the transducer then rotated laterally to allow for an in-plane needle trajectory also for visualization of the pectoral branch of the thoracoacromial artery. The correct interfascial plane was confirmed by the opening of the space between the pectoralis major and pectoralis minor, then bupivacaine 0.5% isobaric 10cc + lidocaine 2% 10cc was injected into this plane. PECS 2 was also performed in supine position, the transducer was placed at the midclavicular line and tilted inferolaterally to visualize the axillary artery, axillary vein, and second rib. The transducer then moved laterally until the pectoralis minor muscle, and serratus anterior muscle are identified. Bupivacaine 0.5% isobaric 15cc + lidocaine 2% 10cc was injected into space between these muscles. In performing TPVB, the patient was placed in a left lateral decubitus position, and aseptic and antiseptic techniques were performed around the cervicothoracic para-vertebral areas up to the lower edge of the scapula. The transducer was positioned on the spinous process and moved laterally and obliquely until the double layer of the internal intercostal membrane, the transverse process and the respiratory movements of the parietal pleura were visualized, and then the needle was positioned 1 cm caudally from the transducer. When the needle reached the space between the internal intercostal membrane and the pleura, local anesthetic containing bupivacaine 0.5% isobaric 10cc + lidocaine 2% 10cc was injected over a period of 30 seconds. (Figure 1). The patient was in supine position at the time of MRM procedure. The procedure was completed within an hour with total

bleeding of 100cc, and vital signs measured as shown in **table 1.** Intravenous ketorolac 30mg/8 hours was prescribed as post-operative analgesic. The patient was monitored up to 24 hours after surgery. Post-operative pain were recorded timely in Numeric Rating Scales (NRS) as shown in **Table 3**. No adverse event and complication was reported.

**Table 1.** Vital signs of Case 1 during surgery and recovery room

| Vital sign | Durante op | Recovery room |
|---|---|---|
| Blood pressure (systolic) | 90-123mmHg | 113mmHg |
| Blood pressure (diastolic) | 51-68mmHg | 71mmHg |
| Heart rate | 49-67 beat/minute | 58 beat/minute |
| Respiratory rate | 16-20/minute | 18/minute |
| SpO2 | - | 99% on room air |

**Figure 1.** Ultrasound guided TPVB with PEC 1 and 2 block in modified radical mastectomy on first patient

**Case 2** is a 49 year-old-woman (height 155 cm, body weight 57 kg) presenting with left breast cancer. The patient haven't undergone any chemotherapy or radiotherapy. The patient had ASA classification class 2 with hypertension controlled with amlodipine 10 mg/day. Nothing remarkable was found on preoperative examinations. Hemodynamic state at the beginning of the surgery was blood pressure of 156/91 mmHg with a pulse rate of 66 bpm Patient was sedated with dexmedetomidine loading dose 1mcg/kg/10 minutes, titration 0.2-0.4mcg/kg/hour. Regional anesthesia was conducted under the guidance of ultrasonography (USG), using a 38-mm 6 MHz linear transducer and a 22G 100-mm regional block needle. PECS 1 and PECS 2 (COMBIPECS) were performed identically as Case 1. In performing SAPB, the patient was positioned in left lateral decubitus. Aseptic and antiseptic techniques were done over the area of mid-axillary line. Scans were done by moving the transducer laterally and distally until the 4th and 5th ribs were visible. The transducer was then rotated into the coronal plane and tilted posteriorly until the serratus anterior and latissimus dorsi

muscles were identified. Local anesthethic containing bupivacaine 0.5% isobaric 10cc + lidocaine 2% 10cc in was injected between the serratus anterior and latissimus dorsi muscles. (Figure 2). The patient was in supine position at the time of MRM procedure. The procedure was completed within 2.5 hours with total bleeding 400cc, and vital sign measured as shown in table 2. Intravenous ketorolac 30mg/8 hours was prescribed as post-operative analgesic. The patient was monitored up to 24 hours after surgery. Post-operative pain were recorded timely in NRS as shown in **Table 3.** No adverse event and complication was reported.

**Table 2.** Vital signs of Case 2 during surgery and recovery room

| Vital sign | Durante op | Recovery room |
|---|---|---|
| Blood pressure (systolic) | 90-131mmHg | 111mmHg |
| Blood pressure (diastolic) | 51-83mmHg | 80mmHg |
| Heart rate | 55-80 beat/minute | 71 beat/minute |
| Respiratory rate | 16-20/minute | 18/minute |
| SpO2 | 98-100% | 99% on room air |

**Figure 2.** Left MRM on second patient with SAPB, PEC 1 and PEC 2

**Table 3.** Post-operative NRS

| Post-op NRS | Case 1 | Case 2 |
|---|---|---|
| 0 hour | 1 | 1 |
| 6 hours | 1 | 1 |
| 12 hours | 1 | 1 |
| 24 hours | 3 | 3 |

## DISCUSSION

Routine anesthesia modality includes general anesthesia (GA), neuraxial anesthesia, and peripheral nerve block. Neuraxial anesthesia is the gold standard for anesthesia and analgesia of thorax, abdomen and pelvis, as well as the visceral organs contained within. However, the techniques have many limitations and complications. Numerous techniques have been developed to provide analgesia in patients who are

contraindicated to epidural anesthesia. Peripheral nerve blocks of the trunk are chosen to provide truncal anesthesia such as paravertebral block, pectoralis nerve block and serratus anterior block. Paravertebral block was one of the first peripheral nerve block, offering many advantages for procedures involving thoracic or abdominal wall such as mastectomy. TPVB covers 1 or 2 dermatomes above and below level of injection. Multiple injection may be required depending the area of body. Anesthetic effect of TPVB could have nearly 24-hour duration[12]. TVPB can also be coupled with other regional anesthetic techniques such as pectoral nerve block[10]. Thoracic paravertebral space could be found posteriorly by the superior costotransverse ligament, anterolaterally by parietal pleura, medially by the vertebrae and intervertebral foramina. Patient is seated and flexed; spinous process is palpated. From midpoint of the superior aspect of each spinous process, point of 2.5 cm is measured and marked. Target nerve is located lateral to spinous process. Needle could be inserted with landmark based technique, using 20G Tuohy needle inserted at each point and advanced perpendicular to the skin, upon contact to transverse process, needle is withdrawn slightly and redirected caudal an additional 1cm. This technique is tricky due to the difficulty in estimating transverse process. Using ultrasound would help measure the depth prior to needle insertion and decrease risk of pneumothorax. Ultrasound is oriented in parasagittal or transverse plane, identifying transverse process, head of rib, costotransverse ligament, and pleura. Paravertebral space is approached from caudal to cephalad direction with parasagittal orientation. However, side effects of TPVB are significant hypotension and bradycardia with major complication being pneumothorax, hemothorax, nerve damage[12].

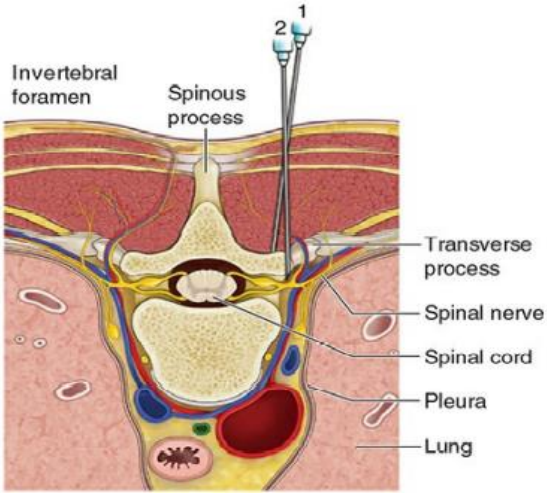


**Figure 3.** Paravertebral anatomy and traditional approach to needle insertion

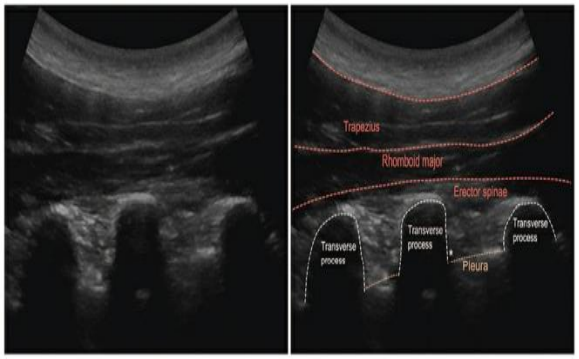


**Figure 4.** Ultrasound guided paravertebral block

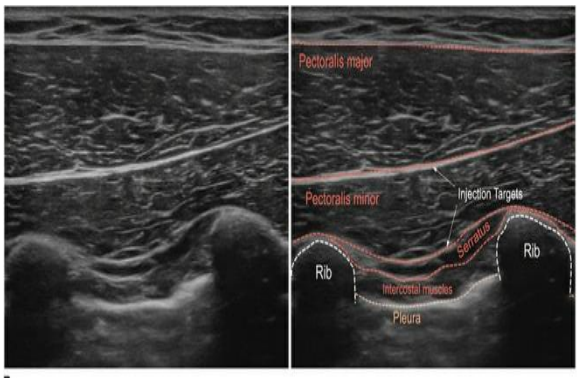


**Figure 5.** Patient and ultrasound positioning PECS block

PECS 1 and 2 (COMBIPECS) block is another less invasive alternative for surgery involving chest wall. PECS 1 acts as fascia plane block targeting medial and lateral pectoral nerves. Local anesthetic is injected in the plan between pectoralis mayor and pectoralis minor muscles at level of third rib. PECS 2 or modified PECS block targets intercostobrachial, third through sixth intercostals and long thoracic nerves. Transducer is placed at midclavicular line with oblique orientation to parasagittal plane. Pectoralis mayor, minor and axillary vessels are identified. Muscles are traced towards its insertion. Needle is inserted lateral to the transducer and advanced in-plane to target interfacial plane between pectoralis major and minor[12]. COMBIPECS block can be used as sole agent, or in combination with other regional techniques for breast surgery.

Serratus anterior plane block (SAPB) is a further modification of pectoralis nerve block, moving injection target proximally to serratus anterior and latissimus dorsi muscles. The block aims to anesthetize hemithorax via branches of intercostal nerve. Patient is placed prone with ipsilateral shoulder abducted, arm resting behind the head. Linear ultrasound transducer is placed on the chest in sagittal orientation to fourth or fifth rib. Probe is moved laterally to midaxillary line, producing nearly coronal orientation of ultrasound probe. Serratus anterior muscle is identified directly superficial to ribs and latissimus dorsi is identified directly superficial to serratus. Block needle is inserted on the superomedial side of the probe and directed inferolateral[12].

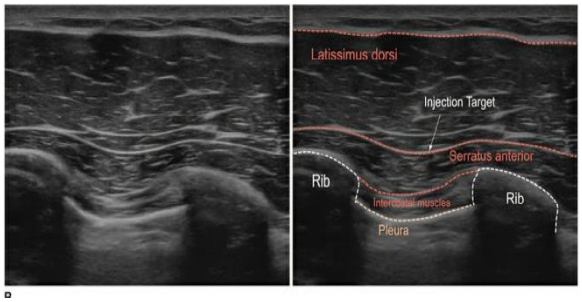


**Figure 6.** Patient and ultrasound positioning SAP block

SABP are relatively easy to perform with high success rate and minimal complication when performed by trained anesthetist, requiring only one injection unlike most other regional blocks. SAPB recently gained popularity in the context of breast surgery, associated with better hemodynamic stability, early ambulation and reduced duration of hospitalization[8].

Recently ultrasound guided pectoralis nerve block and SAPB have been described as an alternative to TPVB. The result shown from the 2 cases of anesthesia modalities of TVPB and SAPB (Figure 1,2) block are great anesthesia choices, showing similar efficacy in terms of reducing post-operative pain (Table 1,2). Both anesthesia regiment does not produce any complication.

This is in accordance to a study by Saad F et al, TPVB and SAPB provide adequate level of anesthesia for thoracotomy, pain reduction was comparable up to 9 hours postoperatively. Hemodynamically, the two procedures were equally safe with few side effects. The study mentioned that in modified radical mastectomy, SAPB provided good analgesia but inferior to TPVB. However, SAPB appeared to be safer in the view of the lower rate of adverse event especially hypotension and bradycardia[13]. It is easier to perform than TPVB with faster onset[9]. SAPB had the advantage of providing analgesia for chest tube- related pain compared to TPVB[14].

Our study provides new insights on potential of combination of several regional anesthesia techniques on providing more safe and effective anesthesia for MRM. Further studies with larger samples and more advanced design are needed to validate our study.

## CONCLUSION

Both TPVB+COMBIPECS and SAPB+ COMBIPECS provide adequate and safe analgesia following MRM with comparable efficacy in our cases. Nevertheless, further to validate the efficacy and safety of these procedures.

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