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ORIGINAL ARTICLE

Ultrasound Guided Serratus Plane Block For Analgesia In Patients Undergoing Mastectomy Surgery

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Abstract

Background: Significant postoperative discomfort is frequently experienced by patients undergoing modified radical mastectomy (MRM). This study aimed to assess whether administering an ultrasound-guided serratus plane block (SPB) in addition to standard general anesthetia could optimize intraoperative and postoperative analgesia in patients undergoing MRM, as compared to placebo.

Methods: In a prospective, double-blind, randomized research, thirty women scheduled for MRM were randomly assigned to receive 30 mL of either normal saline (control, or "GC" group) or 0.25% bupivacaine (serratus, or "GS" group) under ultrasound guidance before conventional general anesthesia was administered. The primary outcome was postoperative pain scores using VAS during movement and at rest. Secondary measures included time to initial rescue analgesia, total 24-hour morphine consumption, hemodynamic stability (heart rate and mean arterial pressure), intraoperative fentanyl use, complications, and mobilization within the first 12 hours.

Results: The GS group had significantly lower mean VAS scores at rest and with movement at all measuring times. The GS arm had lower intraoperative fentanyl usage, consumed less morphine over 24 hours, and showed longer first time to rescue analgesia ($p<0.001$ for all). Compared to 33% of controls, 80% of GS patients mobilized within 12 hours ($p=0.02$). Those who received SPB had stable hemodynamic parameters ($p<0.05$). There were no complications that might be linked to the block.

Conclusion: When combined with general anesthesia for MRM, ultrasound-guided SPB provides better intra- and postoperative pain control, prolongs the time to first rescue morphine, reduces the need for opioids, and encourages faster mobilization without sacrificing hemodynamic stability.

Keywords: Modified radical mastectomy, Serratus plane block, Regional anesthesia, Analgesia

INTRODUCTION

Breast surgery is one of the most frequent surgical operations performed in females. It is reported that 40% of women will experience severe acute postoperative pain after mastectomy surgery and inadequate management of pain will develop chronic post-mastectomy pain syndrome; estimated to affect about 25% to 60% of patients **[1,2]**.

There is strong scientific support for using regional block techniques as an adjuvant to general anesthesia in breast surgery. This technique improves the control of severe postoperative pain, decreasing the need for opioids with their related side effects, lowers the incidence of developing chronic postoperative pain syndrome, helps better postoperative rehabilitation and decreases pulmonary and cardio-vascular complications **[3,4]**.

Using ultrasound guided techniques has led to a significant change in the practice of regional anesthesia. **Blanco and his colleagues** demonstrated the Pectoral Nerve Block (PECS), a less invasive technique. Blocking the pectoral, intercosto-brachial, intercostals II, III, IV, V, VI, and long thoracic nerves is the goal of this approach **[5]**.

Following additional work on the Pecs I and II blocks, a more thorough ultrasound analysis of the thoracic cage's anatomical details revealed two possible potential spaces: one deep (between the serratus anterior muscle and the intercostal nerves) and one superficial (between the latissmus dorsi muscle and the serratus anterior muscle). As feedback, a safe and easy anesthetic block technique is developed which is called the serratus plane block (SPB) [**6]**.

This technique blocks the anterior and lateral branches of the intercostal nerves, the long thoracic nerve, the thoraco-dorsal nerve, and the axillary compartment. It provides effective postoperative analgesia after shoulder surgery, for esophagectomy, in thoracotomy, and for pain control in rib fractures **[6,7,8,9]**. The SPB is a good alternative to thoracic epidural anesthesia or paravertebral block given for pain after surgical procedures manipulating lateral and anterior chest wall **[10]**.

The study aimed to evaluate postoperative analgesic efficacy (using VAS score for pain as a primary outcome) of US guided SPB in patients undergoing modified radical mastectomy (MRM) surgery. Secondary outcomes were time to first rescue analgesia, total perioperative opioid consumption, and incidence of postoperative complications

METHODS

The Prospective clinical trial that was randomized, controlled, and double-blind was conducted at Zagazig University Hospitals between February 12, 2018, and March 20, 2020. Institutional Review Board (IRB) approval number 4276 and written informed consent from patients was acquired. Human subjects' research adhered to the guidelines set in the Declaration of Helsinki.

Study population

Female patients aged 18-60 years with body mass index (BMI) from 25 to < 35 kg/m² and physical status ASA grade I-II, scheduled for unilateral MRM operation were included in this trial. Patient refusal, patient with history of allergy to the study drug (bupivacaine), drug dependence, chronic use of analgesics, neuropathic disease, coagulopathy, patient on anticoagulant therapy or has any contraindication of regional anesthesia e.g. infection at injection site or anatomic distortion, were excluded.

Sample Size calculation

The study had enough power to identify a clinically significant difference between the groups' 6-hour postoperative pain levels. Using a two-sided α of 0.05 and power (1–β) of 0.80 at Confidence Interval 95%, a total sample of 30 patients (15 per group) was needed,

based on previous data showing median VAS scores of 1.0 in the serratus plane block arm against 4.0 in controls **[11]**. To guarantee sufficient sensitivity to the expected effect size, computations were carried out assuming that continuous endpoints had a nonparametric distribution.

Blinding and Randomization

Patients were assigned to one of the two trial arms at random in a 1:1 ratio using a computer-generated allocation sequence. Each assignment was placed into a sequentially numbered, opaque, sealed envelope created by an independent research coordinator in order to ensure allocation concealment. An anesthesiologist not involved in the data collection or subsequent patient care opened the envelope on the morning of surgery and prepared the study solution. Throughout the study, group assignment was kept a secret from patients, treating physicians, and outcome assessors.

Groups for Intervention

• Group GS " serratus group" (n = 15): Just prior to the administration of standardized general anesthesia, 30 mL of 0.25% bupivacaine was injected as a one-shot during an ultrasound-guided SAP.

• Group GC "control group" (n = 15): Received 30 mL of normal saline before the same general anesthesia protocol but underwent the same ultrasound- guided serratus plane block procedure.

Preoperative preparation

The day before surgery all participants were visited for physical examination, reviewing routine laboratory investigations, explaining the aim and end points of the study and clarifying the advantages and possible hazards of the strategy. Informed written consent was taken regarding the procedure from every patient. All patients were kept nil per oral for 2 hours for clear fluid and 6-8 hours for solid meal before the operation.

Patients learnt to express postoperative pain on a scale of 0 - 10 cm line according to visual analogue score (VAS), where (VAS); 0= none (no pain), 10 = severe pain **[12]**.

Upon arrival at the regional block room, routine monitors were applied, and baseline parameters were recorded: Electrocardiogram (ECG), heart rate (HR), mean arterial blood pressure (MAP) and oxygen saturation levels (SpO_2%). Intravenous 18gauge cannula was inserted. 10-20µg/kg midazolam was given as a sedative before procedure.

The patient was lying in the supine position with the ipsi-lateral upper limb abducted at a 90° angle. Following skin sterilization, 3 ml of lidocaine 1% was injected into the puncture site. A superficial linear ultrasound probe (FUJIFIM Sonosite, In C., Bothell, WA, USA) were first placed under the middle of the clavicle. They were then moved downward and laterally to locate the first rib where pectoralis major and pectoralis minor muscles were detected. After advancing the US probe, the serratus anterior muscle appeared above the second, third and 4th ribs. At the level of the 4th and 5th ribs, the transducer was maintained at a small oblique angle, with the lower edge infero-anterior and the upper edge supero-anterior **[6]**. A 22-gauge, 8 cm length needle (Stimuplex D, Germany) was inserted on the mid-axillary line in plane between the latissimus dorsi muscle and the serratus anterior muscle. 30 mL of 0.25% Marcaine (bupivacaine hydrochloride, 25%, Pfizer, USA) in increments of 5 ml

was injected as a local anesthetic solution for unilateral block (Figure 1).

The block success was assessed 5 minutes after block performance, with 5-minute intervals until the target block was achieved. If the target block was not achieved within 30 minutes, it was considered a failure. Assessment was done by loss of cold sensation using iced solutions in the distribution dermatomes on the block side compared to the other side before induction of general anesthesia (target achieving sensory loss in > 4 dermatomes). Once the target was achieved, the patient was taken to the operating room to receive general anesthesia.

Intraoperative

General anesthesia was standardized for all patients. 1- 2 µcg /kg fentanyl, 2 mg/kg propofol were administered intravenously, and 0.15 mg/kg cisatracurium was injected to facilitate intubation with a suitable size of endotracheal tube. 1.2 MAC isoflurane/O_2 mixture was administered, and lungs were ventilated with maintaining normocapnia (End tidal CO_2 = 35-40 mm Hg).

Hemodynamic monitoring (HR and MAP) was observed and recorded immediately after skin incision and at 15, 30, 60, 90 and 120 minutes after skin incision. Incremental doses of fentanyl 1 - 2 µcg /kg were given in inadequate analgesia (presented by an increase more than 20% of the baseline values of the MAP with increase in the heart rate (HR) after exclusion of other causes), total amount of fentanyl consumption was calculated. Hypotension (MAP less than 65 mmHg) was treated by IV fluid boluses then ephedrine (12 mg) intravenously. Bradycardia (HR less than 50 beats/min) was managed by I.V 0.01 mg/kg atropine was administered.

All patients, independent of group assignments, received perfulgan (Paracetamol, Bristol Myers Squibb, UAS) as standard intravenous infusion analgesia at dose of 15mg/Kg every 6 hours post-operatively (maximum dose: 4 g / day), with the first dose 30 minutes before the end of surgery.

After completion of the surgery, inhalational anesthesia was stopped, and the patient received 0.05 mg/kg neostigmine and 0.02 mg/kg atropine sulphate to reverse muscle relaxation.

Postoperative

After anesthetic recovery, the patient was sent to the post-anesthesia care unit (PACU), hemodynamic parameters (HR, MAP) were recorded just on arrival to the PACU, 30 minutes later, 2, 6,12, 18, and 24 hours postoperatively.

At PACU, pain (primary outcome) was assessed and recorded by an observer blinded to the performed technique using VAS score both at rest and movement (sitting from lying down position with arm movement of 90°), at 30 minutes, at 2, 4, 8, 12, 18 and 24 hr. post-surgery **[13]**.

Patients received IV rescue morphine boluses when VAS was above 3 (morphine sulphate, 10mg/ml, Hameln Ltd, United Kingdom) as follows: If required, take 2 mg twice (for a total of three boluses) with at least 10 minutes between each dose, and then take 1 mg repeated if necessary with at least 15 minutes between subsequent doses **[14,15]**.

All patients were assessed for the time to first rescue morphine which is the time passed from the loss of sensation after the block to when the patient experiences

pain or has a VAS score above 3. Total morphine consumption (secondary outcome) was calculated during the first 24 hours postoperatively. Incidence of early patient mobilization (in the first 12 hours postoperatively) was recorded.

Technique complications such as; intra-muscular hematoma (treated by compressing and cooling the affected area, some cases may need surgical drainage of hematoma), pleural perforation (pneumothorax treated with needle aspiration and chest tube insertion) and drugs side effects such as; local anesthetic systemic toxicity (treated with airway management, seizure suppression with benzodiazepines, management of cardiac arrythmias and lipid emulsion therapy), respiratory depression "RR <10/minute or S_aO_2 <90%" (treated with airway management, oxygen therapy, and naloxone to reverse the effects of morphine) and postoperative nausea and vomiting "PONV" (managed with IV 4 mg ondansetron) were observed and recorded.

Statistical Analysis

The data was collected and analyzed using Microsoft Excel. The data was then analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 25.0. Qualitative data was represented by numbers and percentages, whereas quantitative continuous data was represented by mean ± SD. Quantitative non-parametric data was represented by median and interquartile range. To test for significance; differences and associations of qualitative variables were tested using the Chi square test (X2). Differences between quantitative independent data were tested using the t-test, while the Mann-Whiteny test was used for non-parametric data. Multiple comparison analysis was conducted using the Bonferroni Post-hoc test. $P \leq 0.05$ were regarded as significant, and those ≤ 0.001 as highly significant.

RESULTS

Between February 2018 and March 2020, 40 patients had their eligibility evaluated. Thirty patients were randomly allocated into two groups of fifteen each after ten were eliminated for failing to meet the inclusion criteria. Without any dropouts, every randomized patient finished the trial regimen (Figure 2)

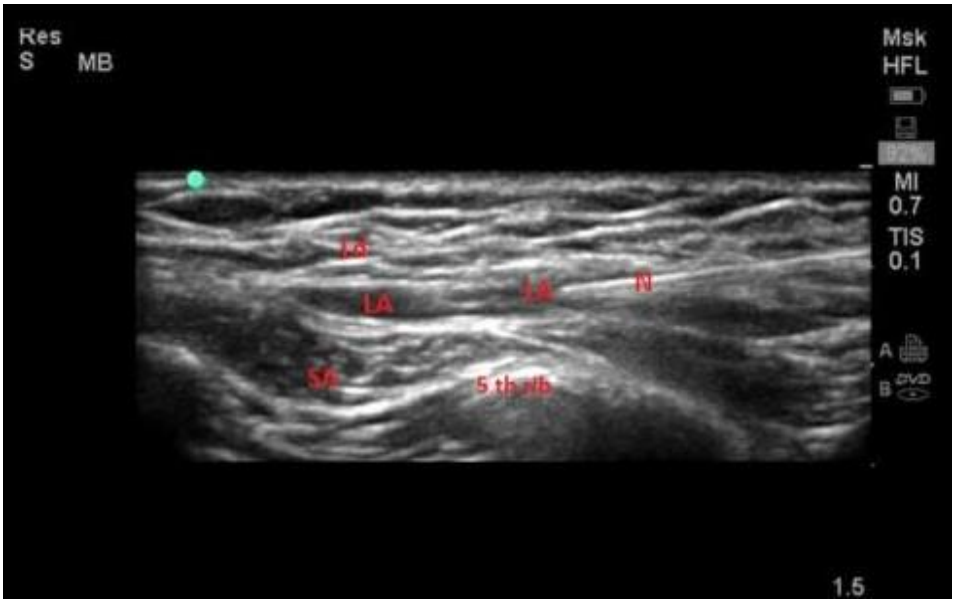

Figure (1): Performance of serratus plane block.

LD: latissimus dorsi muscle, SA: serratus anterior muscle, LA: local anesthetic solution, N: needle, 5th rib

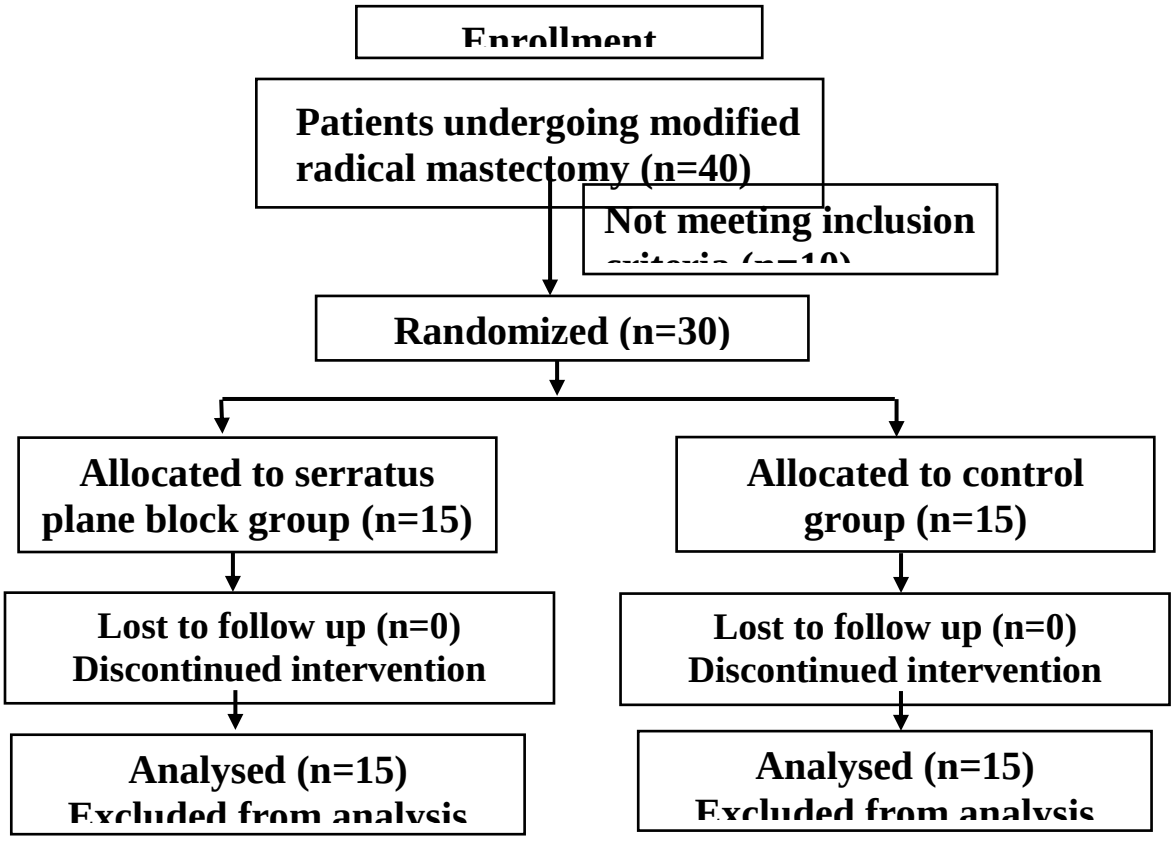

Figure (2): CONSORT flowchart of the study

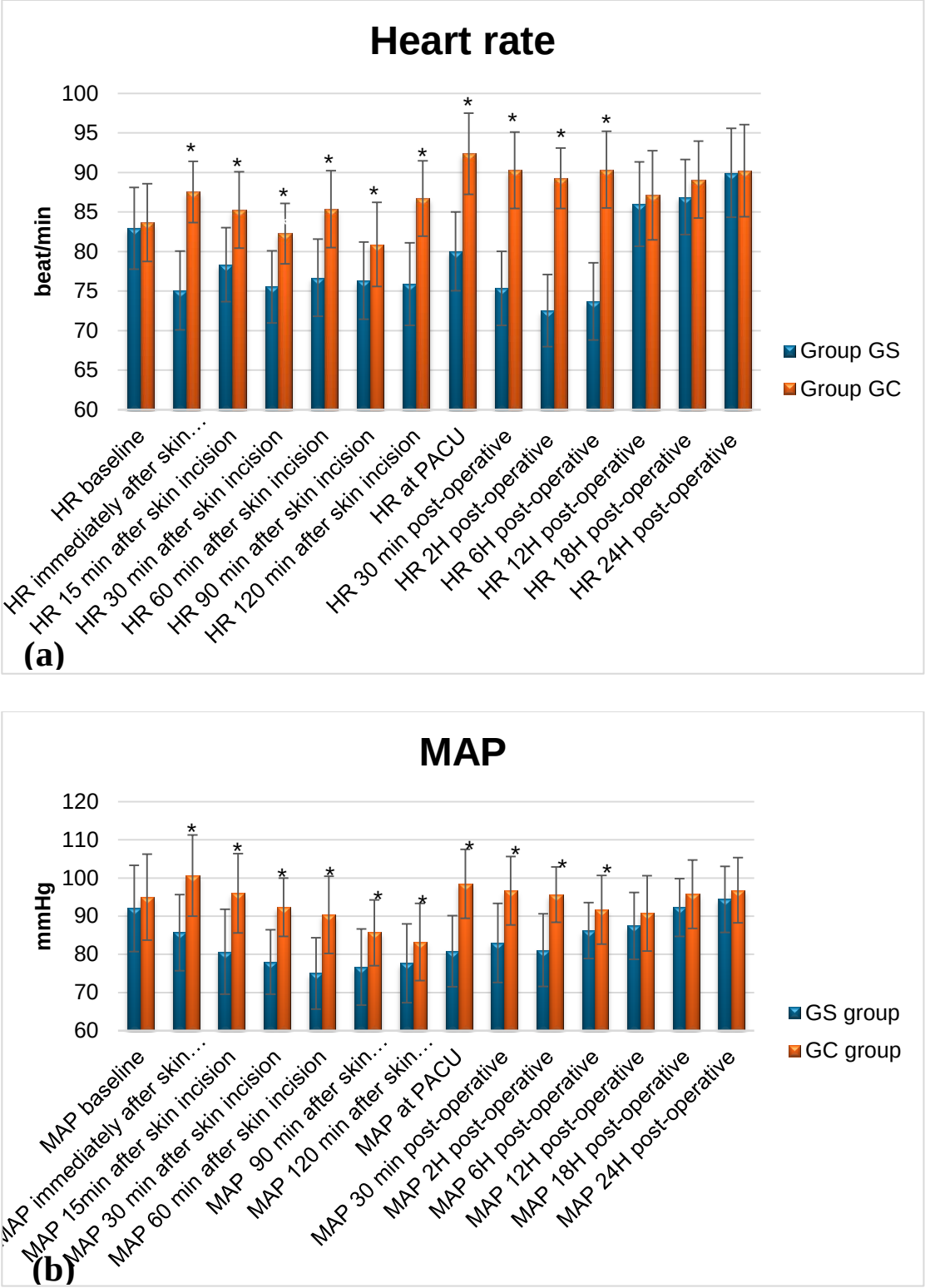

Figure (3): Hemodynamics (**a:** Heart rate, **b**: Mean arterial blood pressure) distribution in studied groups.

Data were expressed as Mean ± SD (Standard deviation) *: Significant

Regarding patient characteristics (age, height, weight, BMI, and ASA status) or surgical variables (side and duration), there were no statistically significant differences between the groups (Table 1). All patients achieved the dermatomal target; nearly 80% of patients showed dermatomal block from T2 to T7, while 40% of patients showed dermatomal block from T2 to T9.

At baseline and 12, 18, and 24 hours after surgery, there was no difference in HR or MAP between the groups ($P > 0.05$). In comparison to the SAP group, the control group showed significantly higher levels of both parameters during skin incision (immediately, and at 15, 30, 60, 90, and 120 minutes; $P < 0.05$), in the PACU, and at 30 minutes, 2 h, and 6 h after surgery ($P < 0.05$) (Figure 3).

During rest and movement upon arrival in the PACU,30 minutes, 2 h, 4 h, and 8 h after surgery, the SAP group (GS) showed lower mean VAS scores than controls (GC) ($P < 0.05$). GS continued to exhibit lower VAS values from 12 to 24 hours, such changes did not become statistically significant (Table 2).

Table (1): Patients' characteristics and operative data in studied groups:

Parameter			GS group (n=15)	GC group (n=15)	P
Age (years) ^	Mean ± SD		44.46±5.64	45.46±7.97	0.69 NS
ASA$	**I**	N (%)	9 (60.0%)	11(73.3%)	0.43 NS
	II	N (%)	6 (40.0%)	4 (26.7%)	
Weight (kg) ^	Mean ± SD		84.0 ± 5.62	82.33 ± 5.51	0.42 NS
Height (cm) ^	Mean ± SD		163.4 ± 4.12	163.13 ± 4.55	0.87 NS
BMI (Kg/m^2) ^	Mean ± SD		31.46 ± 1.72	30.96 ± 2.04	0.48 NS
Duration of operation (Hours) ^	Mean ± SD		2.4±0.507	2.46±0.51	0.724 NS
Mastectomy Side$	**Right**	N (%)	8 (53.3%)	10 (66.7%)	0.46 NS
	Left	N (%)	7 (46.7%)	5 (33.3%)	

Data were expressed as Mean ± SD (Standard deviation) or Numbers (Percentage) N= Number of patients n= Total number of patients in each group GS: General anesthesia plus serratus block group GC: General anesthesia group ^: Independent sample t test $: Chi square test NS: Non significant (P>0.05

Table (2): Visual analogue scale (VAS) during rest and movement over time:

Parameter		During Rest Median (Range)		p	During Movement Median (Range)		p
		GS group (n=15)	GC group (n=15)		GS group (n=15)	GC group (n=15)	
VAS at PACU#		0 (0-1)	2 (1-4)	**0.03***	0 (0-2)	3 (2-5)	**0.008***
Post-operative VAS#	**30 min**	0 (0-2)	3 (2-4)	**0.005***	0 (0-3)	4 (3-5)	**<0.001****
	2 H	0 (0-2)	4 (2-5) [a]	**<0.001****	1 (0-3)	5 (3-6) [a]	**<0.001****
	4 H	1 (0-2)	3 (1-5)	**0.04***	2 (0-3)	4 (2-5)	**0.04***
	8 H	1 (0-2)	3 (0-5)	**0.04***	2 (0-3)	4 (1-5)	**0.04***
	12 H	1 (1-2)	2 (0-4)	0.052 NS	2 (1-3)	3 (1-4)	0.052 NS
	18 H	1 (1-3)	2 (1-3)	0.07 NS	2 (1-4)	3 (2-4)	0.07 NS
	24 H	1 (1-3)	2 (0-3)	0.09 NS	2 (1-4)	3 (1-4)	0.09 NS
F		1.36	**4.03**		1.52	**3.98**	
P		0.82 NS	**0.04***		0.76 NS	**0.04***	

Data were expressed as Median (Range) n= Total number of patients in each group GS: General

anesthesia plus serratus block group GC: General anesthesia group VAS: Visual Analouge Scale PACU: Post Anesthesia Care Unit #: MW Mann Whiteny test F: Repeated measure ANOVA test Post hoc: Bonferroni test (a: significant versus PACU, A: highly significant versus PACU) NS: Non significant (P>0.05) *:Significant (P<0.05) ** Highly significant (p≤0.001)

Intraoperative fentanyl and 24-hour morphine doses were significantly higher for the (GC) than for group (GS) group ($P < 0.05$). A longer time to first rescue morphine was also experienced by GS ($P < 0.05$). Compared to (46.7%; $P < 0.05$) of GC group, GS patients (80%) mobilized within 12 hours after surgery (Table 3).

Table (3): Total intraoperative fentanyl consumption, postoperative morphine usage and patients' mobilization:

Parameters			GS group (n=15)	GC group (n=15)	p
Total intraoperative fentanyl consumption: (mcg) ^	Mean± SD		46.0±13.52	121.33±17.6	**<0.001****
Time to first rescue morphine: (min) ^	Mean± SD		360±87.6	60±0	**<0.001****
Total postoperative morphine (mg) ^	Mean± SD		8.5±1.91	20.4±0.98	**<0.001****
Early Patients' mobilization (in the first 12 hours postoperatively) χ	**Yes**	N (%)	12 (80)	7 (46.7)	**<0.001****
	No	N (%)	3 (20)	8 (53.3)	

Data were expressed as Mean ± SD (Standard deviation) or Numbers (Percentage)
N= number of patients n= Total number of patients in each group GS: General anesthesia plus serratus block group GC: General anesthesia group ^: t Independent sample t test χ: Chi square for trend test **p≤0.001 is statistically highly significant

Compared to the (GS) group, the (GC) group had greater rates of hypotension, nausea, and vomiting ($P < 0.05$). Respiratory depression occurred in one GC patient (respiratory rate <10 breaths/min; $P > 0.05$). There were no reports of pleural puncture, intramuscular hematoma, or local anesthetic toxicity (Table 4).

Table (4): Complications in studied groups:

Parameters			GS group (n=15)	GC group (n=15)	P
Nausea χ	**No**	N (%)	13(86.7%)	2 (13.3%)	**<0.001****
	Yes	N (%)	2(13.3%)	13 (86.7%)	
Vomiting χ	**No**	N (%)	15(100%)	8 (53.3%)	**0.003***
	Yes	N (%)	0(0.0%)	7 (46.7%)	
Respiratory depression χ	**No**	N (%)	15(100%)	14 (83.3%)	0.311 NS
	Yes	N (%)	0(0.0%)	1 (6.7%)	
Hypotension χ	**No**	N (%)	15(100%)	11 (73.3%)	**0.032***
	Yes	N (%)	0(0.0%)	4 (26.7%)	
Intramuscular hematoma χ	**No**	N (%)	0(0.0%)	0 (0.0%)	---

Parameters			GS group (n=15)	GC group (n=15)	P
Pleural perforation $^{\chi}$	**No**	N (%)	0(0.0%)	0 (0.0%)	---
Local anesthetic toxicity $^{\chi}$	**No**	N (%)	0(0.0%)	0 (0.0%)	---

Data were expressed as Numbers (Percentage) N= number of patients n= Total number of patients in each group GS: General anesthesia plus serratus block group GC: General anesthesia group χ: Chi square for trend test *: Significant (P<0.05) ** Highly significant (p≤0.001)

Discussion

Breast cancer ranks among the top three cancers globally, along with lung and colon cancer, and is the most common cancer among women [16]. MRM is the most frequent surgical procedure for patients with breast cancer, and the majority of patients have been observed to experience severe acute pain following the procedure [17]. There are significant physiological and psychological effects of ineffective pain management. Therefore, in terms of preoperative anesthetic care, postoperative pain control for MRM surgery is crucial [18].

The current study showed that the ultrasound guided SPB was safe technique resulted in more postoperative analgesia (VAS) during rest and movement, longer first time to rescue analgesia, less total dose of postoperative opioid consumption and less incidence of nausea and vomiting. Additionally, it demonstrated hemodynamic stability and markedly lower intraoperative fentanyl consumption.

Currently, pain control after mastectomy is based on multimodal pathways including medications, psychosocial interventions, cognitive-behavioral psychology, physical therapy, exercise therapies and interventional techniques.

A step forward from Blanco's work with the Pecs I and II blocks is SAP. The procedure has been made simpler by Blanco and associates to lessen the potential adverse effects associated with injections close to vascular systems. This approach has eliminated the necessity for modification of needle direction and multiple needle insertion. Additionally, because the local anesthetic does not have to trace back to the injected site, its deposition at the effective site should correspond with higher analgesic profiles [6,19].

In line with this study, the work conducted by Abdel Rahman and his colleagues (2022); showed a significant increase in HR and MAP postoperatively in patients received SPB compared to control group. They also reported low intraoperative fentanyl consumption with longer time for first request analgesia postoperatively in SPB group and experienced lower incidences of nausea and vomiting that mostly related to low pain scores and less narcotic consumption [20].

When Baytar et al. (2022) examined the impact of preoperative SPB intraoperative hemodynamic parameters and remifentanil intake; they found no significant changes in intraoperative HR and systolic blood pressure (SBP) before and after intubation, or during surgery between SPB group and control group. However, the SPB group used less remifentanil than the control group [21]. This difference in results can be explained by the fact that in Baytar's

trial, 20 ml of 0.25% bupivacaine was administered, whereas we used 30 ml of 0.25% bupivacaine resulting in a more intense block. Additionally, while a 30% increase in baseline SBP and HR values after intubation was considered evidence of pain in Baytar's study, in the current study, an increase of more than 20% from the baseline was deemed indicative of pain.

In disagreement with our study, Tang et al., who divided patients in their study into either who received general anesthesia (control group) or general anesthesia and SPB (with 20 ml of ropivacaine 0.5%). The two groups showed no significant difference in their HR or MAP values before and after anesthesia. Moreover, Tang and coworkers performed SPB after induction of general anesthesia with no assessment of success of block and level of sensory loss [22].

Paravertebral block and thoracic epidural analgesia are considered useful techniques for management of post-mastectomy pain. Although ultrasound approach is designed to increase the safety and success rates of regional nerve blocks, both procedures can have major complications, including pneumothorax and complete spinal anesthesia [23,24].

Arora and associates in their study conducted on women undergoing radical mastectomy under general anesthesia and receive preoperative either ultrasound-guided SPB or TPVB 30 min before surgery. Tramadol was used for postoperative rescue analgesia. The first time to rescue analgesia was significantly prolonged in the SPB group as compared with the TPVB group. In both groups, the hemodynamic variables were comparable, with the exception of the period immediately after anesthesia induction, when the TPVB group's MAP was lower than that of the SPB group [25]. The SPB group experienced a significantly lower incidence of PONV. They stated that, in contrast to patients of TPVB group, patients of SPB experienced postoperative analgesia for a longer period. Compared to the TPVB group, the SPB group consumed less rescue opioids and had lower postoperative pain levels [25].

This could be explained by the fact that SPB targets the lateral cutaneous branches of the intercostal nerves as they move across the fascial planes, producing widespread analgesia of the anterior chest wall [26]. Although TPVB particularly targets the spinal nerves, the local anesthetic may migrate medially into the epidural space through the intervertebral foramina or lateral to block the intercostal nerves [27]. Only one to four dermatomes can be blocked by a single level TPVB. Consequently, following significant breast cancer surgeries, a single level injection of TPVB might not sufficiently produce appropriate analgesia [24].

Qian and colleagues in 2021 in their prospective randomized study, stated that during the first 24 hours after surgery, SPB dramatically decreased acute postoperative pain both at rest and when moving, postoperative morphine use, PONV incidence, and recovery quality. Furthermore, in line with the current study, they did not detect any SPB-related side effects, such as pneumothorax or local anesthetic toxicity [28].

In order to avoid immediate postoperative pain multimodal analgesia; the use of drugs with complementary mechanisms, is crucial. Opioids have dose-dependent side effects and are less

effective at reducing movement-induced pain than they are at relieving resting pain [29]. Additionally, opioid use may promote angiogenesis and possibly accelerate tumor growth by impairing cell-mediated immunity, especially natural killer cell activity [30]. On the other hand, local anesthetics exhibit cytotoxic and antiproliferative effects. Thus, by reducing the neuroendocrine stress response and perioperative opioid needs, regional anesthetic approaches may preserve immune defenses and minimize tumor recurrence and metastasis [31].

According to Abdallah et al. (2017), the pectoralis I block, and SPB are almost identical. In comparison to the control group following ambulatory breast cancer surgery, both were accompanied by shorter recovery room discharge times, longer first time to analgesic request, and less intraoperative fentanyl use [32]. This is an intriguing discovery because it is believed that the medial and lateral pectoral nerves are main sources of the analgesic effect of pectoralis I block. Actually, the pectoralis I block was first described with the sole purpose of reducing pain during the implantation of sub-pectoral prosthesis and breast expanders [5, 10].

The early analgesic efficacy seen in the Abdallah trial could be explained by several theories, given our incomplete knowledge of the mechanisms of fascial plane blocks' action. It is hypothesized that the postoperative muscular spasm of both pectoralis muscles reduced, resulting in pain relief [33]. Another suggestion is that there is a greater sensory component to the medial and lateral pectoral nerves than conventional anatomical descriptions suggest [34]. Local anesthetics administered intraoperatively under the direct supervision of surgeons may also assist in explaining some of the pain alleviation that has been described [35, 36]. These nerves may also interact with the anterior cutaneous branches of the intercostal nerves to communicate and produce analgesia. Finally, another possibility could be the systemic absorption of local anesthetics [37].

Efficient pain treatment promotes early mobilization, a quicker recovery, and a decrease in postoperative complications. In accordance with the current results, Hards et al., stated that patients receiving SPB showing early mobilization and more satisfaction [38].

This trial has several limitations. The small sample size with short follow-up time (restricted to 24 hours only); we need larger sample size with long follow-up for proper assessment of safety. Furthermore, we did not monitor the patients to see whether block was effective in treating persistent post-mastectomy pain.

Further trials are required using different volumes, different concentrations or adding adjuvant local anesthetics to enhance the intensity and prolong the duration of analgesia or inserting catheter for continuous pain control.

Conclusion

Preoperative ultrasound-guided serratus plane block significantly lowered postoperative pain scores, total 24-hour morphine, and time for first rescue analgesia in patients undergoing modified radical mastectomy. In comparison to the control group, it also reduced the frequency of nausea and vomiting, improved intraoperative hemodynamic stability, and decreased fentanyl consumption.

Declarations:

Ethics approval and consent to

participate.

This prospective, observational study was performed in the department of anaesthesiaو intensive care and pain management, Faculty of Medicine, Zagazig University, after Institutional Review Board (IRB) approval (ZU-IRB #4276) and obtaining patients' informed consent for participation in the study during the period from February 12, 2018 to March 20, 2020. All study procedures were carried out in accordance with the ethical standards of the Helsinki Declaration of 2013.

Availability of data and materials

The data used and analyzed during our study are available from the corresponding author on reasonable request.

Competing interests The authors have no competing interests.

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Authors' contributions

All authors reviewed the final manuscript and approved it. Rehab A Wahdan registered, collected, and analyzed the data, and wrote the main manuscript text. Shereen E. Abd Ellatif collected data, helped within the design of the study, and wrote the abstract. Khadeja M Elhossieny and Asmaa M. Galal Eldeen prepared the tables and figures, helped with the study design, and writing review and editing. Sanaa Ahmad El-Tohamy supervision, analyzed the data, and helped within the study design.

Writing process:

Authors did not use AI in the writing process of this research.

REFERENCES

1) Taylor RS, Ullrich K, Regan S, Broussard C, Schwenkglenks M, Taylor RJ, et al. The impact of early postoperative pain on health-related quality of life. Pain Pract. 2013;13: 515-23.

2) Chiang DLC, Rice DA, Helsby NA, Somogyi AA, Kluger MT. The incidence, impact, and risk factors for moderate to severe persistent pain after breast cancer surgery: a prospective cohort study. Pain Med. 2023;24(9):1023-34. doi: 10.1093/pm/pnad065. PMID: 37184910; PMCID: PMC10655209.

3) Andersen KG, Kehlet H. Persistent pain after breast cancer treatment; a critical review of risk factors and strategies for prevention. J Pain. 2011;12(7): 725–46.

4) Andreae MH, Andreae DA. Regional anesthesia to prevent chronic pain after surgery: a Cochrane systematic review and meta-analysis. Br J Anaesth. 2013;111(5): 711-20.

5) Blanco R, Farjado M, Parras Maldonado T. Ultrasound description of pecs II (modified pecs I): a novel approach to breast surgery. Rev Esp Anestesiol Reanim. 2012;59(9):470–5.

6) Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. Anaesthesia. 2013;68(11):1107–13.

7) Womack J, Varma MK. Serratus plane block for shoulder surgery. Anaesthesia. 2014;69:395-6.

8) Kunhabdulla NP, Agarwal A, Gaur A, Gautam SK, Gupta R, Agarwal A. Serratus anterior plane block for multiple rib fractures. Pain Physician. 2014;17(4): E553-5.

9) Madabushi R, Tewari S, Gautam SK, Agarwal A. Serratus anterior plane block; a new analgesic technique for

post-thoracotomy pain. Pain Physician. 2015;18(3): E421-4.

10) Tighe SQ, Karmakar MK. Serratus plane block: do we need to learn another technique for thoracic wall blockade? Anaesthesia. 2013;68(11):1103- 6.

11) Saad FS, El Baradie SY, Abdel Aliem MAW, Ali MM, Kotb TAM. Ultrasound-guided serratus anterior plane block versus thoracic paravertebral block for perioperative analgesia in thoracotomy. Saudi J Anaesth. 2018;12(4):565-70.

12) Bond MR, Pilowsky I. Subjective assessment of pain and its relationship to the administration of analgesics in patients with advanced cancer. J Psychosom Res. 1966;10:203-8.

13) Hetta DF, Rezk KM. Pectoralis-serratus interfascial plane block vs thoracic paravertebral block for unilateral radical mastectomy with axillary evacuation. J Clin Anesth. 2016;34:91-7.

14) Bakeer AH, Kamel KM, Abdelgalil AS, Ghoneim AA, Abouel Soud AH, Hassan ME. Modified pectoral nerve block versus serratus block for analgesia following modified radical mastectomy: a randomized controlled trial. J Pain Res. 2020;13 :1769-75.

15) Motov SM, Vlasica K, Middlebrook I, LaPietra A. Pain management in the emergency department: a clinical review. Clin Exp Emerg Med. 2021;8(4):268-78.

16) Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics. CA Cancer J Clin. 2021;71(1): 7–33.

17) Zhao J, Han F, Yang Y, Li H, Li Z. Pectoral nerve block in anesthesia for modified radical mastectomy: a meta-analysis based on randomized controlled trials. Medicine (Baltimore). 2019;98(18): e15423.

18) Tang W, Luo G, Lu Y, Chen C, Liu H, Li Y. Application of a new serratus anterior plane block in modified radical mastectomy under ultrasound guidance: A prospective, randomized controlled trial. J Clin Anesth. 2021;74:110377.

19) De la Torre PA, García PD, Alvarez SL, Miguel FJ, Pérez MF. A novel ultrasound-guided block: a promising alternative for breast analgesia. Aesthet Surg J. 2014;34(1):198-200.

20) Abdel Rahman MAF, Salama HG, Abdel Razik RA, Galal RF and Farag HM. A comparative study between ultrasound-guided serratus anterior plane block and conventional IV analgesics for post-operative pain management in modified radical mastectomy. Ain-Shams journal of anaesthesiology. 2022;14:44.

21) Baytar C, Aktas B, Aydin BG, Piskin O, Cakmak GK, Ayoglu H. The effects of ultrasound-guided serratus anterior plane block on intraoperative opioid consumption and hemodynamic stability during breast surgery: a randomized controlled study. Medicine (Baltimore). 2022; 101:35(e30290).

22) Tang W, Luo G, Lu Y, Chen C, Liu H, Li Y. Application of a new serratus anterior plane block in modified radical mastectomy under ultrasound guidance: A prospective, randomized controlled trial. J Clin Anesth. 2021;74:110377.

23) Albi-Feldzer A, Duceau B, Nguessom W, Jayr C. A severe complication after ultrasound-guided thoracic paravertebral block for breast cancer surgery: total spinal anaesthesia: a case report. Eur J Anaesthesiol. 2016 ;33(12):949–51.

24) Pace MM, Sharma B, Anderson-Dam J, Fleischmann K, Warren L, Stefanovich P. Ultrasound-guided thoracic paravertebral blockade: a retrospective study of the incidence of complications. Anesth Analg. 2016;122(4):1186–91.

25) Arora S, Ovung R, Bharti N, Yaddanapudi S, Singh G. Efficacy of serratus anterior plane block versus

thoracic paravertebral block for postoperative analgesia after breast cancer surgery: a randomized trial. Braz J Anesthesiol. 2022;72(5):587-92.

26) Mayes J, Davison E, Panahi P, Patten D, Eljelani F, Womack J, et al. An anatomical evaluation of the serratus anterior plane block. Anaesthesia. 2016; 71:1064–9.

27) Cowie B, McGlade D, Ivanusic J, Barrington MJ. Ultrasound-Guided thoracic paravertebral blockade: a cadaveric study. Anesth Analg. 2010;110(6):1735-9.

28) Qian B, Huang S, Liao X, Wu J, Lin Q, Lin Y. Serratus anterior plane block reduces the prevalence of chronic postsurgical pain after modified radical mastectomy: A randomized controlled trial. J Clin Anesth. 2021;74: 110410.

29) Benyamin R, Trescot AM, Datta S, Buenaventura R, Adlaka R, Sehgal N, et al. Opioid complications and side effects. Pain Physician. 2008;11(2): 105-20.

30) Afsharimani B, Cabot P, Parat MO. Morphine and tumor growth and metastasis. Cancer Metastasis Rev. 2011;30(2): 225-38.

31) Kaye AD, Patel N, Bueno FR, Hymel B, Vadivelu N, Kodumudi G, et al. Effect of Opiates, anesthetic techniques, and other perioperative factors on surgical cancer patients. Ochsner J. 2014;14(2): 216-28.

32) Abdallah FW, MacLean D, Madjdpour C, Cil T, Bhatia A, Brull R. Pectoralis and serratus fascial plane blocks each provide early analgesic benefits following ambulatory breast cancer surgery: a retrospective propensity matched cohort study. Anesth Analg. 2017;125(1):294–302.

33) Goshievich A, Kirkham KR, Brull R, Brown MH. Novel approach to intractable pectoralis major muscle spasms following sub-muscular expander-implant breast reconstruction. Plast Surg Case Studies. 2015;1:1–3.

34) Bremner-Smith AT, Unwin AJ, Williams WW. Sensory pathways in the spinal accessory nerve. J Bone Joint Surg Br. 1999;81(2):226–8.

35) Bell M. Office anesthesia for breast augmentation made easy. Can J Plast Surg. 2007;15(3):178.

36) Parker WL, Charbonneau R. Large area local anesthesia (LALA) in submuscular breast augmentation. Aesthet Surg J. 2004;24(5):436–41.

37) Jabs D, Richards BG, Richards FD. Quantitative effects of tumescent infiltration and bupivicaine injection in decreasing postoperative pain in submuscular breast augmentation. Aesthet Surg J. 2008;28(5):528–33.

38) Hards M, Harada A, Neville I, Harwell S, Babar M, Ravalia A, et al. The effect of serratus plane block performed under direct vision on postoperative pain in breast surgery. J Clin Anesth. 2016;34:427-31.

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