GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gscbps.gsconlinepress.com/

(RESEARCH ARTICLE)

EFFECTIVENESS OF RHOMBOID INTERCOSTAL AND SUB-SERRATUS (RISS) PLANE BLOCK REGIONAL ANESTHESIA AS ADJUVANT ANALGESIA IN MANAGEMENT OF POST-OPERATIVE PAIN IN PATIENTS UNDERGOING MASTECTOMY SURGERY

Nyoman Damar Widya Dharma *, Putu Pramana Suarjaya, Kadek Agus Heryana Putra, I Made Gede Widnyana and Tjokorda Gde Agung Senapathi

Department of Anesthesiology, Pain Management, and Intensive Care, Udayana University, Sanglah General Hospital Bali.
* Corresponding Author

GSC Biological and Pharmaceutical Sciences, 2026, 36(03), 122–128

Publication history: Received on 02 August 2026; revised on 10 September 2026; accepted on 13 September 2026

Article DOI: https://doi.org/10.30574/gscbps.2026.36.3.0316

ABSTRACT

Background: Postoperative pain after mastectomy often decreases patients' quality of life and requires effective pain management. The RISS block (Rhomboid Intercostal and Sub-Serratus) is an alternative technique that can reduce pain and opioid requirements after surgery.

Methods: This study is a single-blind randomized clinical trial involving 40 mastectomy patients, divided into two groups: one group received general anesthesia with the RISS block, and the other group received only general anesthesia. Primary outcomes measured included opioid consumption in the first 24 hours postoperatively, pain intensity using the NRS scale, and the time to first use of PCA analgesics.

Results: The group receiving the RISS block showed a significant reduction in opioid consumption (20 ± 20 mcg vs. 100 ± 40 mcg, $p < 0.05$), lower pain intensity at hours 1, 3, 6, 12, and 24 ($p < 0.05$), and a longer time to first use of PCA (8 ± 18 hours vs. 3 ± 2 hours, $p < 0.05$).

Conclusion: The RISS block is effective in reducing opioid requirements and controlling postoperative pain after mastectomy. This technique can be a safe and efficient option in postoperative pain management.

Keywords: RISS, Mastectomy, Analgesia, Regional Anesthesia, Pain management

1 INTRODUCTION

Anesthesia options for chest wall and upper abdominal surgery continue to be explored to find options that can satisfy postoperative pain management, surgical operator comfort, and minimize side effects from the anesthesia itself. Local anesthetic infiltration, peripheral nerve block, thoracic epidural anesthesia, paravertebral block, intercostal nerve block are options as adjuvant analgesia for chest wall and upper abdominal surgery in addition to general anesthesia which has

been widely used as standard. One of the analgesia options for post-chest wall and upper abdominal surgery is the Rhomboid Intercostal and Sub-Serratus (RISS) plane block. This technique was introduced by Elsharkawy et al. in 2018 which offers an approach to chest wall and upper abdominal analgesia. [1] This technique can be part of a multimodal strategy to reduce the need for opioids. The advantage of the RISS block is that the injection is away from the surgical site so the medication will not disturb the surgical field or cauterize if given preoperatively.[2]

2 MATERIALS AND METHODS

This study is a pure experimental research with a double-blind randomized control trial design. The subjects in this study were divided into two groups: the experimental group received RISS Block, while the control group received standart anesthesia without adjuvant block. To assign the subjects into either the first experimental group or the control group, randomization was conducted, and blinding was applied to both the subjects and the researcher. Then the pain intensity was assessed using a numerical rating scale (NRS) at 1, 3, 6, 12, dan 24 hours, the duration of the analgesic effect, the total opioid requirement in 24 hours postoperatively . The study was conducted in the operating room of the Central Surgical Installation of a teaching hospital from June to October 2024.

Inclusion Criteria includes adult patients aged 18-80 years undergoing mastectomy surgery with physical status ASA I-II. *Exclusion Criteria include* drug allergy, infection in the area to be blocked , severe cardiovascular disorders, body mass index (BMI) ≥ 35 kg/m2, history of chronic analgesia use , use of blood thinners that have not been stopped according to guidelines and coagulopathy, the patient or patient's guardian refuses to sign a consent form to participate in this study , patients with impaired consciousness*. Drop Out Criteria includes* complications (eg, allergic reactions, severe bleeding, death) and patient was on ventilator postoperatively

2.1 RISS Procedure

- Identification of the location for performing the rhomboid intercostal block (RIB) is carried out, namely right on the medial scapula at the level of T5-T6. The injection identification guide uses ultrasonography (USG).
- The USG machine uses a linear transducer with an oblique sagittal position approximately 1 to 2 cm medial to the medial border of the scapula.[2]
- The following structures need to be identified from superficial to deep: trapezius muscle, rhomboid major muscle, intercostal muscles between the costae bones, pleura, and lungs. Then, identification of the tissue plane between the rhomboid major muscle and the intercostal muscles is carried out.[2]
- A 100 mm sonovisible needle is inserted from cranial to caudal using the in-plane technique. The needle is injected between the rhomboid major muscle fascia and the intercostal muscles. The location of the needle is confirmed with 2 mL of normal saline solution, after which 20 mL of local anesthetic is injected into the fascial plane between the rhomboid major muscle and the intercostal muscles.[3]
- Continued with identification of the location of the sub-serratus block, the linear ultrasound transducer is moved caudally and laterally, distal to the inferior angle of the scapula behind the posterior axillary line.
- Identification of the tissue layers is carried out from superficial to deep, namely the latissimus dorsi muscle, serratus anterior muscle, intercostal muscles between the costae bones, pleura, and lungs.
- The injection needle is inserted into the skin at the same entry site as used for the RIB block, but is directed caudally and laterally through the inferior angle of the scapula. If the needle tip does not extend beyond the inferior edge of the scapula (due to obesity and tall stature), a new skin injection point is used medial to the inferior angle of the scapula and the posterior axillary line.
- The needle location is confirmed with 2 mL of normal saline solution, after which 10 mL of local anesthetic is injected into the tissue plane between the serratus anterior muscle and the external intercostal muscle, performing hydrodissection of the tissue plane between the serratus anterior muscle and the serratus insertion into the costae bone.
- Patients were given PCA morphine demand only analgesia with the following provisions: bolus dose of 20 mcg per squeeze, maximum dose of 100 mcg/4 hours and lockout interval of 6 minutes and ibuprofen 400mg per oral (po) given every 8 hours and paracetamol 500 mg (po) given every 6 hours.
- After the patient moves to the room, the acute pain service (APS) team will evaluate the pain scale at 1, 3, 6, 12, 24 hours postoperatively, the first time the PCA button was pressed and the total opioid consumption data in 24 hours on the PCA machine will be recorded.
- Complications and side effects during surgery and postoperatively such as hypotension, arrhythmia, bradycardia, nausea, vomiting, intravascular injection, lower extremity muscle weakness, and local anesthesia systemic toxicity are recorded in the evaluation recording sheet

2.2 Statistical Analysis

Descriptive analysis aims to describe the characteristics of the subjects and research variables based on the treatment group. Variables that are on a numeric data scale are displayed as the mean and standard deviation (SD) if they are

normally distributed, while if they are not normally distributed, they use the median and *interquartile range* . The normality test aims to assess whether variables such as age (years), height (cm), weight (kg), BMI (kg/m^2), distribution of pain scale variables, total intravenous opioid use, time interval to first postoperative PCA use and quality of postoperative recovery follows a normal distribution. This analysis was conducted using the Shapiro-Wilk test at a significance level of 0.05, where data is considered normal if $p > 0.05$. The homogeneity test is used to evaluate whether the variances between groups are homogeneous. The homogeneity of variance is tested using Levene's test. Variances are considered homogeneous if $p > 0.05$ and not homogeneous if $p \leq 0.05$. Differences in The effectiveness of the block in terms of pain scale, total use of intravenous opioids, time interval between first PCA use postoperatively were assessed based on mean differences, so an independent t-test was used. If the data between the control and treatment groups are not normally distributed, the Mann-Whitney test is applied in the data analysis. Percentages and figures are used to represent qualitative data such as ASA physical status, using 2x2 cross-tabulation analysis. The statistical test applied is the Chi-Square test. Conclusions are drawn based on a 95% Confidence Interval (CI) and a P-value with a significance level of $\alpha < 0.05$. The entire data analysis process is performed using SPSS statistical software.

3 RESULT

The sample's characteristics can be seen in Table 1. All the subjects between the case and the control group were comparable.

Table 1: Subject Characteristics

Patient Characteristics	Group		p-value
	Case (n=20)	Control(n=20)	
Umur (tahun)	49.00 ± 9.25	56.87 ± 11.81	0.52*
BB (kg)	58.20 ± 6.87	56.60 ± 10.66	0.63*
TB (cm)	158.47 ± 4.70	154.87 ± 6.62	0.09*
IMT (kg/m2)	23.12 ± 1.90	23.50 ± 3.36	0.71*
ASA Physical Status			
I, n (%)	7 (47%)	5 (33.3%)	0.36**
II, n (%)	8 (53%)	10 (66.7%)	
Surgery duration (minute)	200.33 ± 32.04	196.33 ± 33.93	0.74*

*independent t-test . **Fisher's Exact , significant if $p < 0.05$

3.1 Comparison of Total 24-Hour Postoperative Fentanyl Consumption in Both Groups

Both groups were given fentanyl with PCA postoperatively in order to compare the differences in the amount of opioid use in 24 hours. Data on total opioid use in 24 hours are shown in Table 2.

Tabel 2: Differences in fentanyl use 24 hours postoperatively between group A and group B

Groups	Group A (general anesthesia+ RISS)	Group B (general anesthesia)	p-value
Total fentanyl 24 hours post-operatively (mcg) (Median ± IQR)	20 ± 20	100 ± 40	< 0.05*

* Mann-Whitney Test.

Data on 24-hour postoperative fentanyl use had an abnormal distribution, so the Mann-Whitney test was performed, then the presentation was displayed in the form of median ± IQR. In group A, the value was 20 ± 20 mcg, while group B had a value of 100 ± 40 mcg. The difference in the amount of fentanyl use was found to be statistically significant with a significant p value ($p < 0.05$).

3.2 Comparison of 24-Hour Postoperative NRS in Both Groups

Patients in group A underwent general anesthesia and intraoperative RISS, while in group B only general anesthesia was performed. The difference in treatment was to see the usefulness of RISS as one of the adjuvant modalities for

intraoperative analgesia until postoperative mastectomy. NRS examinations were performed periodically at 1, 3, 6, 12, and 24 hours postoperatively and were analyzed in both groups. NRS range data in both groups of subjects showed a picture with an abnormal distribution in all time evaluation parameters. Therefore, in table 5.3, the overall NRS value data is displayed in the form of median (IQR). Significance analysis was performed using the Mann-Whitney test for this variable.

Tabel 3: Comparison of NRS values in group A with group B

Group	NRS 1 hour Median (IQR)	NRS 3 hours Median (IQR)	NRS 6 hours Median (IQR)	NRS 12 hours Median (IQR)	NRS 24 hours Median (IQR)
A (RISS)	2 (1)	2 (1)	1 (1)	1 (1)	0 (0)
B	3 (1)	2 (1)	3 (1)	2 (1)	1 (1)
p-value	0.000**	0.004**	0.000**	0.033**	0.000**

**Mann-Whitney test

At 1 hour postoperatively, the median NRS value in group A was 2 (1) while group B had a value of 3 (1). At 3 hours postoperatively, the median NRS value of group A was 2 (1) and B was 2

At 6 hours postoperatively, the NRS in group A was 1 (1) and group B was 2 (1). At 12 hours postoperatively, the NRS value in group A was 1 (1) and in group B was 2 (1). At 24 hours postoperatively, the NRS value in group A was 0 (1) and in group B was 1 (1). All NRS values at 1, 3, 6, 12 and 24 hours postoperatively showed that the NRS values in group A were lower than those in group B, with statistically significant differences ($p<0.05$).

3.3 Comparison of timing of first postoperative opioid administration

The effectiveness of analgesia in both groups was calculated from the time the patient was extubated and transferred to the recovery room until the patient pressed the PCA button for the first time.

Table 4: Time of first postoperative opioid administration in both groups

	Group A (RISS)	Group B	p-value
Time of first postoperative opioid administration (Hours)	8 ± 18	3 ± 2	0.000**
Median + IQR			

**Mann-Whitney test

From the statistical test, there was a significant difference in the first time PCA was squeezed in the treatment group with the control ($p < 0.05$). The analysis showed that the duration of the analgesic effect after mastectomy surgery in the treatment group was longer than the control group. It can be concluded that the group that received RISS block as an adjuvant analgesia in post-mastectomy patients experienced a longer pain-free period compared to the group that was only given IV opioids post-surgery.

4 DISCUSSION

Pain is a major problem experienced by post-mastectomy patients. As many as 20% - 60% of breast cancer patients who undergo mastectomy experience acute pain or chronic pain if not treated adequately. Pain can cause many psychosocial problems and have a major impact on the patient's quality of life. Sleep, stress and difficulty concentrating so that they cannot carry out normal daily activities due to pain are the experiences of patients with breast cancer. Pain also causes a prolonged post-operative recovery period and has an impact on increasing treatment costs. [3,4]

Regional anesthesia has become one of the components of multimodal analgesia in post-operative pain management for breast cancer. Regional anesthesia has also become part of the standard Enhanced Recovery After Surgery (ERAS) protocol for breast cancer surgery. One of the peripheral nerve blocks that can be used is the RISS block. RISS block can provide analgesia from dermatomes T2 to T11 with consistent injection distribution to the lateral cutaneous branches of the intercostal nerves T4 to T9, indicating that this block provides analgesia to the thoracic wall and upper abdominal wall. This study evaluated the effectiveness of RISS block on postoperative pain intensity, opioid requirements and reduction in the incidence of opioid side effects.[5]

In this study, it was found that 24-hour postoperative fentanyl consumption in the group receiving RISS block was significantly lower, namely 20 ± 20 mcg compared to 100 ± 40 mcg in the group not receiving the block ($p < 0.05$). The lower fentanyl consumption in the group receiving RISS block was due to the long duration of analgesia from RISS block until postoperatively, this caused patients to have a low pain scale and did not require additional fentanyl, in contrast to the group not given RISS block, where patients would feel a higher pain scale postoperatively because there were no modalities other than paracetamol and NSAIDs in providing analgesia. Patients in this group would require repeated administration of fentanyl in an effort to reduce the pain scale to a tolerable limit. This is in line with research conducted by Altiparmak et al. where total fentanyl consumption within 24 hours was lower in the group with RISS (30 mcg, IQR 20-40 mcg) compared to the control group (100 mcg, IQR 80-100 mcg) where the p value was <0.001. [6] Another study conducted by Deng et al. showed that rhomboid intercostal and sub-serratus blocks in the management of postoperative mastectomy pain required a lower total 24-hour tramadol consumption in the group given RISS compared to the control group ($p<0.001$).[7]

The combination of RISS assisted by ultrasound and general anesthesia was shown to be effective in reducing postoperative pain intensity compared to the control group ($p<0.05$). In this study, in addition to using PCA fentanyl for postoperative, paracetamol and NSAID ibuprofen were also used in patients who had no contraindications for its use in implementing multimodal analgesia in postoperative pain management. Multimodal analgesia supports reducing postoperative opioid consumption in both groups, but in group A opioid consumption was lower related to the adequate RISS block effect in providing analgesia because the local distribution of anesthesia in the fascial plane between the intercostal, serratus and rhomboid muscles spread both ventrally and dorsally from the thoracic intercostal innervation which provides adequate analgesia in mastectomy patients. Data related to postoperative NRS in this study showed a pattern of pain intensity that tended to decrease in group B (control) in the first 3 hours after surgery, but there was a pattern of increasing NRS values at 6 hours and the use of fentanyl in the increased NRS. While the pain intensity in group A (treatment) was seen to be low from 1 hour after surgery to 24 hours after surgery. [8]

The pain intensity of the group that received RISS block was lower when compared to the group that did not receive treatment. The initial pain scale in group A ranged from NRS 1 - 2, this can be attributed to the long duration of surgery, so that the administration of RISS block at the beginning of surgery had begun to regress and the minimal use of opioids during intraoperatively caused the NRS value in the early hours after surgery not all to be NRS 0. The pain score with postoperative NRS in group A was significantly lower at all evaluation time points (1, 3, 6, 12 and 24 hours after surgery) compared to group B which did not receive treatment ($p < 0.05$). The analgesic efficacy of RISS was reported to be effective in reducing NRS pain scores for 24 hours after surgery. [9] A review by Longo et al on the analgesic efficacy and safety of RISS in breast surgery also reported that the use of RISS can reduce pain intensity at 1, 3, 6, 12 to 24 hours after surgery.[10]

The findings in this study also showed that RISS block administration was associated with significantly longer and adequate analgesia duration compared to the group that was not given RISS block. The time to press the PCA button for the first time after surgery in group A had a median time of 8 hours, while the control group had a median time of 3 hours. This indicates a longer and adequate analgesia effect causing patients to need more time before feeling pain and needing additional analgesia. Metabolism of local anesthetic drugs in plana fascia blocks plays an important role in determining the duration of anesthesia. Local anesthetic drugs such as bupivacaine, lidocaine, and ropivacaine can be metabolized in the liver (systemic metabolism) and can also be degraded locally in the tissue. The rate of this metabolism directly affects the duration of anesthesia. Local anesthetic drugs that have a longer half-life (eg, bupivacaine) usually provide a longer effect than drugs that are more rapidly metabolized (such as lidocaine).[11]

The choice of local anesthetic type will affect the duration of blockade. The addition of adjuvants such as vasoconstrictors (eg, epinephrine) can prolong the duration of action of local anesthetics. Vasoconstrictors slow blood flow in the injection area, thereby reducing the systemic metabolic rate and increasing the duration of drug action. In a systematic review study conducted by Wang et al., it was reported that the prevalence of severe pain after breast surgery reached 10.9%. [12] In this study, complications of acute pain after mastectomy with NRS ≥ 7 were not found in either group. This may have occurred because all patients, both control and treatment, received multimodal analgesia using PCA. Related to the side effects of opioid use such as pruritus, nausea-vomiting or postoperative ileus were not found in either group.

In addition to the statistical findings obtained in this study, researchers also noticed that there were differences in the use of drugs during intraoperatively, the use of anesthesia maintenance was observed to be lower in the group that received the RISS block, this contributed to the pharmacoeconomic aspects of patients who underwent the RISS block. In general, this study reported that RISS using local anesthesia bupivacaine plain 0.25% volume 30 ml (20 ml in Rhomboid interostal block and 10 ml in Sub-serratus plane block provides good 24-hour postoperative analgesia efficacy, thus providing direct benefits to patients, namely reducing postoperative pain.

The decrease in perioperative opioid consumption is directly related to cost-efficiency, so it will be beneficial for the hospital and insurance agency that guarantees the patient. In addition, the RISS block is easy to perform even in patients

with different demographic profiles, does not interfere with the surgical operator because the injection point is far from the surgical field, and is safe because it is assisted by the use of ultrasound. RISS is expected to be part of the ERAS protocol to improve the quality of perioperative care in patients undergoing mastectomy surgery.

5 CONCLUSION

TAP block with semilunar line approach is an effective and safe analgesia adjuvant for colorectal laparotomy.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

Statement of ethical approval

Ethical approve is already been obtained and informed consent have been obtained for every samples.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

REFERENCES

[1] Altlparmak, B. et al. (2020) 'Evaluation of ultrasound-guided rhomboid intercostal nerve block for postoperative analgesia in breast cancer surgery: a prospective, randomized controlled trial', Regional anesthesia and pain medicine. Reg Anesth Pain Med, 45(4), pp. 277–282. doi: 10.1136/RAPM-2019-101114.

[2] Yayik, A. M. et al. (2019) 'An alternative plane block for multiple rib fractures: Rhomboid Intercostal and Sub-Serratus block (RISS)', The American journal of emergency medicine. Am J Emerg Med, 37(12), pp. 2263.e5-2263.e7. doi: 10.1016/J.AJEM.2019.158429.

[3] Fisher, B. et al. (2002) 'Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer', The New England journal of medicine. N Engl J Med, 347(16), pp. 1233–1241. doi: 10.1056/NEJMOA022152.

[4] Jiang, C. W. et al. (2021) 'Comparison of rhomboid intercostal nerve block, erector spinae plane block and serratus plane block on analgesia for modified radical mastectomy: A prospective randomised controlled trial', International journal of clinical practice. Int J Clin Pract, 75(10). doi: 10.1111/IJCP.14539.

[5] Piraccini, E. (2020) 'Rhomboid Intercostal Block for Breast Surgery: An Alternative to the Erector Spinae Plane Block?', Turkish Journal of Anaesthesiology and Reanimation. Turkish Society of Anaesthesiology and Reanimation, 48(4), p. 346. doi: 10.5152/TJAR.2020.46158.

[6] Kozanhan, B. et al. (2019) 'Rhomboid Intercostal and Subserratus Plane block for modified radical mastectomy and axillary curettage in a patient with severe obstructive sleep apnea and morbid obesity.', Journal of Clinical Anesthesia, 57, pp. 93–94.Deng,

[7] W. et al. (2021) 'Rhomboid intercostal block combined with sub-serratus plane block versus rhomboid intercostal block for postoperative analgesia after video-assisted thoracoscopic surgery: a prospective randomized-controlled trial', BMC Pulmonary Medicine. BMC, 21(1), p. 68. doi: 10.1186/S12890-021-01432-7.

[8] Scott, K. B., Johns, D. and Agarwal, C. A. (2022) 'Mastectomy', Atlas of Operative Techniques in Gender Affirmation Surgery. StatPearls Publishing, pp. 211–232. doi: 10.1016/B978-0-323-98377-8.00021-X.

[9] Sherwin, A. and Buggy, D. J. (2018) 'Anaesthesia for breast surgery', BJA Education. Elsevier, 18(11), p. 342. doi: 10.1016/J.BJAE.2018.08.002.

[10] Sung, H. et al. (2021) 'Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries', CA: A Cancer Journal for Clinicians. American Cancer Society, 71(3), pp. 209–249. doi: 10.3322/CAAC.21660.

[11] Bansal, P., Sultania, N. and Bansal, K. (2023) 'Rhomboid intercostal sub serratus plane block – Same bird with different horizons', Asian Journal of Medical Sciences, 14(12), pp. 305–307.

[12] Kumar, S. et al. (2018) 'A randomised controlled study of the post-operative analgesic efficacy of ultrasound-guided pectoral nerve block in the first 24 h after modified radical mastectomy', Indian Journal of Anaesthesia. Wolters Kluwer -- Medknow Publications, 62(6), p. 436. doi: 10.4103/IJA.IJA_523_17

[13] Elsharkawy, H. et al. (2018) 'Rhomboid Intercostal and Subserratus Plane Block: A Cadaveric and Clinical Evaluation', Regional anesthesia and pain medicine. Reg Anesth Pain Med, 43(7), pp. 745–751. doi: 10.1097/AAP.0000000000000824.