Efficacy of Two Volumes of Bupivacaine 0.375% on Postoperative Analgesia in Ultrasound-guided Rhomboid Intercostal Block in Modified Radical Mastectomy: a Randomized Controlled Trial

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ABSTRACT

Background: Rhomboid intercostal block (RIB) is a novel regional analgesia procedure which controls pain after surgery involving the chest wall. The current study aimed to compare the postoperative analgesia of two different volumes of bupivacaine for an ultrasound (US)-guided RIB in cases undergoing modified radical mastectomy (MRM).

Methods: This study was a randomized controlled double-blinded study that comprised 82 cases and was scheduled for MRM under general anesthesia (GA), cases were randomly assigned into 2 equal groups; RIB with 25 ml of 0.375% isobaric bupivacaine in 41 patients (Group V 25) and rhomboid intercostal plane block with 40 ml of 0.375% isobaric bupivacaine in 41 patients (Group V 40).

Results: There were no significant differences between the two groups as regards demographic data, ASA score, and duration of surgery and post-anesthesia care unit (PACU) stay. In terms of pain assessment, post-operative VAS at 2, 4, 8, 16, and 24h postoperative during rest and arm movement were comparable in both groups and the total 24 hours postoperative morphine requirements has no significant difference between 2 groups .

Conclusion: Regarding MRM and from the results of the current study we concluded that US-guided RIB provides efficient post-operative analgesia. In addition, both volumes provide comparable post-operative analgesic effects with regard to postsurgical 24hr opioid consumption, analgesic requirement, hemodynamics, and pain score.

Keywords: rhomboid intercostal block, Breast Neoplasms, Mastectomy, Pain, Postoperative, Analgesia, Ultrasonography, Interventional, local anesthetic, bupivacaine, Analgesics, Opioid, different volumes.

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INTRODUCTION

Breast cancer is the commonest cancer in females ***(Ghoncheh et al., 2016)***. Modified radical mastectomy (MRM) has been considered the primary procedure in the context of breast cancer management. It consists of removing the whole breast including skin, areola, nipple, and axillary lymph nodes (LNs) while preserving the pectoralis major muscle (PMM) ***(Lyman et al., 2014)***. Acute pain control prevents surgical response and decreases the need for opioids and analgesics to preserve immune function ***(Richebé et al., 2011)***. Opioids especially morphine was recorded to be associated with higher frequencies of infection and recurrence, even metastasis through suppression of both cellular and humoral immunity ***(Afsharimani et al., 2011)***.

The regional anesthetic technique proved better control of Acute pain and hence less chronic pain ***(Souzdalnitski et al., 2010)***. There are many techniques for regional anesthesia in breast surgeries. For example, thoracic epidural blockade, thoracic paravertebral blockade, intercostal nerve blockade, and local wound infiltration. Besides neurological complications of thoracic epidural and paravertebral blocks such as bradycardia, hypotension, intravascular injection, paraplegia, epidural hematoma, and total spinal there is technical difficulty and these blocks require highly skillful anesthesiologists, so it is not preferable in routine use ***(Norum and Breivik, 2011, Tahiri et al., 2011)***.

Thoracic Paravertebral blockade and intercostal nerve blockade are accompanied by greater rates of adverse events which include pneumothorax and Horner syndrome and there is a higher risk of local anesthetic (LA) toxicity ***(Schnabel et al., 2010)***. Ultrasound (US) has an essential role in the development of regional anesthesia of the breast. Many interventions developed after detailed knowledge of the sonographic anatomy of fascial planes of the breast and back such as pectoral nerve block I and II, serratus plane block, erector spinae plane block, and rhomboid intercostal block (RIB) ***(Diéguez et al., 2016)***.

The RIB is a new procedure. It is recently described as controlling acute and chronic pain in the chest wall and thoracoscopic surgery***(Elsharkawy et al., 2016)***. The easiness and rapidness and safety of this technique (RIB) make

it the best choice for controlling pain in breast surgery ***(Altıparmak et al., 2020)*.**

Of note, there is no study comparing different volumes of injectate on the quality of postoperative analgesia in MRM, so we hypothesize that a lower volume of injectate with the same concentration is accompanied by a comparable efficacy of analgesia. Here, in the current study, we aimed to compare and assess the efficiency of two different volumes with the same concentration of bupivacaine in the US-guided RIB in reducing postoperative pain (POP) after a modified radical mastectomy.

PATIENTS AND METHODS

This study was a randomized controlled double-blinded study. The total number of recruited patients was 100 patients, and from them, 82 patients fulfilled the eligibility criteria and were scheduled for modified radical mastectomy under GA. The study was carried out at the Oncology Center, Mansoura University (OCMU) from September 2021 to September 2022 after obtaining approval from the Institutional Research Board, Faculty of Medicine, Mansura University on the date 22/04/2021, code no. **(MD.21.04.455)**. Informed written consent was taken from all patients enrolled in this study.

This study included female cases aged between 25-65 years with physical status I or II based on the American Society of Anesthesiologists (ASA) and would have an elective unilateral modified radical mastectomy, but we excluded patients with allergy to the LA, with infection at the injection site, with bleeding diathesis, with hepatic, cardiac, and renal failure and their BMI was $\geq$40 kg/m^2

Randomization and blinding

Cases were haphazardly allocated by a computer-generated randomization table and group allocation was concealed in sequentially numbered, sealed opaque envelopes, cases were haphazardly assigned into 2 equal groups; RIB with 25ml of 0.375% isobaric bupivacaine in 41 patients (Group V 25) and RIB with 40ml of 0.375% isobaric bupivacaine in 41 cases (Group V 40).

Methods

The investigator visited the patient the day before the operation and took a complete history, physical examination, and laboratory investigations (complete blood picture, blood sugar level, coagulation profile, liver function tests, and renal function tests). Entire cases were informed about the study protocol and the nature of the block. A linear visual analog scale (VAS) on a scale of 0-10 cm (0 for no pain and 10 for worst pain) was explained to each patient ***(Hawker et al., 2011, Kommuru et al., 2014)*.** All patients were instructed to fast for 6h before surgery time and were given lactated ringer of 8 ml/kg to restore the fasting fluid deficit on the morning of surgery. In the pre-anesthesia room, the investigator applied routine monitoring [electrocardiogram, non-invasive blood pressure (NIBP), heart rate (HR), and pulse oximetry] and inserted a 20-gauge canula and gave the patient 2mg midazolam as a premedication. In the operating room, the researcher attached standard monitoring devices including E.C.G., pulse oximetry, NIBP, and capnography. GA was induced by 1 µg/kg fentanyl, 2 mg/kg propofol, and 0.5 mg/kg atracurium besylate to enhance tracheal intubation. After ensuring full muscle relaxation, an endotracheal tube (ETT) was inserted, its proper position was confirmed by auscultation and capnography then secured in place. The anesthesiologists kept anesthesia by isoflurane 1-2 minimum alveolar concentration guided by hemodynamic stability with subsequent doses of atracurium besylate 0.1 mg/kg every 20-30 minutes to ensure adequate muscle relaxation. Also, he maintained Ventilation using volume-controlled ventilation with initial setting [tidal volume (VT) 6-8ml/kg, respiratory rate (RR) 10-14 breath/min, (I: E ratio) 1:2 to keep end-tidal carbon dioxide (Et CO2) 30-40 mmHg] then we put the patient in the lateral position to give the block.

Rhomboid Intercostal Plane Block Technique

The RIB is applied in the area described as the triangle of auscultation situated on the medial scapular edge. This region is related superiorly by the lower margin of the trapezius, distally by the latissimus dorsi, and laterally by the medial scapular border. The lower edge of the rhomboid major muscle (RMM), the lateral portion of the erector spinae muscle (ESM), and the serratus anterior muscle, which are all located above the sixth and seventh ribs and their intercostal muscles, make up the triangle's floor**.** The RIB was carried out by injection to the upper intercostal muscle plane and underneath the rhomboid muscles.

The patient was positioned in lateral decubitus with the involved breast lying superiorly. The ipsilateral arm was adducted across the chest to shift the scapula laterally and open up this space. A linear US transducer (6–12MHz) was positioned medial to the inferior margin of the scapula with the orientation marker pointed cranially. The US landmarks, trapezius muscle, rhomboid muscle, intercostal muscles, pleura, and lung were recognized. A single injection was given at the T6-7 level into the tissue plain situated between the RMM and intercostal muscles. Under a complete aseptic situation, an 80mm 21-gauge needle-guided US was introduced at the level of T6-7. To validate the correct needle tip location after no blood or air

was aspirated, the rhomboid intercostal plane was hydro-located with 2 mL of normal saline. A single injection of 25mL (group V 25) OR 40mL (group V 40) of 0.375% isobaric bupivacaine according to group allocation was applied into the interfascial plane between the RMM and intercostal muscles. By using ultrasonography, the distribution of the LA under the rhomboid muscle was visualized. The same anesthesiologist performed all block procedures. After that, the patient was positioned in the supine position.

After surgery, all patients were extubated after fulfillment of the criteria of extubation and after giving reversal with neostigmine (0.05mg/kg) and atropine (0.02 mg/kg) and the cases were transferred to the post anesthesia care unit (PACU). The operative duration was documented. Entire cases received standard postoperative analgesia (1gm Paracetamol every 8 hours IV). An initial dosage of 2mg (Bw < 60kg) or 3 mg (Bw > 60kg) with subsequent administration of 3mg of morphine every 15 min till required or adverse events happened. This has occurred at time points of VAS score assessment if VAS >3 and on patient request if needed.

Fig. (1): Placement of US-probe for the performance of RIB ***(Altıparmak et al., 2020)*.**

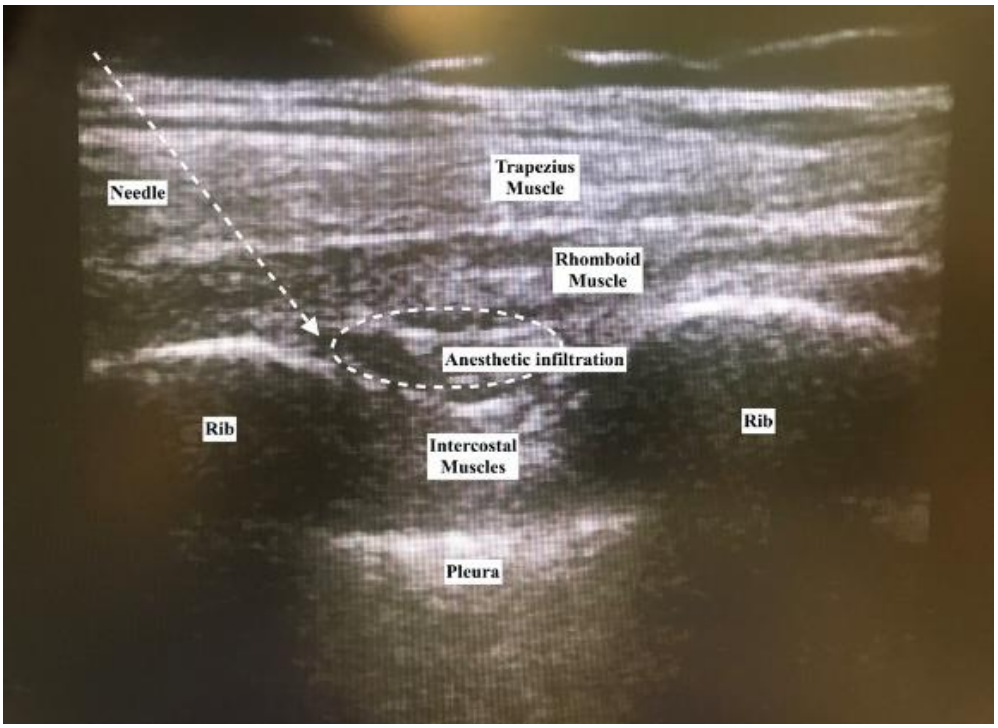

Fig. (2): The landmarks of RIB and LA injection under US view ***(Altıparmak et al., 2020).***

Collected Data

- The total analgesic requirements during the initial 24h Postoperative.
- The duration of analgesia: time of first analgesic request from the start of surgery.
- Postoperative visual analog score (VAS) and at 2,4,8,16,24 Hours postoperatively.
- Postoperative complications.

Statistical Analysis

IBM's SPSS Statistics for Windows (version 25) was utilized for the statistical analysis of the collected data. Shapiro-Wilk test was utilized to evaluate the normal distribution of the data distribution. Normal distribution of continuous variables were expressed as mean±SD whereas categorical variables and the abnormal distribution of continuous ones were expressed as median and IQR or number and percentage. One-way ANOVA and Kruskal Wallis tests were used for normal and abnormal distribution of continuous data correspondingly. Chi-square test was utilized for categorical data using the crosstabs' function. Entire tests were carried out with a 95% CI. If needed, bivariate correlations were evaluated by utilizing Pearson's correlation coefficient based on the studied data. P value < 0.05 was considered statistically significant.

RESULTS

This study recruited 100 patients. 82 patients met the inclusion criteria. There were no significant differences between the two groups as regard sociodemographic data, ASA score, duration of surgery, and PACU stay (**Table 1).**

Intra-operative block-related adverse effects including hypotension, bradycardia, and the need for intraoperative ephedrine and atropine showed no significant differences between the two groups **(Table 2,3)**. In terms of pain assessment, post-operative VAS at 2h, 4h, 8h, 16h, and 24h postoperative during rest and arm movement were comparable in both groups (**Table 4)**. In addition, there were no statistically significant differences between the two groups concerning the need for rescue analgesia, the time of the 1st analgesic request, and the total 24-hour postoperative morphine requirements (**Table 5)**. Post-operative block or morphine-related side effects including nausea, vomiting, pain at the injection site, or pneumothorax revealed no significant differences between both groups (**Table 6)**.

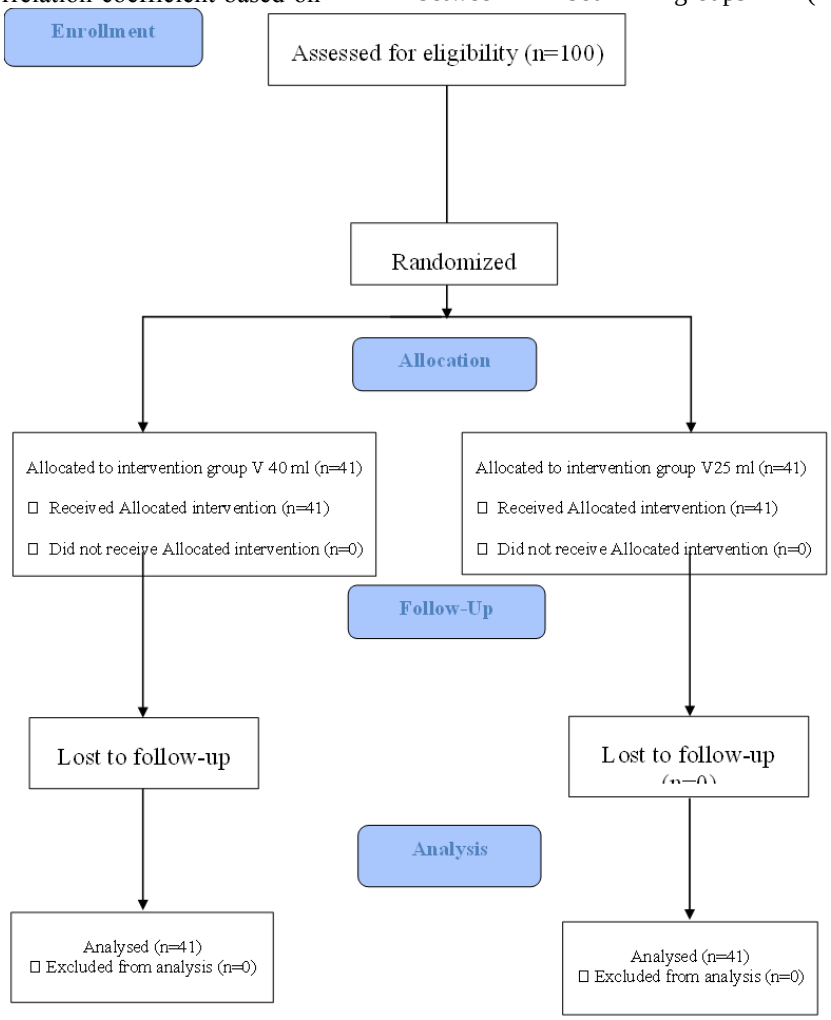

Figure (3): Consort flow chart showing study design.

Table (1): Demographic characteristics, duration of the surgery, PACU, and ASA classification of the studied groups.

		40 ml group (n= 41)	25 ml group (n= 41)	95% CI	P-value
Age (years)		51.20 ± 9.885	50.66 ± 11.579	-4.20, 5.27	0.822
BMI (kg/m2)		36.23 ± 8.123	35.50 ± 7.852	-2.79, 4.24	0.682
duration of surgery (minutes)		89.27 ± 28.053	101.71 ± 29.146	-25, 0.1	0.052
PACU stay (minutes)		34.59 ± 5.744	32.76 ± 6.041	-0.76, 4.42	0.164
ASA	**I**	21 (51.2%)	25 (61.0%)	-	0.373
	II	20 (48.8%)	16 (39.0%)		
P is significant when < 0.05. **BMI: body mass index** **PACU: post-anesthesia care unit.**					

Table (2): Block-related intraoperative complications of the studied groups.

Intraoperative complications	40 ml group (n= 41)	25 ml group (n= 41)	Odds ratio	P-value
Hypotension	7 (17.1%)	11 (26.8%)	1.78	0.286
Bradycardia	8 (19.5%)	6 (14.6%)	0.71	0.557
P is significant when < 0.05.				

Table (3): Intraoperative need for ephedrine and atropine of the studied groups.

	40 ml group (n= 41)	25 ml group (n= 41)	95% CI/ Odds ratio	P-value
Need for Ephedrine	7 (17.1%)	11 (26.8%)	1.78	0.286
Ephedrine dose (mg)	18.57 ± 6.268	23.64 ± 12.667	16.06, 5.93	0.343
Need for Atropine	8 (19.5%)	5 (12.2%)	0.57	0.364
Atropine dose (mg)	0.50 ± 0.0	0.50 ± 0.0	-	1
P is significant when < 0.05.				

Table (4) Postoperative VAS score at rest and movement of the studied groups.

	40 ml group (n= 41)	25 ml group (n= 41)	95% CI	P-value
VAS at rest				
2 hours	2.15 ± 1.682	2.41 ± 1.612	-0.99, 0.46	0.463
4 hours	3.12 ± 1.873	3.27 ± 1.858	-0.97, 0.67	0.723
8 hours	4.61 ± 1.759	4.88 ± 1.900	-1.07, 0.54	0.509
16 hours	3.12 ± 1.503	3.22 ± 1.557	-0.77, 0.58	0.774
24 hours	3.07 ± 1.780	3.27 ± 1.817	-0.99, 0.60	0.625
VAS at movement				
2 hours	4.32 ± 2.103	4.02 ± 1.739	-0.56, 1.14	0.494
4 hours	5.59 ± 2.168	5.39 ± 2.120	-0.75, 1.14	0.681
8 hours	5.22 ± 1.810	5.78 ± 2.162	-1.44, 0.32	0.206
16 hours	4.56 ± 1.689	4.73 ± 1.659	-0.91, 0.56	0.645
24 hours	4.98 ± 1.796	5.07 ± 1.794	-0.89, 0.69	0.806
VAS: visual analogue scale				

Table (5): Postoperative analgesic profile of the studied groups.

	40 ml group (n= 41)	25 ml group (n= 41)	95% CI/ Odds ratio	P-value
Need for rescue analgesia	34 (82.9%)	36 (87.8%)	1.48	0.532
Time of the first request of analgesia (hours)	4.85 ± 2.204	4.06 ± 1.835	-0.17, 1.76	0.104
Total morphine requirement	5.49 ± 4.237	6.22 ± 4.102	-2.56, 1.10	0.429

24hr (mg)				
P is significant when < 0.05.				

Table (6): Relevant postoperative complications of the studied groups.

Postoperative complications	40 ml group (n= 41)	25 ml group (n= 41)	Odds ratio	P-value
Nausea	5 (12.2%)	6 (14.6%)	1.23	0.746
Vomiting	1 (2.4%)	2 (4.9%)	2.05	0.556
Pain at the injection site	5 (12.2%)	2 (4.9%)	0.37	0.236
Pneumothorax	0 (0.0%)	0 (0.0%)	1	1
P is significant when < 0.05.				

DISCUSSION

Breast cancer is the commonest cancer in females ***(Ghoncheh et al., 2016)*.** Modified radical mastectomy (MRM) is the primary procedure in the context of breast cancer management. It consists of removing the entire breast including skin, areola, nipple, and axillary LNs while preserving the PMM ***(Lyman et al., 2014)*.** On the other hand, preceding research demonstrated that acute POP could be associated with delay in wound healing, depressed respiration, hemodynamic instability, and anxiety and is highly accompanied by the development of chronic pain ***(Poleshuck et al., 2006, Chen et al., 2022)*.** To treat these issues, doctors often prescribe opioids. On the other hand, an increase in opioid use has negative adverse events, including sedation, emesis, and prolonged length of hospital stay (LOS) ***(Benyamin et al., 2008)***. Alternative approaches to enhancing patient comfort and delivering efficient analgesia have been explored ***(Stanley et al., 2012)***. The RIB could be carried out by injection to the upper intercostal muscle plane below the rhomboid muscle. It could provide analgesia at the T3–T9 levels ***(Elsharkawy et al., 2016)*.**

Research on the role of nerve blockade for postsurgical analgesia following breast surgery has been conducted. ***(Morioka et al., 2015, Wahba and Kamal, 2014)***, yet, there is little research on block efficacy for breast surgery ***(Karaca et al., 2019)*.** Furthermore, the amount and concentration of LA haven't been emphasized in the literature. Thus, the current study aimed to compare and evaluate the efficiency of 2 different volumes with the same concentration of bupivacaine in the US-guided rhomboid intercostal plane block in reducing the POP after an MRM.

This was a controlled double-blinded study that comprised 82 cases, scheduled for MRM under GA. The study was carried out at the Oncology Center, Mansoura University (OCMU) for 12 months from September 2021 to September 2022. Regarding demographic and clinical parameters, the current study demonstrated that; there were no statistically significant differences between both groups as regards all demographic data, ASA score and duration of surgery, and PACU stay. Such outcomes demonstrated that both groups were comparable and such data weren't interfering with the results.

As regards the total 24-hour postoperative morphine requirements, the present study revealed that there were no significant differences between both groups with regard to the need for rescue analgesia, the time of the 1st analgesic request, and the total 24-hour postoperative morphine requirements. **Deng and his colleagues** conducted a double-blinded, single-center, prospective randomized trial on 100 patients undergoing VATS to receive RIB who were divided into four groups randomly: control group with no RIB and R0.2%, R0.3%, and R0.4%; they underwent common anesthesia in addition to the RIB with ropivacaine at 0.2%, 0.3%, and 0.4% in a volume of 30ml. They demonstrated that at 0.2% ropivacaine RIB, the patient's time to first postsurgical analgesic need is short, the postsurgical 48h opioid dosage is large, the injection amount of parecoxib is large, and the patient satisfaction is low. When the ropivacaine value increased to 0.3%, there was a significant improvement, however, when the ropivacaine value increased to 0.4%, there was no significant change ***(Deng et al., 2022)***.

Ekinci and his colleagues who made a study on 90 ASA status I–II female cases aged between 18 and 65 years who scheduled breast augmentation surgery under GA were comprised. The patients were haphazardly divided into 3 groups (Group 20 = 20 ml of anesthetic solution, Group 30 = 30 ml anesthetic solution, and Group K = Control group). The post-surgical evaluation was conducted by utilizing the VAS score. The VAS scores were recorded postoperatively at 1h, 2h, 4h, 8h, 16h, and 24h. They found that Groups 20 and 30 had statistically significantly decreased fentanyl consumption than the Control group ($p>0.05$). Between Group 20 and Group 30, there was no statistically significant difference in fentanyl consumption. ***(Ekinci et al., 2019)*.**

Along the same line, **Jiang and his colleagues** who conducted a study on 90 patients were haphazardly divided into 3 groups receiving

US-guided SAB, ESP block (ESPB), and RIB. Entire groups received 20mL 0.5% ropivacaine. Within 24 hours post-surgical, the cases received an IV injection of tramadol 1-2mg/kg in the surgical ward for pain relief. They have displayed that; US-guided RIB could efficiently decrease the tramadol dosage within 24h after MRM, and it could efficiently alleviate pain within 24h following MRM in comparison with serratus plane block ***(Jiang et al., 2021).***

Tramadol dosage in the RIB (269.67±48.75 mg) and ESPB groups (273.67±36.90mg) was significantly less than that in the SAB group (314.33±18.88mg) 24 hours after the procedure (P .001). Within 24 hours, there was no significant difference in the amounts of tramadol consumed between the ESPB and RIB groups (P =.676). When patients were active, the numerical rating scale (NRS) scores in the ESPB and RIB groups were significantly lower than those in the SAB group at 0.5, 1, 3, 6, 12, 18, and 24 hours after the operation (P .05 for all comparisons); however, within 24 hours after surgery, when patients were active, there was no significant difference between the NRS scores of the RIB and ESPB groups ***(Jiang et al., 2021).***

This came in the same line with **Deng and his colleagues** who conducted their study to evaluate the analgesic actions of the RIB and RISS block following VATS. They have displayed that both US-guided RIB and RISS block could efficiently decrease the requirement for sufentanil within 24h following VATS and less sufentanil dosage is needed in patients with RISS block. US-guided RIB alone and RISS block could efficiently alleviate pain within 24h after VATS and RISS block blocker is more effective ***(Deng et al., 2021).***

In their experiment, **Deng and his colleagues** discovered that the NRS score was 3/10 and the dynamic score was 5/10 within 12 hours of the surgery after the injection of 20ml 0.375% ropivacaine with the RIB, and no rescue analgesia was needed. On the other hand, the RIB's analgesic effect was poor in the first 12 to 24 hours following surgery, when the mean NRS score was around four this may be attributed to different injectate as they inject ropivacaine instead of bupivacaine ***(Deng et al., 2021).***

Accordingly, one case study conducted by **Ökmen and his colleagues** showed that the RIB may be as effective as other plane blocks applied to the thoracic region. But more information from ongoing research is still needed ***(Ökmen, 2019).***

Likewise, **Elsharkawy and his colleagues** have shown that the RISS block appears to have a significant role in the control of perioperative pain after abdominal surgeries, adding to the multimodal analgesic regimen ***(Elsharkawy et al., 2020).***

In terms of pain assessment, the present study demonstrated that; post-operative VAS at 2h, 4h, 8h, 16h, and 24h postoperative during rest and arm movement were comparable in both groups. In the same line, **Başak Altıparmak and his colleagues** conducted that Participants in the study had to be between the ages of 18 and 70, have an ASA status of I or II, and be scheduled for an elective unilateral MRM with axillary LN dissection. Patients were divided into two groups, each with 30 cases. The first group of patients group R had US-guided RIB with 30mL of 0.25% bupivacaine. Group C, the control group, did not receive any block interventions. They have demonstrated that; There was no difference in NRS scores between groups except postsurgical 12th hour ***(Altıparmak et al., 2020).***

Chen and his colleagues (2022) conducted a meta-analysis on RIB and evaluated the analgesic efficiency and safety of RIB following thoracic surgery and breast surgery. They found that with regard to NRS, the RIB group demonstrated a significant reduction in scores compared to the no-block group in 0–1 and 6–8h, which mean a lower pain level in the RIB group. Although there was no significant difference between groups in NRS at the resting time of the initial 24h, RIB demonstrated promising postsurgical analgesic effects, that could be helpful in early postsurgical rehabilitation of cases ***(Chen et al., 2022)***.

Concerning block-related intraoperative complications, the current study revealed that RIB was associated with hypotension and bradycardia compared to baseline in both groups. However, both groups demonstrated insignificant differences (P>0.05). Also, the intraoperative need for ephedrine and atropine in the studied groups was insignificant.

Also, **Elsharkawy and his colleagues** conducted a case series of 21 cases who were undergoing abdominal surgeries. They have demonstrated that; the RISS block provided efficient postsurgical analgesia. Additionally, they demonstrated that; there were variations in the dermatomal coverage ranging from T3 to T12. They demonstrated that; the adverse events of the rhomboid intercostal block included blood loss, hematoma, hypotension, internal organ injury, catheter site infection, and LA toxicity were reported ***(Elsharkawy et al., 2020)*.**

But multiple studies hadn't recorded any rhomboid intercostal block-related complications ***(Altıparmak et al., 2020, Ciftci et al., 2021, Deng et al., 2021, Jiang et al., 2021)***

The current study demonstrated that; post-operative block or morphine-related side effects

including nausea, vomiting, pain at the injection site, or pneumothorax demonstrated no significant differences between both groups. **Chen and his colleagues** have demonstrated that a lot of research recorded that the RIB group has limited number of postsurgical adverse events. The commonest adverse event was PONV, and there was a significant difference between the RIB and no block groups. PONV incidence was 10.30% in the RIB group and 34.60% in the no-block group, correspondingly. This could be owing to low fentanyl consumption in the RIB group. Emesis is mostly owing to vagal excitation, hypotension, abdominal distension, and opioid consumption. A RIB doesn't affect the vagus nerve, has minimal effects on hemodynamic parameters, and the postoperative opioid consumption is rare, as a result, emesis incidence is low to some extent ***(Chen et al., 2022)***.

Likewise, **Ekinci and his colleagues** found that emesis incidence was increased in the control group compared to the other groups, although there was no significant difference between groups 20 and 30, as shown by ***(Ekinci et al., 2019).***

Obviously, opioid tolerance (the need to increase the dosage to get the same analgesic effect) and opioid-induced hyperalgesia (paradoxical increase in pain with opioid administration) could participate in poorly controlled pain and dosage escalation. RIB may decrease opioid consumption, with subsequent prevention of Opioid-induced hyperalgesia ***(Cata et al., 2016, Colvin et al., 2019)***.

In addition, low opioid consumption and good analgesia provided by the RIB group abolish postoperative respiratory depression and allow patients to take adequate tidal volumes and respiratory rate which prevent postoperative atelectasis and pulmonary infections. Another benefit is that low-dose opioids could be associated with different potential advantages, which include the minimal possibility of constipation and pruritus. Shortly, low opioid consumption and good analgesia provided by RIB could participate in enhanced recovery following the operation ***(Chen et al., 2022).***

LIMITATIONS

We didn’t evaluate the sensory dermatomal block or the radiological spread of the LA, as the variation in their spread leads to differences in the intensity and duration of the block. We didn’t use catheters. However, we wanted to evaluate the duration of single-shot blocks. The VAS scale is a subjective method for the assessment of pain and needs patients to be intelligent and cooperative, so it is not an accurate method for assessment.

CONCLUSION

Regarding modified radical mastectomy and from the results of the current study we concluded that US-guided RIB provides effective post-operative analgesia. In addition, both volumes provide comparable post-operative analgesic effects in terms of postoperative 24hr opioid consumption, analgesic requirement, hemodynamics, and pain score.

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