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A COMPARATIVE STUDY OF ROPIVACAINE ALONE VERSUS ROPIVACAINE AND DEXAMETHASONE IN ULTRASOUND GUIDED SERRATUS ANTERIOR PLANE BLOCK FOR POSTOPERATIVE ANALGESIA AFTER MODIFIED RADICAL MASTECTOMY

Anaesthesiology

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ABSTRACT

Background: Breast cancer is a prevalent condition among women that significantly impacts their quality of life. Modified Radical Mastectomy is the most common surgical intervention for this disease. These breast surgeries often result in severe acute pain, which can delay patient discharge from post-operative care. Consequently, effective pain management during the perioperative period is crucial. The Serratus Anterior Plane (SAP) block is an innovative and straightforward regional anesthesia technique that uses ultrasound guidance to provide pain relief in the thoracic region. The study aims to check the analgesic efficacy of dexamethasone as a adjuvant with ropivacaine and ropivacaine alone in ultrasound guided serratus anterior plane block for postoperative analgesia after modified radical mastectomy. **Methods:** Forty six patients undergoing elective modified radical mastectomy were divided into two groups .Group 1 received 20 ml of 0.2% Ropivacaine and 2 ml of 8 mg Dexamethasone and Group 2 received 20 ml of 0.2% Ropivacaine. The primary outcome was to compare ropivacaine alone and ropivacaine with dexamethasone in ultrasound guided serratus anterior block for postoperative analgesia in modified radical mastectomy patients in terms efficacy and duration of analgesia. Secondary outcomes were hemodynamics and were compared between groups. **Results:** The comparison of mean hours until rescue analgesia was required shows a statistically significant difference between Group 1 (ropivacaine with dexamethasone) and Group 2 (plain ropivacaine) in serratus anterior plane blocks. Group 1 had a longer duration before requiring rescue analgesia (3.4 ± 0.9 hours) compared to Group 2 (2.9 ± 0.67 hours), with the difference being statistically significant ($p = 0.048$). **Conclusions:** Addition of dexamethasone to ropivacaine in serratus anterior plane blocks did not significantly improve pain intensity scores, it did extend the duration of analgesia before rescue medication was needed. This modest but statistically significant prolongation of analgesic effect suggests a potential clinical benefit in postoperative pain management, particularly in delaying the need for additional pain relief.

KEYWORDS

Breast Cancer, MRM, SAPB, Ropivacaine, Dexamethasone, Time to rescue analgesia. (MRM - Modified Radical Mastectomy, SAPB - Serratus Anterior Plane Block)

INTRODUCTION

Breast cancer is the most common type of cancer affecting women according to global public health data[1]. Surgical removal of the tumor is the primary treatment for breast cancer but postoperative pain is of great concern in breast cancer patients. Around 50% of breast cancer patients experience postoperative pain[2-3]. Acute post-surgical pain itself hampers with postoperative recovery, impair pulmonary and immune functions and can also precipitate myocardial infarction[4-6]. Serratus anterior plane block is a interfascial plane block technique used to relieve thoracic pain by injecting a local anaesthetic into the plane between the latissimus dorsi muscle and serratus anterior muscle[7]. SAPB provides effective postoperative analgesia by blocking the lateral cutaneous branches of the thoracic intercostal nerves.

To enhance the quality and duration of regional blocks, many adjuvants have been used in addition to local anaesthetic drugs. Studies conducted have shown that SAPB can be used as a locoregional analgesic technique to reduce pain after breast surgery[8-9]. The limited duration of analgesia provided by local anaesthetics has warranted the use of several adjuvants, for example tramadol, epinephrine, clonidine or dexmedetomidine to enhance the duration and quality of analgesia but are associated with adverse effects[10-12]. Studies conducted has shown that Dexamethasone when combined with local anaesthetics prolong the duration of intercostal blockade and also possess anti-inflammatory action[13]. Addition of dexamethasone to ropivacaine for SAP block increases the time to first rescue analgesic in the postoperative period. However, the effect of dexamethasone in the SAP block has not been studied much.

Hypothesis for the study is addition of dexamethasone to serratus anterior plane block with ropivacaine will have no improved analgesic effect in modified radical mastectomy, alternate hypothesis is addition of dexamethasone to serratus anterior lock with ropivacaine will improve the analgesic efficacy in modified radical mastectomy. The primary objective is to compare the time to first rescue analgesia and the secondary objectives is to compare the intraoperative fentanyl requirement, total paracetamol and tramadol requirements, in 24 hours, postoperatively.

Aim: The study aims to check the analgesic efficacy of dexamethasone as an adjuvant with ropivacaine and ropivacaine alone in ultrasound guided serratus anterior plane block for postoperative analgesia after modified radical mastectomy

Objective:
To compare the analgesic efficacy of dexamethasone with ropivacaine and ropivacaine alone in USG guided serratus anterior plane block for postoperative analgesia after modified radical mastectomy

Primary Outcome: To compare ropivacaine alone and ropivacaine with dexamethasone in ultrasound guided serratus anterior block for postoperative analgesia in modified radical mastectomy patients in terms efficacy and duration of analgesia

Secondary Outcomes:
1) Intraoperative fentanyl requirement.
2) Postoperative tramadol intake in the first 24 hours.
3) Pain with movement and without movement at the surgical site.
4) Hemodynamic changes, if any.
5) Side effects if any.

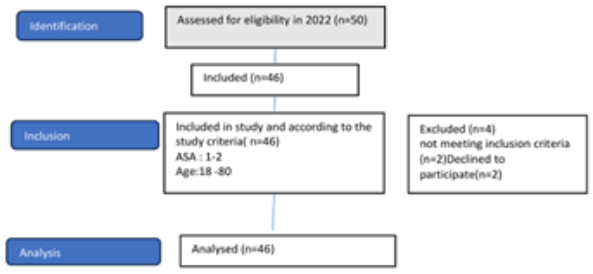
MATERIAL AND METHODS

Source of Data

The institute's ethical committee approved this observational study. Forty six randomly assigned female patients belonging to the age group of 18-80 years who were hospitalized at A J Institute of Medical Sciences and Research Centre, Mangalore at least a day prior to the day of surgery and who were expected to undergo elective modified radical mastectomy over a period of 24 months (from July 2022-2024) were included in the study. Patients were included in the study till the sample size of 46 (23 in each group) was reached.

Study Design

It was an observational, comparative, analytical study. A convenience sampling technique was used in the study. Informed consent was taken before the commencement of the study and the patient data was kept confidential. The data was recorded by the observer.



Inclusion Criteria

We included all patients scheduled for elective modified radical mastectomy belonging to the patient's physical status American Society of Anesthesiologists (ASA) classes 1 and 2, aged between 18 - 80 years, weight 30 - 90 kg.

Exclusion Criteria

We excluded patients who refused to participate in the study, patients with coagulation disorders , infection at the puncture site, local inflammation, known allergy to any medication used in the study, refusal of nerve block, pre -existing chronic pain(lasting at least for 3 months and any other conditions that are unsuitable for this study.

Sample Size

Based on a study conducted by Kumar V et al[14] , to detect a difference of 10 hours (L) in the time taken for rescue analgesia between groups assuming 95% confidence interval and 80% power with the pooled Standard deviation of 12, the sample size estimated for the study was 22.5 in each group. Further assuming a 10% attrition rate, the final size estimated for the study was 23 in each group. Hence, the study recruited a total of 50 patients.

Sampling Technique

All the patients who were taken up for elective surgeries under general anesthesia meeting the inclusion criteria until the sample size was met were chosen based on convenience sampling.

Study Procedure And Methodology

Following approval from the Ethical committee ,ASA grade 1 and 2 ,female patients aged between 18-80 years ,who underwent elective modified radical mastectomy under general anesthesia in AJ institute of medical science and research centre, were divided into two groups - Group 1 and Group 2.

Patients in Group 1 received 20ml of 0.2% Ropivacaine + 2 ml of 8 mg Dexamethasone Group 2 received 20 ml of 0.2% Ropivacaine

Before the day of surgery, the complete data on demographic characteristics, a detailed pre-anaesthetic assessment, baseline vitals, and laboratory investigations were obtained. Written informed consent was obtained from all the included patients. All patients receive Tab. Pantoprazole 40 mg on the night before surgery. We advised our patients to remain nil per month for solids for at least 8 hours, semi-solids for a duration of 4 hours, and clear liquids for a period of 2 hours. On the day of surgery, 18-gauge intravenous access under aseptic precautions. The patient was shifted to the operating room and made to lie supine on the OT table.

Patients were monitored with a non-invasive monitor throughout the study , including heart rate, non-invasive blood pressure(systolic ,diastolic and mean arterial pressure) every 3 minutes, oxygen saturation and electrocardiogram , capnography and temperature.

Procedure For General Anesthesia

All patients were pre oxygenated with 100% oxygen for 3 minutes using a pre-checked anesthesia machine before induction of general anesthesia. Inj. midazolam 1 mg iv and Inj. fentanyl 2µg/kg iv. was given as premedication before induction. Patients were induced with inj. Thiopentone sodium 3-5 mg/kg or inj. Propofol 1-2 mg/kg iv .After paralyzing with Inj. succinylcholine 1 mg/kg iv., manual ventilation for 60 seconds, and tracheal intubation was facilitated.

Patients were intubated using a size 3 or 4 Macintosh blade for laryngoscopy and a polyvinyl chloride endotracheal tube of an internal diameter of 7.0 mm for females and 8.0 mm for males. The ET-tube was secured after confirmation of position by end-tidal carbon dioxide (EtCO2) tracing. Bilateral equal air entry by the 5-point auscultation technique was checked. Oxygen(O2) and nitrous oxide(N2O) mixture were maintained at 33% and 66% respectively with sevoflurane at 1-2% to achieve iso-MAC of 1.2-1.5.The controlled mechanical ventilation was maintained with a tidal volume of 6-8 mg/kg of ideal body weight and a inspiratory to expiratory ratio of 1:2 with <5 cm H2O of PEEP.

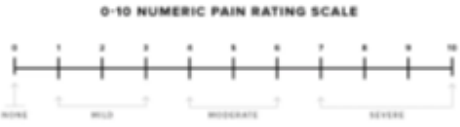
Inj. Vecuronium /Cisatracurium 0.1mg/kg was administered as muscle relaxant. No surgical stimulation was allowed for five minutes after intubation. Intraoperative vecuronium/cisatracurium boluses were administered as required to maintain the plane of general anesthesia. If an increase in HR or MAP values by more than 20% of the baseline was noted ,Fentanyl was administered. Total intraoperative fentanyl doses was noted. Thereafter paracetamol (15mg/kg) was administered for both groups and repeated after every 8 hours for the first 24 hours. Intraoperative HR, systolic blood pressure, diastolic blood pressure ,mean arterial blood pressure and ECG was monitored every 5 minutes.

The ultrasound guided SAP block was administered to all patients after the surgery. A linear high frequency (6-13 MHz) ultrasound probe was used to guide the block.

Maintaining all aseptic precautions , the probe was placed in the sagittal plane in the midclavicular region of the thoracic region. The ribs was counted inferiorly and laterally until the 5th rib was identified in the midclavicular line. The muscles overlying the 5th rib was identified: the latissimus dorsi(superficial) and serratus muscles(inferior). At more depth, intercostal muscles and pleura was visualized. Under an ultrasound guided in-plane approach and in caudal to cranial direction , a 23 G Bevelled needle was inserted until the tip is placed between serratus anterior muscle and fifth rib. The drug was injected after aspiration to exclude intravascular needle placement.

At the end of procedure , sevoflurane/isoflurane was turned off, fresh gas flow was increased and 100% oxygen was given. Neostigmine (50 µg/kg) and glycopyrrolate (10 µg/kg) was used to reverse neuromuscular paralysis. After the return of adequate respiratory efforts, ETT was removed. All patients were shifted to the post-anaesthetic care unit (PACU) for further monitoring, observation, pain assessment and rescue analgesia. Postoperatively, pain assessment was done after shifting the patient to PACU (time zero) and thereafter at 2nd, 4th hour and on day 1. The assessment was done using NRS.

NRS was assessed at rest and on 90° arm abduction on the side of surgery. The HR and MAP were assessed at the same time . On pain assessment, if NRS was ≥4, rescue medication, tramadol (1 mg/kg) with 100ml normal saline was administered.



Parameters Studied

a) Time of first rescue analgesia(Tramadol)
b) NPRS score at 0th,2th,4th hour and day 1 intervals
c) Hemodynamic data: HR and NIBP (systolic, diastolic and mean) at 0th,2th,4th hour and day 1 intervals.
d) Demographic data, the duration of surgery.
e) Side effects or complications, if any.

Study Hypothesis

Addition of dexamethasone to serratus anterior plane block with ropivacaine will have no improved analgesic effect in modified radical mastectomy Alternate Hypothesis:

Addition of dexamethasone to serratus anterior plane block with ropivacaine will improve the analgesic efficacy in modified radical mastectomy

Statistical Analysis

The data was analyzed using SPSS for Windows [version 26.0, IBM Corp., Armonk, NY]. The normality of data was assessed using the

Shapiro -Wilk test. Normally distributed data was compared using an unpaired t-test and skewed data was compared using the Mann-Whitney U test. Collected data was presented as mean +/- SD , numbers and percentages as appropriate.

Data are collected either in continuous, numerical or categorical forms. Data was presented as frequencies (N), proportions (%) or as mean, median and standard deviation) was analysed using unpaired t test.

Student t test was used to test significant differences in outcome such as time to first rescue analgesia between groups.

Paired t test was used to test the significant differences in the group before and after the procedure .A probability P<0.05 value was considered as statistically significant. Intergroup analysis of categorical data was analyzed using contingency tests like the Chi - square test or Fisher's exact test as appropriate. Age , BMI, Grade of disease , duration of surgery , time of rescue analgesia and intraoperative fentanyl requirement was used for multivariate analysis. A probability P<0.05 value was considered as statistically significant.

Sample Size Estimation

Based on a study conducted by Kumar V et al[14] the sample size estimated for the study in order to detect a difference of 10 hours (L) in the time taken for rescue analgesia between groups assuming 95% confidence interval and 80% power with the pooled Standard deviation of 12,the sampling size estimated for the study is 22.5 approximately equal to 23 in each group. If drop out of 10% is considered in each group, we need 23 in each group.

RESULTS

The study included 46 patients, ASA 1 or 2 , aged 18 - 80 .All participants received identical premedication and intravenous induction agents , followed by intubation. Anaesthesia was maintained with 1.2 - 1.5 % sevoflurane/O2/N2O.Post surgery SAPB was administered to both groups with Group 1 receiving dexamethasone with ropivacaine and group 2 receiving plain ropivacaine.

The study evaluated analgesic efficacy and potency of dexamethasone with ropivacaine with time to first rescue analgesia and NRS.NRS was assessed with arm at rest and abduction at different time point like 0 ,2 , 4 and 1 day time intervals .Hemodynamic variations like SBP ,DBP , MAP was assessed with hand in rest and in abducted positions at 0 , 2 ,4th and 1 day time intervals.

We compared demographic and physiological parameters between two groups, each consisting of 23 subjects. The analysis covers age, weight, height , Body mass index(BMI), American Society of Anesthesiologists (ASA)status and cardiovascular measurements .

- **Age:** Group 1 had a mean age of 52.9 ± 13.11 years, while Group 2 averaged 49.3 ± 11.25 years. The age data was normally distributed, and the unpaired t-test showed no statistically significant differences (P = 0.32).
- **Weight:** Group 1 had a mean weight of 61.78 ± 12.7 kg, and Group 2 averaged 60.52 ± 8.9 kg. The weight data was normally distributed, and the unpaired t-test showed no statistically significant differences (P = 0.69).
- **Height:** The mean height for Group 1 was 150.1 ± 8.5cm, while Group 2 averaged 152.9 ± 5.1cm .The height data was normally distributed, and the unpaired t-test showed no statistically significant differences (P = 0.19).
- **Body Mass Index (BMI):** Group 1 had a mean BMI of 27.7 ± 7.3 kg/m², while Group 2 averaged 25.8 ± 3.4 kg/m². The data was normally distributed, the unpaired t-test showed no statistically significant differences (P = 0.26).
- **ASA Status:** In Group 1 ,43% were classified as ASA 1 and 57 % as ASA 2 , Group 2 had 35 % classified as ASA 1 and 65 % as ASA 2.Fisher's exact test revealed no significant difference in ASA status distribution (P = 0.814).
- **Mean Heart Rate at different time points at rest:** Group 1 had a mean heart rate of 74.13 ± 10.4 beats per minute, while Group 2 averaged 76.83 ± 10.08 beats per minute at baseline. The data was normally distributed, and the unpaired t-test at rest showed that the difference between the groups at different time points at rest; 0 hours, 2 hours, 4 hours, and 1 day was not statistically significant (P < 0.05) as shown in Table 1

Mean Heart Rate at different time points at arm abduction: Group 1 had a mean heart rate of 76.83 ± 10.08 beats per minute, while Group 2 averaged 69.87 ± 13.03 beats per minute at baseline. The data was normally distributed and the unpaired t test indicated statistically significant difference(P = 0.049).However ,the difference between the groups at different time points; 2 hours, 4 hours, and 1 day was not statistically significant (P > 0.05) as shown in table 1

Table 1. Comparison of heart rate between two groups at different time intervals

			N	Mean ± SD	SE mean	t	P value
At rest	0 hours	Group 1	23	74.13 ± 10.4	2.17	1.7	P = 0.09
		Group 2	23	68.22 ± 12.7	2.65		NS
	2 hours	Group 1	23	72.3 ± 10.05	2.09	0.39	P = 0.69
		Group 2	23	70.57 ± 18.64	3.8		NS
	4 hours	Group 1	23	71.78 ± 8.2	3.1	0.7	P = 0.48
		Group 2	23	69.3 ± 15.03	1.5		NS
	1 day	Group 1	23	75.26 ± 7.2	1.5	1.6	P = 0.11
		Group 2	23	71.04 ± 10.02	2.1		NS
At 90	0 hours	Group 1	23	76.83 ± 10.08	2.09	2.02	P = 0.049*
		Group 2	23	69.87 ± 13.03	3.88		NS
	2 hours	Group 1	23	75.5 ± 9.1	1.9	-0.7	P = 0.44
		Group 2	23	78.7 ± 17.5	3.6	7	NS
	4 hours	Group 1	23	75.13 ± 7.5	1.5	-0.4	P = 0.64
		Group 2	23	76.7 ± 14.4	3.02	6	NS
	1 day	Group 1	23	76.74 ± 6.09	1.2	1.1	P = 0.24
		Group 2	23	73.52 ± 11.42	2.3		NS

- **Median Systolic Blood Pressure at different time points at rest (SBP):** Group 1 had slightly higher SBP when compared to Group 2. The data was non parametric, Mann Whitney U test indicated the difference in median values was not statistically significant (P > 0.05) as shown in Table 2
- **Median Systolic Blood Pressure at different time points at 90(SBP) :**Group 1 had similar SBP when compared to participants in Group 2. The data was non parametric, Mann Whitney U test indicated the difference in median values was not statistically significant (P > 0.05) as shown in Table 2

Table 2. Comparison of SBP between two groups at different time points

			N	Median	IQR	Z	P value
At rest	0 hours	Group 1	23	134	120 - 160	-1.02	P = 0.3
		Group 2	23	132	106 - 135		NS
	2 hours	Group 1	23	132	99 - 150	-0.7	P = 0.4
		Group 2	23	130	97 - 155		NS
	4 hours	Group 1	23	134	105 - 142	-0.602	P = 0.54
		Group 2	23	134	104 - 140		NS
	1 day	Group 1	23	118	115 - 138	-1.67	P = 0.09
		Group 2	23	116	108 - 130		NS
At 90	0 hours	Group 1	23	136	125 - 156	-0.309	P = 0.75
		Group 2	23	136	127 - 139		NS
	2 hours	Group 1	23	136	104 - 154	-0.11	P = 0.91
		Group 2	23	134	104 - 160		NS
	4 hours	Group 1	23	136	113 - 144	-0.22	P = 0.82
		Group 2	23	136	108 - 130		NS
	1 day	Group 1	23	120	118 - 140	-1.75	P = 0.08
		Group 2	23	120	112 - 130		NS

- **Median Diastolic Blood Pressure (DBP) at different time points at rest:** at 0 hours and after 1-day Group 1 had lower DBP when compared to participants in Group 2. In addition, at 2 hours and 4 hours, participants in both groups had similar DBP. The data was non parametric, Mann Whitney U test indicated the difference in median values was not statistically significant (P > 0.05) as shown in Table 3
- **Median Diastolic Blood Pressure (DBP) at different time points at arm abduction:** at 0 hours and 2 hours, participants in

both groups had similar DBP. However, after 4 hours and after 1 day, Group 1 had lower DBP when compared to participants in Group 2 .The data was non parametric ,Mann Whitney U test indicated the difference in median values was statistically significant (P = 0.01 & P = 0.005) as shown in table 3

Table 3. Comparison of DBP between two groups at different time points

			N	Median	IQR	Z	P value
At rest	0 hours	Group 1	23	80	70 - 90	-0.067	P = 0.94
		Group 2	23	82	66 - 98		NS
	2 hours	Group 1	23	76	68 - 80	-0.022	P = 0.98
		Group 2	23	76	67 - 90		NS
	4 hours	Group 1	23	74	70 - 82	-0.38	P = 0.7
		Group 2	23	74	70 - 84		NS
	1 day	Group 1	23	65	64 - 80	-0.913	P = 0.31
		Group 2	23	80	64 - 80		NS

- **Mean Arterial Pressure at different time points at rest (MAP):** Group 1 had a higher MAP than participants in the Group 2. The data was normally distributed and unpaired t test indicated the difference between the groups at different time points; 0 hours, 2 hours, 4 hours, and 1 day was not statistically significant (P > 0.05) as shown in Table 4
- **Mean Arterial Pressure at different time points at arm abduction 90(MAP):**Group 1 had a higher MAP at 2 hours and lower MAP than participants in Group 2 at 4 hours. The MAP was found to be similar in both groups at 0 hours and after 1 day. The data was normally distributed and unpaired t test indicated difference between the groups at different time points 0 hours, 2 hours, 4 hours, and 1 day was not statistically significant (P > 0.05) as shown in table 4

Table 4. Comparison of MAP between two groups at different time points

			N	Mean ± SD	SE	t	P value
At rest	0 hours	Group 1	23	97.9 ± 12.2	2.5	0.47	P = 0.6
		Group 2	23	96 ± 15.2	3.1		NS
	2 hours	Group 1	23	93.9 ± 12.3	2.58	0.303	P = 0.76
		Group 2	23	92.7 ± 13.8	2.88		NS
	4 hours	Group 1	23	92.17 ± 7.9	1.65	0.364	P = 0.71
		Group 2	23	91.3 ± 6.5	1.3		NS
	1 day	Group 1	23	98.7 ± 13.1	2.7	0.29	P = 0.76
		Group 2	23	88.04 ± 7.4	1.5		NS
At 90	0 hours	Group 1	23	101.8 ± 11.4	2.3	-0.07	P = 0.94
		Group 2	23	102.08 ± 13.6	2.8		NS
	2 hours	Group 1	23	95.26 ± 13.4	2.7	0.27	P = 0.78
		Group 2	23	92.1± 7.9	1.6		NS
	4 hours	Group 1	23	94.6 ± 7.8	1.6	-1.3	P = 0.2
		Group 2	23	98.7 ± 13.1	2.74		NS
	1 day	Group 1	23	89.7 ± 7.2	1.5	0.316	P = 0.75
		Group 2	23	88.4 ± 18.3	3.8		NS

- **Median NRS between the groups at different time points at rest:** The data was non parametric ,Mann -Whitney U test indicated there was no statistically significant difference in median NRS scores among participants between both the groups at 0 hour, 2 hours, 4 hours, and 1 day (P > 0.05) as shown in table 5

Table 5. Comparison of NRS at rest between the groups at different time points

NRS			N	Median	IQR	Z	P value
At rest	0 hours	Group 1	23	3	2.0-3.0	-0.51	P = 0.6
		Group 2	23	3	2.0-3.0		NS
	2 hours	Group 1	23	3	3.0-3.0	-0.57	P = 0.56
		Group 2	23	3	2.0-3.0	6	NS
	4 hours	Group 1	23	3	3.0-4.0	-1.45	P = 0.14
		Group 2	23	3	3.0-3.0		NS
	1 day	Group 1	23	3	1.0-4.0	-1.39	P = 0.16
		Group 2	23	3	1.0-4.0		NS

- **Median NRS between the groups at different time points at arm abduction :** The data was non parametric ,Mann -Whitney U test indicated that there was no statistically significant difference in median NRS scores among participants between both the groups at 0 hour, 2 hours, 4 hours, and 1 day (P > 0.05) as shown in table 6

Table 6:Comparison of NRS at 90 degree arm abduction at different time points

			N	Median	IQR	Z	P value
At 90	0 hours	Group 1	23	3	3.0 - 4.0	-0.305	P = 0.76
		Group 2	23	3	3.0 - 4.0		NS
	2 hours	Group 1	23	3	3.0 - 4.0	-1.2	P = 0.2
		Group 2	23	3	3.0 - 3.0		NS
	4 hours	Group 1	23	3	3.0 - 5.0	-0.66	P = 0.56
		Group 2	23	3	3.0 - 3.0		NS
	1 day	Group 1	23	1	1.0 - 3.0	-1.45	P = 0.15
		Group 2	23	1	1.0 - 2.0		NS

- **Mean hours of rescue analgesia between the groups :** The time to first rescue analgesia was 3.4 hours in Group 1 which was longer than 2.9 hours among participants in Group 2. The data was normally distributed and unpaired t test indicated that the mean difference between the groups was statistically significant (P = 0.048) as shown in table 7

Table 7.Comparison of mean hours of rescue analgesia taken by participants between the groups

	N	Mean ± SD	SE mean	t	P value
Group 1	23	3.4 ± 0.9	0.18	2.034	P = 0.048*
Group 2	23	2.9 ± 0.67	0.14		

- **Mean intraoperative Fentanyl requirement :** Group 1 had a mean fentanyl requirement of 104.35 ± 14.4 , Group 2 had an average of 102.17 ± 10.42. Group 1 required more intraoperative Fentanyl when compared to participants in Group 2. The data is non parametric and unpaired t test indicated that there was not statistically significant difference (P = 0.56) as shown in table 8

Table 8. Comparison of intraoperative Fentanyl requirement (in mcg)

	N	Mean ± SD	SE mean	t	P value
Group 1	23	104.35 ± 14.4	3	0.58	P = 0.56
Group 2	23	102.17 ± 10.42	2.1		NS

- **Mean postoperative Tramadol requirement in 24 hours:** Group 1 had a tramadol requirement of 2.09 ± 0.41 ,Group 2 had an average of 1.22 ± 0.42.The requirement of postoperative Tramadol Group 1 was 2.09 hours when compared to 1.22 hours among participants in Group 2.The data was non parametric and unpaired t test indicated that the mean difference was found to be statistically significant (P = 0.001) as shown in table 9

Table 9. Comparison of postoperative Tramadol requirement in 24 hours

	N	Mean ± SD	SE mean	t	P value
Group 1	23	2.09 ± 0.41	0.087	7.03	P = 0.001**
Group 2	23	1.22 ± 0.42	0.88		

In summary, this comprehensive analysis of demographic and physiological parameters revealed no statistically significant differences between the two groups across all measured variables. This suggests that the groups were well-matched in terms of age, ASA status, height, weight and BMI measurements.

Primary Outcome-

The efficacy and duration of analgesia was compared using time to first rescue analgesia shown in Table,7

The comparison of mean hours until rescue analgesia was required shows a statistically significant difference between Group 1 (ropivacaine with dexamethasone) and Group 2 (plain ropivacaine) in serratus anterior plane blocks. Group 1 had a longer duration before requiring rescue analgesia (3.4 ± 0.9 hours) compared to Group 2 (2.9 ± 0.67 hours), with the difference being statistically significant (p = 0.048). This indicates that participants who received plain ropivacaine requested additional pain relief earlier than those who received the ropivacaine-dexamethasone combination. The data, which was normally distributed according to the Shapiro-Wilk test, suggests that the addition of dexamethasone to ropivacaine in serratus anterior plane blocks may prolong the duration of analgesia. While the absolute time difference is modest, this finding implies a potential clinical benefit in

postoperative pain management for patients receiving the ropivacaine-dexamethasone combination, as it delays the need for rescue medication.

The study compared the analgesic efficacy of serratus anterior plane block using ropivacaine with dexamethasone (Group 1) versus plain ropivacaine (Group 2), with pain assessed using the Numeric Rating Scale (NRS) while the patient's arm was at rest by the side of the body(Table 5). Despite the addition of dexamethasone, which is often used to prolong anesthetic effects, no statistically significant differences in pain scores were observed between the two groups at any time point from rest to 1 day post-procedure. Both groups maintained similar median pain scores throughout, suggesting that adding dexamethasone to ropivacaine in this block did not provide superior analgesia compared to ropivacaine alone. The slight trend towards difference at 4 hours (P = 0.14) did not reach statistical significance. These findings indicate that for pain control at rest, the addition of dexamethasone to ropivacaine in serratus anterior plane blocks may not offer clinically meaningful improvements over ropivacaine alone in this specific application.

The comparison of NRS scores for 90-degree arm abduction following serratus anterior plane block with ropivacaine and dexamethasone (Group 1) versus plain ropivacaine (Group 2) shows no statistically significant differences between the groups at any time point (Table 6). Both groups maintain similar median pain scores (3) from 0 to 4 hours, with a notable reduction to 1 at the 1-day mark. While Group 1 shows slightly wider interquartile ranges at 4 hours and 1 day, these differences do not reach statistical significance ($p > 0.05$ for all comparisons).

ith the results for pain at rest, suggest that adding dexamethasone to ropivacaine in serratus anterior plane blocks does not provide superior analgesia compared to ropivacaine alone, both at rest and during arm abduction, up to 1 day post-procedure. The similar pain control efficacy is observed across all measured time points, indicating comparable analgesic performance of both treatments in this specific application.

Secondary Outcomes-

- **Intraoperative Fentanyl requirement:** The data from Table 8 compares the intraoperative Fentanyl requirement between two groups. Group 1 (n=23) had a mean Fentanyl requirement of 104.35 mcg (SD ± 14.4, SE mean 3), while Group 2 (n=23) required a mean of 102.17 mcg (SD ± 10.42, SE mean 2.1). The comparison was analyzed using an unpaired t-test, resulting in a t-value of 0.58 and a p-value of 0.56. This p-value is greater than the conventional significance threshold of 0.05, indicating no statistically significant difference between the two groups in terms of intraoperative Fentanyl requirement.

The data was confirmed to be normally distributed using the Shapiro-Wilk test, validating the use of the t-test for this analysis. These results suggest that despite the slight numerical difference in mean Fentanyl requirement, both groups had similar analgesia needs during the intraoperative period. The lack of statistical significance (NS) implies that any observed difference between the groups is likely due to chance rather than a true difference in Fentanyl requirements between the interventions or treatments received by each group.

- **Postoperative Tramadol intake in 24 hours:** The data from Table 9 compares the postoperative Tramadol requirement in 24 hours between two groups. Group 1 (n=23) had a mean Tramadol requirement time of 2.09 hours (SD ± 0.41, SE mean 0.087), while Group 2 (n=23) required Tramadol at a mean time of 1.22 hours (SD ± 0.42, SE mean 0.88). The comparison was analyzed using an unpaired t-test, resulting in a t-value of 7.03 and a highly significant p-value of 0.001.This statistically significant difference (p = 0.001) indicates that Group 1 took Tramadol significantly later than Group 2 in the postoperative period. Specifically, patients in Group 1 waited about 0.87 hours (approximately 52 minutes) longer before requiring Tramadol compared to patients in Group 2.

These results suggest that the intervention or treatment received by Group 1 may have provided more effective or longer-lasting pain relief in the immediate postoperative period, delaying the need for additional analgesia. The significant delay in Tramadol requirement for Group 1 implies a potentially clinically relevant difference in postoperative pain management between the two groups.

- **Pain with movement and without movement at surgical site:** The study compared pain without movement and with movement using NRS at different time intervals. The data was analyzed in Mann -Whitney U test indicated there was no statistically significant difference in median NRS scores among participants between both the groups at 0 hour, 2 hours, 4 hours, and 1 day at rest and abduction (P > 0.05) as shown in table 5 and 6.
- **Hemodynamic Changes:** Mean heart rates were similar between Group 1 and Group 2 at rest, with no statistically significant differences observed over time. During arm abduction, Group 1 had a significantly higher baseline heart rate (P = 0.049), but differences at later time points were not significant. Systolic blood pressure (SBP) at rest was slightly higher in Group 1, while during arm abduction, SBP was similar between groups; however, these differences were not statistically significant in either condition. Diastolic blood pressure (DBP) showed no significant differences at rest, but during arm abduction, Group 1 had significantly lower DBP at 4 hours (P = 0.01) and 1 day (P = 0.005) post-intervention. Mean arterial pressure (MAP) was generally higher in Group 1 at rest, and varied between groups during arm abduction, with Group 1 having higher MAP at 2 hours and lower MAP at 4 hours compared to Group 2. However, these MAP differences were not statistically significant in either condition. Heart rate and MAP were analyzed using unpaired t-tests, while SBP and DBP were analyzed using Mann-Whitney U tests. The most notable finding was the significant difference in DBP during arm abduction at later time points, with Group 1 showing lower values compared to Group 2.
- **Side Effects**: The study compared the incidence of side effects between Group 1 and Group 2, each consisting of 23 participants. Vomiting occurred in 2 patients (8.69%) in each group, showing no difference between the groups (P = 1.000). Nausea was reported in 2 patients (8.69%) in Group 1 and 1 patient (4.34%) in Group 2, but this difference was not statistically significant (P = 0.782). Neither group experienced any cases of bradycardia, hypotension, local anesthetic systemic toxicity (LAST), or nerve injury. The total number of adverse events was slightly higher in Group 1 (4 events) compared to Group 2 (3 events). Chi-square tests were used to analyze the data, and no statistically significant differences were found between the groups for any of the reported side effects (P > 0.05 for all variables) as shown in Table 10 .

Table 10 . Comparison Of Side Effects Between The Two Groups

Side effects	Group 1(N=23)	Group 2(N=23)	P value
Vomiting	2(8.69%)	2(8.69%)	1.000
Nausea	2(8.69%)	1(4.34)	0.782
Bradycardia	0(0%)	0(0%)	
Hypotension LAST Nerve injury	0(0%) 0(0%) 0(0%)	0(0%) 0(0%) 0(0%)	
Total	4	3	

Overall, both groups demonstrated a similar and low incidence of adverse effects, with no severe complications observed in either group

- Table 11 shows the multivariate analysis which was conducted to examine the relationship between various factors and an unspecified outcome variable. The analysis included age, BMI, intraoperative fentanyl dose, duration of surgery, intraoperative paracetamol dose, and disease grade as independent variables. The regression model as a whole was not statistically significant (F = 1.41, P = 0.225), indicating that the combination of these factors did not significantly predict the outcome variable. None of the individual factors showed a statistically significant association with the outcome (all P > 0.05). Disease grade approached significance (P = 0.059) but did not reach the conventional threshold of 0.05.

Table 11. Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	8	7.15413	0.89427	1.41	0.225
AGE	1	0.9472	0.94724	1.49	0.229
BMI	1	0.0560	0.05600	0.09	0.7689
INTRAOP FENTANYL(MCG)	1	0.0007	0.00068	0.00	0.974
DURATION OF SURGERY (HRS)	1	1.1113	1.11133	1.75	0.194

INTRAOP PCT (MG/KG)	1	1.4510	1.45096	2.29	0.139
DISEASE GRADE	3	5.1524	1.71748	2.71	0.059
Error	37	23.4546	0.63391		
Total	45	30.6087			

The model explained only a small portion of the variance in the outcome, as evidenced by the relatively small adjusted sum of squares for the regression (7.15413) compared to the total (30.6087). These results suggest that the examined factors, either individually or in combination, do not strongly predict the outcome variable in this study.

DISCUSSION

Our study's findings on the efficacy of adding dexamethasone to ropivacaine in serratus anterior plane (SAP) blocks align with the general trend in current literature, but with some notable differences. The primary outcome of delayed time to first rescue analgesia in the dexamethasone group (3.4 vs 2.9 hours, p = 0.048) is consistent with other studies, though the magnitude of effect varies. For instance, Sharma and colleagues reported a much longer duration of analgesia (median 547.50 minutes) with dexamethasone, while Chen JQ et al[15]. found a longer time to first bolus in their dexamethasone group for continuous SAP blocks. The smaller effect size in our study could be attributed to differences in block technique, surgical procedures, or definitions of "rescue analgesia" across studies.

Interestingly, our study found no significant differences in pain scores between groups, which contrasts with several reports in the literature. Sharma et al[16]. observed lower Visual Analog Scale (VAS) scores from the 4th to 12th hour postoperatively in their dexamethasone group, while Nayak et al[17]. reported significantly lower pain scores at multiple time points when dexamethasone was added to ropivacaine in PEC II blocks for mastectomy. This discrepancy might be due to variations in block technique, surgical procedure, assessment timing, or dexamethasone dosage. It highlights the complex nature of pain perception and management, suggesting that while dexamethasone may delay the need for rescue analgesia, its effect on perceived pain intensity may vary.

Our finding of delayed postoperative tramadol requirement (2.09 vs 1.22 hours, p = 0.001) in the dexamethasone group is consistent with the literature, though again, the magnitude of effect differs across studies. Sharma et al. reported significantly less intravenous tramadol consumption, Nayak et al[17]. found lower postoperative morphine consumption with dexamethasone in PEC II blocks, and Chen JQ et al[15]. observed fewer PCA button presses in their dexamethasone group. These variations likely reflect differences in choice of rescue analgesic, surgical procedure, and duration of postoperative observation.

The safety profile of dexamethasone as an adjuvant in our study, showing no significant increase in adverse effects, aligns with the current literature. However, it's worth noting that most studies, including ours, have relatively short follow-up periods, which may not capture long-term effects. Additionally, there appears to be a lack of specific monitoring for potential steroid-related side effects in the reviewed literature, presenting an area for future research.

While our study focused on dexamethasone, some literature suggests other adjuvants may also be effective. For instance, Gao Z et al[18]. found that dexmedetomidine as an adjuvant to ropivacaine in erector spinae plane blocks provided superior postoperative pain management compared to both dexamethasone and ropivacaine alone. This highlights the need for future studies directly comparing different adjuvants in the same block technique and surgical setting.

In conclusion, our findings generally support the beneficial effect of adding dexamethasone to ropivacaine in SAP blocks, particularly in delaying the need for rescue analgesia. However, the variations in outcomes across studies underscore the complexity of pain management and the influence of factors such as block technique, surgical procedure, and assessment methods. Future research should focus on largerscale trials with longer follow-up periods, direct comparisons of different adjuvants, and more standardized protocols to better elucidate the role of dexamethasone in regional anesthesia across various surgical contexts.

Limitations of the study:

This study faced several important limitations that warrant consideration when interpreting the results. The relatively small sample size may have limited our ability to detect subtle differences between groups, potentially explaining discrepancies between our findings and those of larger studies, particularly regarding pain scores. The short 24-hour follow-up period might not have fully captured the long-term effects of dexamethasone, including potential benefits or side effects. Additionally, the choice of serratus anterior plane (SAP) block for modified radical mastectomy (MRM) procedures may not have been optimal, as it might not provide comprehensive coverage for all areas affected by MRM, especially the axillary region. The involvement of multiple anesthesiologists in administering the blocks introduced potential variability in technique and expertise, which could have influenced block effectiveness and study outcomes. Although the blocks were administered after surgery but before reversal of anesthesia, which prevented patients from perceiving pain during block placement, the distorted post-surgical anatomy may still have complicated accurate block placement. This timing, while avoiding immediate postoperative pain, might have affected the spread and efficacy of the local anesthetic in the altered tissue planes. Lastly, our use of a single dexamethasone dose may not represent the optimal amount for maximizing analgesic efficacy and duration.

Future Scope:

Future research in this area should address the limitations identified in our study and explore additional aspects to enhance our understanding of dexamethasone as an adjuvant in regional anesthesia. Larger sample sizes should be employed to increase statistical power and potentially uncover subtle differences. Follow-up periods should be extended to several days or weeks to better assess the prolonged effects of dexamethasone. Comparative studies between SAP blocks and other regional techniques like PECS blocks or paravertebral blocks could determine the most effective approach for MRM procedures. Standardizing block administration, preferably by a single experienced anesthesiologist, would minimize technique variability. Preoperative block timing should be considered to avoid issues related to postoperative anatomy distortion and potentially improve block effectiveness. Dose response studies could help determine the optimal dexamethasone dose for maximizing analgesic efficacy and duration. Long-term safety assessments should be conducted to identify any potential complications associated with dexamethasone use in regional anesthesia. Future studies should also incorporate more patient-centered outcomes such as quality of recovery, satisfaction, and functional recovery. Lastly, economic evaluations could assess the cost-effectiveness of adding dexamethasone to regional anesthesia techniques in the context of overall perioperative care. By addressing these areas, future research can provide a more comprehensive understanding of dexamethasone's role as an adjuvant in regional anesthesia and optimize its clinical application.

CONCLUSION

This observational study demonstrated that the addition of dexamethasone to ropivacaine in serratus anterior plane blocks for postoperative pain management yields mixed but promising results. The most notable finding was a modest yet statistically significant delay in the time to first rescue analgesia and postoperative tramadol requirement in the dexamethasone group. This suggests that dexamethasone may extend the duration of analgesia provided by the block, potentially reducing early postoperative analgesic needs. However, it's important to note that this delay did not translate into significant differences in pain scores or overall analgesic efficacy between the groups. This discrepancy highlights the complex nature of pain perception and management, indicating that while dexamethasone may prolong the block's effects, it may not necessarily enhance pain relief intensity. Importantly, the combination of dexamethasone and ropivacaine appeared to be safe, with no observed increase in adverse effects compared to ropivacaine alone. This safety profile is crucial when considering new adjuvants in clinical practice. Taken together, these findings suggest a potential role for dexamethasone as an adjuvant in serratus anterior plane blocks, particularly in scenarios where extending the duration of analgesia is desirable. However, the lack of significant improvement in pain scores underscores the need for further research to fully elucidate the clinical implications of this combination.

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