

To Study The Efficacy of USG – Guided Pectoral Nerve Block (PEC-II) and Serratus Anterior Plane Block (SAP) Using Levobupivacaine 0.25% in Patients Undergoing Breast Surgeries

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Abstract:

Effective postoperative pain management is crucial for enhancing patient recovery and improving quality of life following surgery. Ultrasound-guided thoracic interfascial plane blocks, specifically the Pectoral Nerve Block II (PEC II) and the Serratus Anterior Plane Block (SAPB), are relatively simple and easy-to-learn techniques. These blocks have been developed as alternatives to thoracic epidural anaesthesia and paravertebral blocks for regional analgesia in breast surgeries. Our study aimed to evaluate the effectiveness of these two blocks in managing postoperative pain for 24 hours following breast surgeries, such as modified radical mastectomy (MRM) or simple mastectomy. Pain was assessed using the Visual Analog Scale (VAS), along with the timing of the first analgesic requirement and the total tramadol consumption within 24 hours. This observational study was conducted to determine the impact of these blocks on acute post-surgical pain.

Methodology: This interventional study was conducted on 30 patients undergoing breast surgeries under general anaesthesia, with 15 patients receiving either a PECS-II blocks or a Serratus Anterior Plane Block (SAPB). A total of 30 ml of anaesthetic solution was prepared using 25 ml of 0.25% levobupivacaine combined with dexmedetomidine (1 mcg/kg), diluted to 30 ml with normal saline. Tramadol (1-2 mg/kg) was provided as rescue analgesia. Postoperative pain was assessed using the Visual Analog Scale (VAS) at multiple time points (0, 1, 2, 4, 8, 16, and 24 hours after surgery). Additionally, the time to first analgesia (TFA) and any complications were recorded.

Result: In this study, we observed that first rescue analgesia or duration of analgesia was more in patients who received SAP (511.0 ± 40) than patients who received PEC block (378.4 ± 60) which was statistically highly significant ($p < 0.001$).

Conclusion: This study has clarified that employing an ultrasound-guided SAP block, combined with dexmedetomidine as an adjuvant alongside 0.25% levobupivacaine, results in superior postoperative analgesia compared to PEC block.

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Introduction

Breast cancer is the most frequently diagnosed malignancy and the leading cause of cancer-related deaths in women, surpassing lung cancer. While mortality rates have declined by 2%–4% annually since the 1990s due to advancements in treatment and early detection, the global incidence of breast cancer remained significant at 11.7% in 2020 across all age groups and both sexes[1]. Surgical treatment for breast cancer can lead to complications, including nerve damage, which may result in post-mastectomy pain syndromes such as phantom breast pain, intercostobrachial neuralgia, or neuropathic pain[2]. Modified radical mastectomy (MRM) is

among the most commonly performed procedures and is a major cause of severe acute postoperative pain in breast surgery. Furthermore, acute postoperative pain is a key independent risk factor for the development of chronic post-mastectomy pain.[3]

Regional anesthesia techniques such as thoracic epidural block, thoracic paravertebral block (TPVB), and intercostal nerve block have been widely used for anesthesia and analgesia in breast surgery. Among these techniques, TPVB is considered the gold standard for providing effective

postoperative pain relief in breast surgery patients.[2]

However, these invasive regional techniques carry potential risks during the perioperative period, including complications such as pneumothorax, accidental vascular injection, epidural or intrathecal spread, and total spinal anesthesia. These risks make them less suitable for outpatient or day-stay procedures. Additionally, the reluctance of many anesthesiologists to use invasive methods in breast surgery has further limited their widespread implementation[4].

Recently, ultrasound-guided (USG), less invasive thoracic wall interfascial plane blocks have emerged as an alternative to the paravertebral block. One such technique is the Pectoralis (PECS I) block, which targets the medial and lateral pectoral nerves and is particularly useful for procedures like breast expansion or prosthetic surgeries[5].

An advanced variation, the PECS II block, combines the PECS I block while also targeting the T2-T6 intercostal nerves and the long thoracic nerve[6]. This modification provides effective analgesia for more extensive breast surgeries, such as simple mastectomies or modified radical mastectomies with axillary node clearance. The PECS II block involves a two-step injection of local anesthetic: (i) between the pectoral muscles and (ii) between the serratus anterior and pectoralis minor muscles.[7]

Another recently introduced interfascial block is the Serratus Anterior Plane (SAP) block, which provides analgesia by targeting the intercostal nerves, typically from T2 to T9. This technique involves injecting local anesthetic either between the serratus anterior and intercostal muscles or between the serratus anterior and latissimus dorsi muscles[8]. The SAP block is effective in numbing

a broader range of intercostal nerves and provides more specific coverage of the thoracic nerves.[9]

Unlike TPVB, these interfascial plane blocks do not cause sympathetic blockade and have fewer side effects as they are superficial blocks.

Dexmedetomidine is a highly selective alpha-2 adrenergic receptor agonist, used as an adjunct to local anaesthetics, this accelerates the onset of action and increases the duration of nerve block[1].

We hypothesized that the serratus plane block will provide better analgesia and sensory block than the PECS II block for breast surgeries with lesser side effects.

The primary objective of the study was to evaluate Analgesic efficacy of PECS II block and SAP block for post operative pain relief. Secondary objectives were to evaluate VAS scores post-operatively, time for first analgesic medication, total rescue analgesic consumption and intraoperative and postoperative hemodynamic parameters and immediate post-op complications.

Aims and Objectives

Primary: The main goal of the study is to evaluate analgesic efficacy of PECS II block and SAP block for post operative pain relief in patients undergoing breast surgeries.

Secondary: To evaluate pain score post-operatively and the time of requirement for first Analgesia, total analgesia required.

Type of Study: Observational hospital-based study.

Location: OT complex, department of Anaesthesia, Gandhi Medical college, Bhopal Madhya Pradesh.

Sample Size: 30.

Inclusion Criteria	Exclusion Criteria
ASA Grade I and II	Patients refusal
Age between 18 – 60 years	ASA Grade III and more
Patient undergoing Breast surgery under GA	Cardiac disease, Respiratory distress, Psychiatric disorders, Uncontrolled Hypertension or diabetes mellitus
	Pregnancy
	Drug allergy
	Coagulation disorders

Methodology

A prospective observational study was conducted on 30 patients in the Department of Anaesthesiology at Gandhi Medical College, Bhopal, Madhya Pradesh, between May and August 2024, following approval from the institutional ethics committee. Participants were divided into two groups:

- Group dPEC: 15 patients received 0.5 ml/kg of 0.25% levobupivacaine combined with 1

mcg/kg dexmedetomidine, diluted to a total volume of 30 ml with normal saline.

- Group dSAP: 15 patients received the same dosage and dilution as Group dPEC.

Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. All participants underwent a comprehensive pre-anesthetic evaluation and were informed about the study procedures. The Visual Analog Scale (VAS) for pain assessment, ranging from 0 (no pain) to 10

(worst imaginable pain), was explained to each patient. Informed written consent was obtained from all participants.



Figure 1: Graphic representing probe position obtained during a Pecs I block (left), Pecs II block (middle) or a serratus plane block (right).

Pectoralis II block: The patient was positioned supine with the arm abducted. An ultrasound probe was first placed in the infraclavicular region at the lateral third of the clavicle and then moved laterally to identify the axillary artery and vein above the first rib, along with the pectoralis major and minor muscles. At the level of the second rib, the pectoral branch of the thoracoacromial artery was located—either by noting its pulsatile nature or using color Doppler. A needle was then inserted in-plane from a superomedial to an inferolateral direction between

the pectoralis muscles, and 10 mL of the drug solution was injected. Next, the probe was moved toward the axilla until the serratus anterior muscle was visualized above the 2nd, 3rd, and 4th ribs, near the lateral border of the pectoralis minor. The needle was reintroduced into the fascial plane between the pectoralis minor and serratus anterior muscles, and after confirming negative aspiration, 20 mL of the solution was injected. The overall volume of the drug administered was 30 mL.

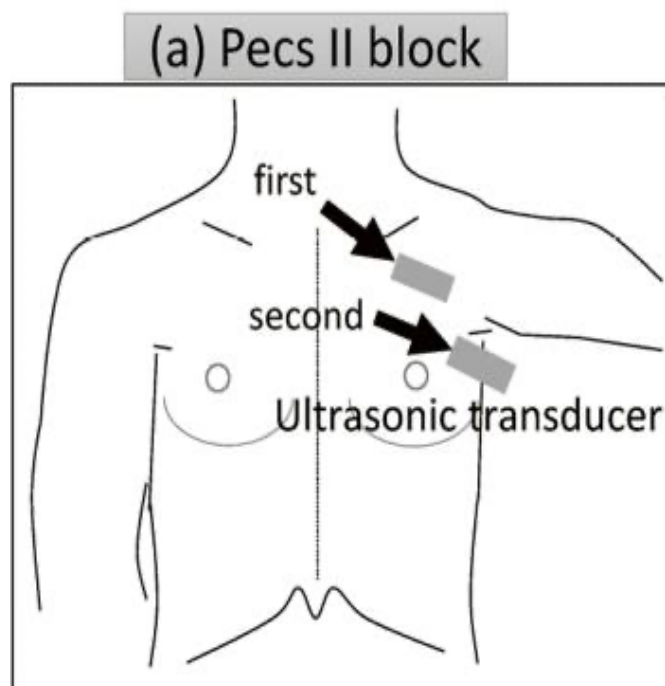


Figure 2: Probe position in PEC II block.

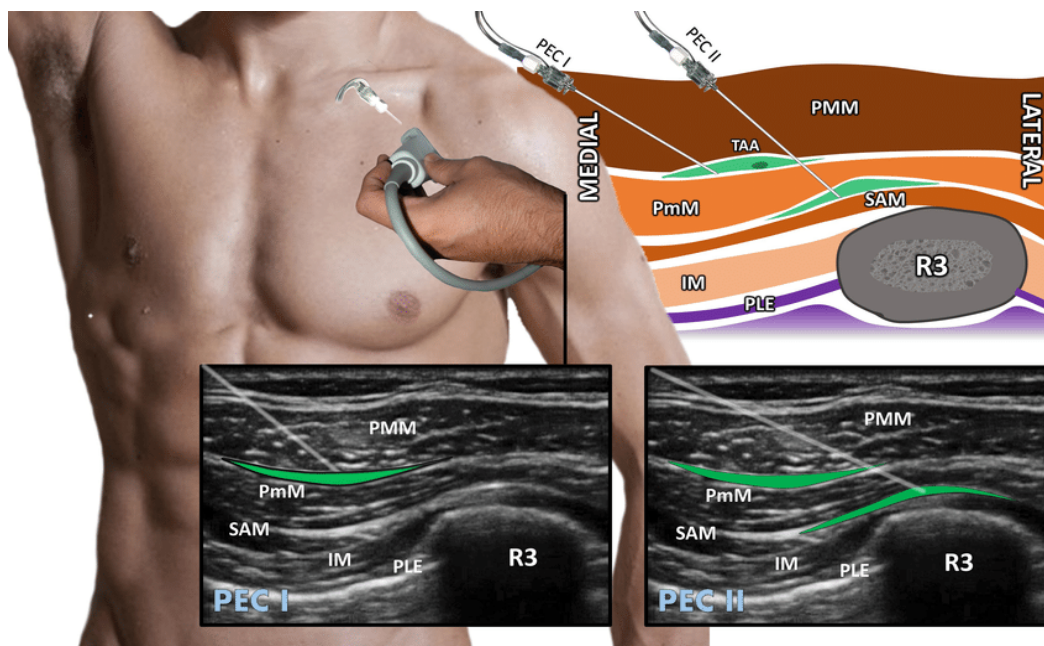


Figure 3: Sonoanatomy of PEC II block showing pectoral branch of thoracoacromial artery. [PMM - pectoralis major muscle, PmM - pectoralis minor muscle, SAM - serratus anterior muscle]

Serratus anterior plane block: Patients were positioned supine with their arms abducted. An ultrasound probe was placed in the midaxillary line at the third intercostal space, oriented medially to laterally. Ultrasound imaging identified the following structures from superficial to deep: subcutaneous tissue, serratus anterior muscle, intercostal muscles (external, internal, and innermost), ribs, pleura, and lung. Using an in-plane approach, a block needle was inserted in a caudal-to-cranial direction until its tip was positioned between the serratus anterior and external intercostal

muscles. After confirming negative aspiration, 30 mL of the drug solution was administered.

Postoperatively, pain was assessed using the Numerical Rating Scale (NRS) at 0, 2, 4, 6, 8, 10, 12, and 24 hours. Intravenous tramadol at 0.5 mg/kg was provided as the first rescue analgesic when the NRS exceeded 3 or upon patient request. The time to first rescue analgesia was recorded. Additionally, side effects and complications related to the use of dexmedetomidine were monitored.

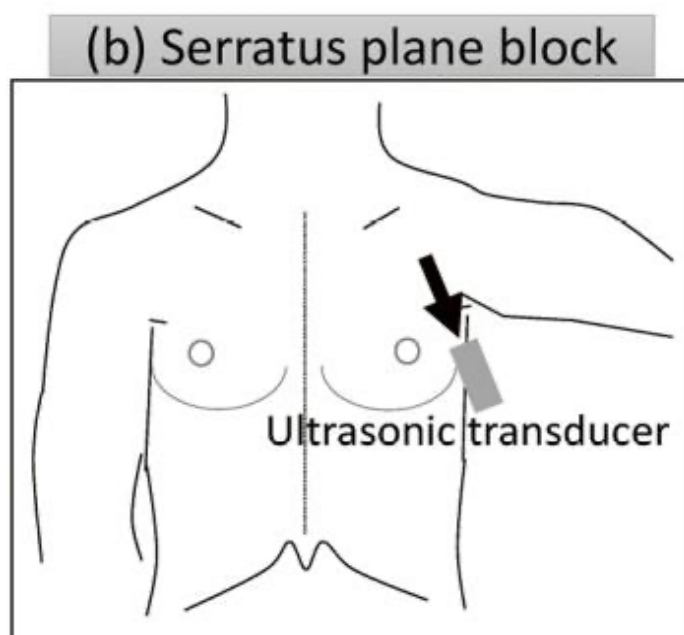


Figure 4: Probe position SAP block.

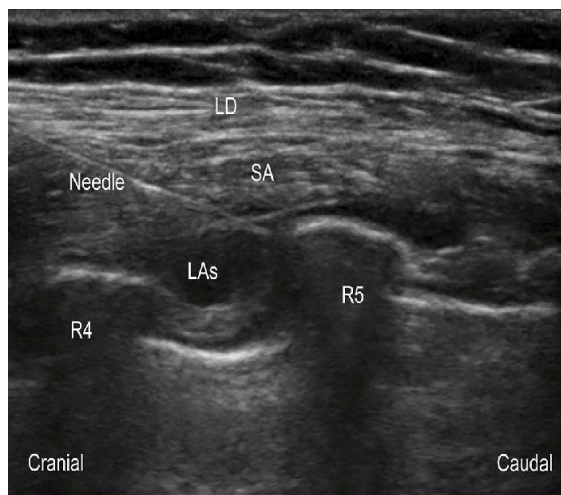
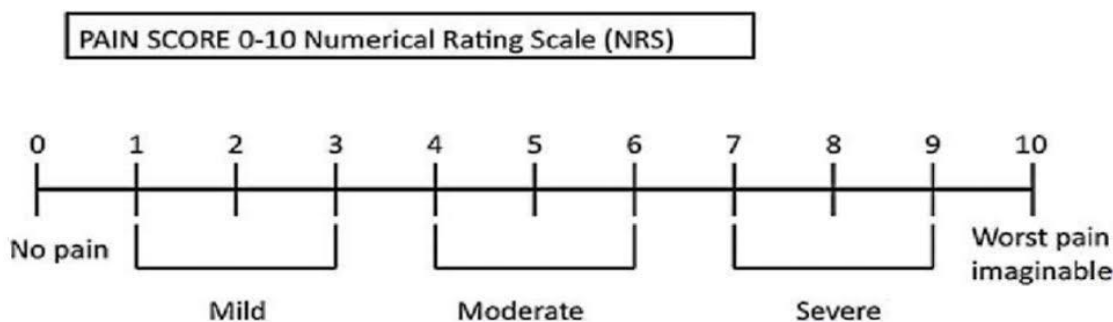


Figure 5: Serratus plane block with spread of local anaesthetic between muscle and rib. (SAM – serratus anterior muscle, LD- Latissimus dorsi, LA – local anaesthetic)

Pain Assessment Tool: Numerical Rating Scale:
 The Numerical Rating Scale has shown a high correlations as compared to other pain-assessment tools. The patients were asked to circle the number

between 0 and 10, zero representing “no pain at all” whereas the upper limit represents “the worst pain possible”



Statistical Analysis: Data entered in Microsoft excel software SPSS version 27 was used for performing the statistical analysis. In both groups the continues variables Such as age, SBP, DBP, HR, NRS Scores, First rescue analgesia are expressed as mean and standard division.

and total analgesia), the studied groups were compared using student’s unpaired t-Test.

Normally or continuously distributed data (hemodynamic parameters, time for first analgesia

Non- parametric data such as VAS score - Mann-Whitney U test.

All statistical tests were performed with the confidence level of 95% and power off 80% for all the statistical interpretations p value less than 0.05 was considered as significant.

	Group	N	Mean and SD
Age	Group dPEC	15	50.10 ± 4.856
	Group dSAP	15	50.63 ±4.694

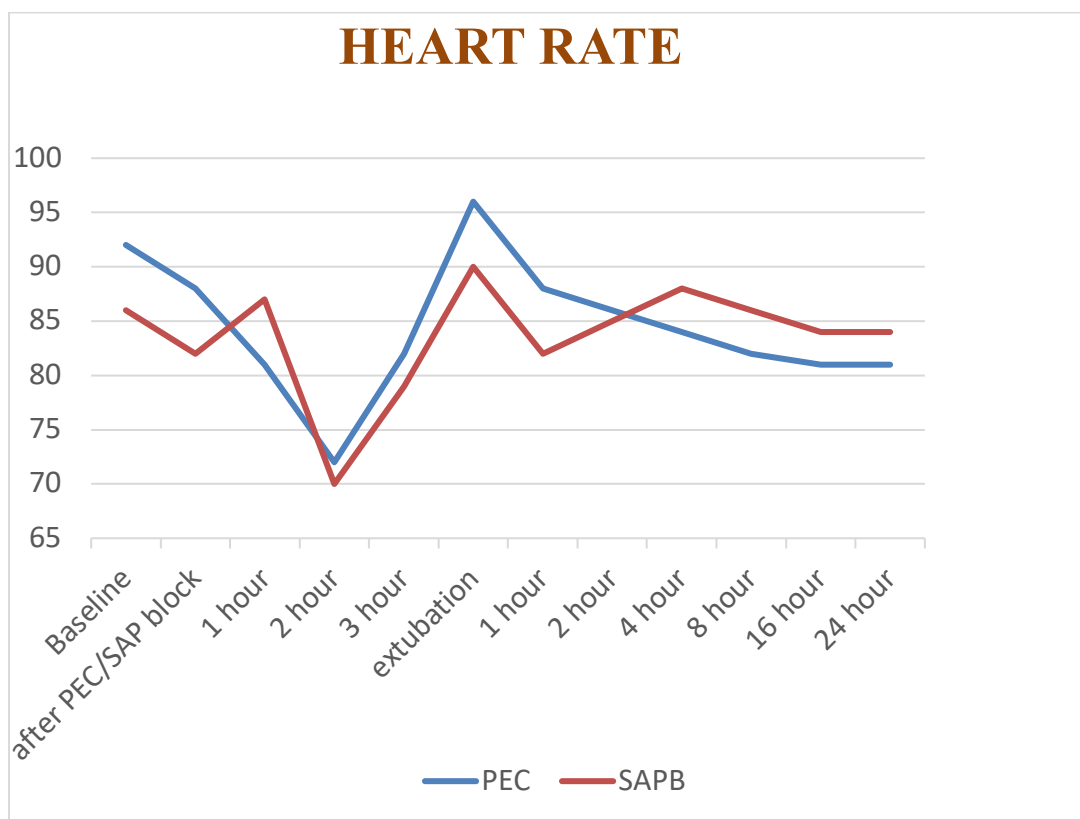
Age distribution among study groups

Unpaired T-Test applied. P value<0.05 was taken Statistically significant.

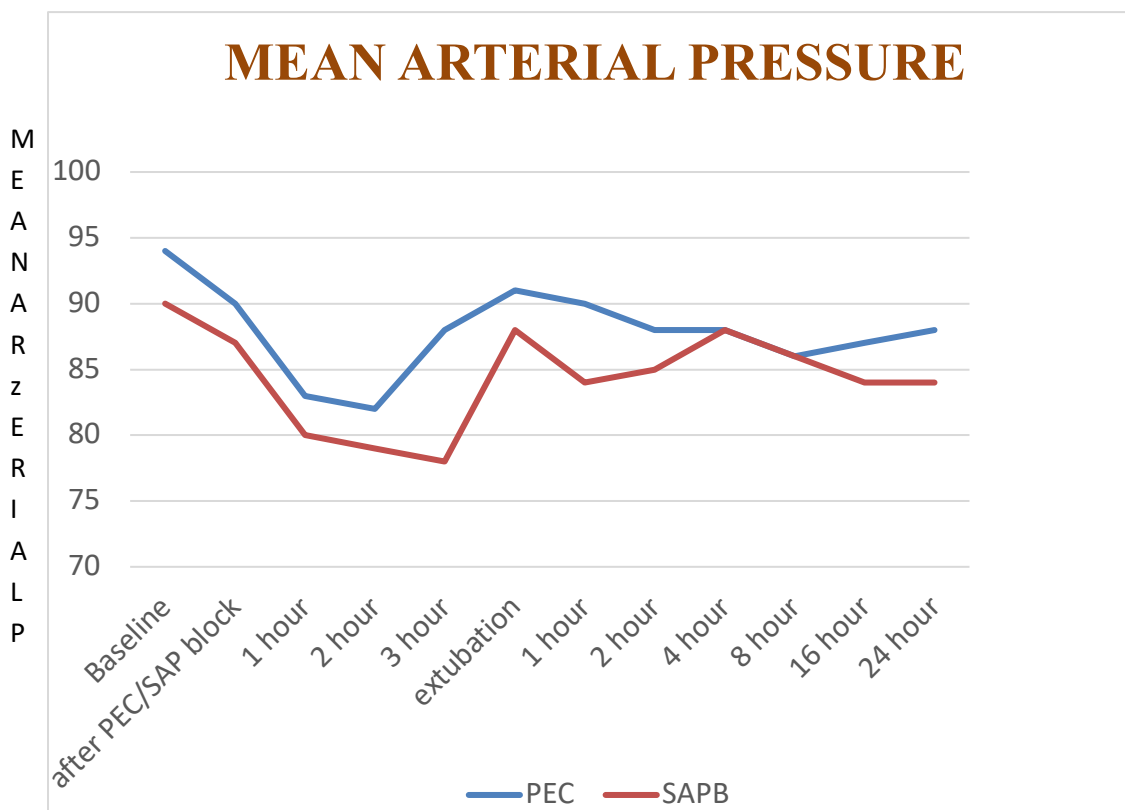
ASA Grade	Frequency	Perecent
ASA Grade I	13	43%
ASA Grade II	17	56%

ASA Grade distribution

Comparison of hemodynamic parameters intraoperatively and postoperatively in both the groups



Graph showing Mean Heart Rate of both Groups.



Graph showing Mean Arterial Pressure of both Groups. Unpaired T-test was used. P value was statistically insignificant.

Variables	PECS-2 Block (N=15)	SAP Block (N=15)	P- Value
At extubation	1 (0-1)	0 (0-1)	0.068
1st Hour	1 (1-2)	0 (0-1)	0.091
2nd Hour	2 (1-2)	1 (0-1)	0.085
4th Hour	2 (1-2)	1 (1-2)	<0.05
8th Hour	4 (4-5)	2 (1-2)	<0.05
16th Hour	5 (4-5)	4 (0-1)	<0.05
24th Hour	5 (4-5)	3 (0-1)	<0.05

Comparison of NRS scores at different time intervals

Variables	PEC Block (N=15)	SAP Block (N=15)	P- Value
Time to 1 st analgesia request (minute)	378.4 ± 60	511.0 ± 40	<0.05
Total analgesia consumption (Tramadol)	100 ± 50	50 ± 25	<0.05

Discussion

Thoracic interfascial plane blocks are considered easy and safe superficial nerve blocks for breast surgery.

In the study of Alshawadfy A. et al. showed that patients undergoing MRM who received SAP block had a significantly longer time to rescue analgesia compared to those who received PEC II block. In addition, SAP block significantly lowered patients' need for total analgesia and VAS scores postoperatively. This was similar to our observational study.

In a similar study of Wang et al. supposed that SAP could paralyse a large number of anterolateral cutaneous branches of T6-T9 intercostal nerves, producing better analgesic effect.

Our results were similar to study conducted by Jain et al. compared TPVB, PECS, and SAP block in terms of analgesic efficacy and the spread of local anaesthetic by ultrasound imaging, correlating it with the sensory blockade.

In the study of Alshawadfy A. et al. showed that patients undergoing MRM who received SAP block had a significantly longer time to rescue analgesia compared to those who received PECS II block. In addition, SAP block significantly lowered patients' need for total analgesia and VAS scores postoperatively. This was similar to our observational study[9].

In another study, Magoon et al, compared the fascial plane blocks, there was no significant difference between the SAPB and Pec II groups except the mean post-extubation VAS score at 12 h which was significantly lower in SAPB (3.23 ± 0.50) compared to the Pecs II group (3.71 ± 0.69) (P value <0.05)[10].

None of our study participants faced complications related to block performance like- intravascular

injection, hematoma formation, pneumothorax, local anaesthetic toxicity or neural injury.

Result

- Continues variables were compared among both groups Using independent T- Test While category variables were compared using Mann-Whitney U Test depending on the distribution. P value<0.05 was taken Statistically significant There was no difference in age distribution in both the groups and was statistically insignificant. Comparison of Mean Heart Rate, mean systolic and diastolic blood pressure of both Group dSAP and Group dPEC was statistically insignificant as well. The NRS scores among the GROUP dSAP were significantly lower than that of GROUP dPEC during all the intervals of time (p<0.05). SAP Block (GROUP dSAP) showed lower NRS scores at most of the time interval. Total analgesic consumption in the Group dSAP was lower compared to that of Group dPEC which was significant statistically (p<0.05). No significant side effects or complications occurred in patients of both the groups at any point of time (Post-operative adverse effects: nausea, vomiting, bradycardia, hypotension was not significantly different among the two groups).

Conclusion

This study elucidated that SAP block performed by USG-guidance using Dexmedetomidine as an adjuvant with 0.25% levobupivacaine could account for better analgesia postoperatively than PEC block using Dexmedetomidine as an adjuvant with 0.25% levobupivacaine. SAP block provided better post-operative pain control in terms of low NRS scores as compared to PEC II block in patients undergoing breast surgeries. Though PEC II and SAPB, both block intercostal nerves, serratus plane block was more consistent in blocking T2-T6 intercostal nerves than PECS II, resulting in a superior analgesic efficacy. Side effects due to usage of local anaesthetics and adjuvants were nil.

References

1. Wu Y, Kang Y, Li Y, Fu B. Impact of Ultrasound-Guided Deep Serratus Anterior Plane Block Combined with Dexmedetomidine as an Adjuvant to Ropivacaine Inpatient Quality of Recovery Scores Undergoing Modified Radical Mastectomy: A Randomized Controlled Trial. *Front Oncol.* 2022 Mar 31; 12:858030.
2. Jain D, Mohan VK, Bhoi D, Batra RK, Kashyap L, Shende D, et al. Analgesic efficacy and spread of local anesthetic in ultrasound-guided paravertebral, pectoralis II, and serratus anterior plane block for breast surgeries: A randomized controlled trial. *Saudi J Anaesth.* 2020;14(4):464–72.
3. 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.
4. Moon EJ, Kim SB, Chung JY, Song JY, Yi JW. Pectoral nerve block (PECS block) with sedation for breast conserving surgery without general anesthesia. *Ann Surg Treat Res.* 2017 Sep;93(3):166–9.
5. Blanco R, Fajardo M, Parras Maldonado T. Ultrasound description of Pecs II (modified Pecs I): A novel approach to breast surgery. *Revista Española de Anestesiología y Reanimación.* 2012 Nov;59(9):470–5.
6. Versyck B, Van Geffen GJ, Van Houwe P. Prospective double blind randomized placebo-controlled clinical trial of the pectoral nerves (Pecs) block type II. *Journal of Clinical Anesthesia.* 2017 Aug; 40:46–50.
7. Bashandy GMN, Abbas DN. Pectoral Nerves I and II Blocks in Multimodal Analgesia for Breast Cancer Surgery: A Randomized Clinical Trial. *Regional Anesthesia and Pain Medicine.* 2015;40(1):68–74.
8. 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.
9. Alshawadfy A, Al-Touny SA. Comparing the quality of analgesia with ultrasound-guided pectoral nerve block and serratus anterior plane block II in patients undergoing modified radical mastectomy: a randomised clinical trial. *Anaesthesiol Intensive Ther.* 2023;55(1):52–9.
10. Magoon R, Kaushal B, Chauhan S, Bhoi D, Bisoi AK, Khan MA. A randomised controlled comparison of serratus anterior plane, pectoral nerves and intercostal nerve block for post-thoracotomy analgesia in adult cardiac surgery. *Indian J Anaesth.* 2020 Dec;64(12):1018–24.
11. Yao Y, Li J, Hu H, Xu T, Chen Y. Ultrasound-guided serratus plane block enhances pain relief and quality of recovery after breast cancer surgery: A randomised controlled trial. *Eur J Anaesthesiol.* 2019 Jun;36(6):436-441. doi: 10.1097/EJA.0000000000001004. PMID: 31021882.
12. Bin Ghali K, AlKharraz N, Almisnid O, Alqarni A, Alyamani OA. The Pectoral (PECS) Regional Block: A Scoping Review. *Cureus.* 2023 Oct 6;15(10):e46594. doi: 10.7759/cureus.46594. PMID: 37933365; PMCID: PMC10625794.