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Research Article

A COMPARATIVE STUDY OF CLONIDINE AND FENTANYL AS ADJUVANTS TO 0.5% LEVOBUPIVACAINE IN ULTRASOUND-GUIDED PECTORAL NERVE (PEC) BLOCK FOR MINOR BREAST SURGERIES

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Abstract

Background: Ultrasound-guided Pectoral Nerve (PEC) block is a well-established regional anesthesia technique providing targeted perioperative analgesia for minor breast procedures. Adding adjuvants to local anesthetics enhances blockade speed, quality, and duration. This study evaluated and compared the clinical efficacy, postoperative analgesia, and hemodynamic stability of clonidine versus fentanyl as adjuvants to 0.5% levobupivacaine in USG-guided PEC blocks.

Methods: This prospective, randomized, comparative clinical study included 100 ASA I–II patients aged 18–50 years scheduled for elective minor breast surgeries under ultrasound-guided PEC block. Patients were randomly allocated into two equal cohorts (n = 50 per group):

- **Group C (Clonidine Group):** Received 15 mL of 0.5% Levobupivacaine + Clonidine 1 µg/kg.
- **Group F (Fentanyl Group):** Received 15 mL of 0.5% Levobupivacaine + Fentanyl 1 µg/kg.

Time to first request for rescue analgesia, Visual Analogue Scale (VAS) scores across recovery windows (0–2 hours and 4–12 hours), total 24-hour rescue analgesic consumption, and perioperative hemodynamic parameters (Heart Rate and Mean Arterial Pressure post-incision) were recorded and compared.

Results: The mean time to first rescue analgesia was significantly longer in Group C (9.48 hours) compared to Group F (5.15 hours; $p < 0.001$). Group F demonstrated significantly lower VAS pain scores in the immediate postoperative period (0–2 hours; $p = 0.01$), whereas Group C achieved significantly lower VAS scores during extended recovery (4–12 hours; $p < 0.001$) and reduced overall 24-hour analgesic demand ($p < 0.05$). Hemodynamic stability was significantly better maintained in Group C, while severe adverse events (profound

bradycardia, severe hypotension, hypoxemia, or respiratory depression) were absent in both groups.

Conclusion: Both clonidine and fentanyl are effective local anesthetic adjuvants to levobupivacaine in USG-guided PEC blocks for minor breast surgeries. While fentanyl provides faster block onset and superior pain relief in the immediate post-operative hours, clonidine offers significantly longer-lasting postoperative analgesia, superior extended pain control, reduced 24-hour analgesic requirement, and a highly stable hemodynamic profile.

Keywords: Pectoral nerve block, PEC block, Clonidine, Fentanyl, Levobupivacaine, Ultrasound-guided regional anesthesia, Postoperative analgesia, Minor breast surgery.

INTRODUCTION

Effective perioperative analgesia is critical for optimal recovery, early mobilization, and enhanced satisfaction in patients undergoing minor breast procedures. Inadequate pain control can lead to prolonged post-anesthesia care unit stays, increased opioid reliance, and systemic adverse effects. [6,10]

The ultrasound-guided Pectoral Nerve (PEC) block has emerged as a gold-standard regional technique [3,4,6], offering highly targeted pain control for breast surgeries with minimal risk of central neuraxial or pleuro-pulmonary complications. [3,6]

Local anesthetics like levobupivacaine provide primary analgesia; however, the duration of action of a plain local anesthetic single-shot block is often insufficient [5,6] to cover the extended postoperative period. Consequently, adjuvants are frequently combined with local anesthetics to enhance blockade speed, quality, and significantly prolong analgesic duration. [5,8]

Clonidine, a centrally and peripherally acting alpha2-adrenergic agonist [2,5], and fentanyl, a synthetic mu-opioid receptor agonist, have both been utilized as adjuvants to improve block dynamics. While direct opioid receptor binding and systemic absorption contribute to fentanyl-mediated analgesia, clonidine exerts its effect via inhibition of substance P release [5], hyperpolarization of cyclic adenosine monophosphate (cAMP)-dependent currents, and localized vasoconstriction. [4,5,7,9,11]

Comparative data evaluating the distinct clinical trade-offs between clonidine and fentanyl when added to 0.5% levobupivacaine in ultrasound-guided PEC blocks remain limited. Therefore, this study was designed to compare the clinical efficacy, postoperative pain relief dynamics, analgesic demand, and hemodynamic safety of clonidine versus fentanyl in patients undergoing elective minor breast surgeries. [4,8,10]

MATERIALS AND METHODS

Study Design and Setting

This study was conducted as a prospective, randomized, double-blind, comparative clinical study in the Department of Anaesthesiology at K. H. Patil Institute of Medical Sciences & Hospital, Gadag, Karnataka, India.

Study Population

A total of 100 patients scheduled for elective minor breast procedures under USG-guided PEC block were enrolled.

Inclusion Criteria:

- Patients aged between 18 and 50 years.
- Either gender scheduled for elective minor breast surgeries.
- American Society of Anesthesiologists (ASA) physical status Grade I and II.

Exclusion Criteria:

- Patient refusal to participate in the block procedure.
- Active local infection at the block injection site.
- Known hypersensitivity or allergy to levobupivacaine, clonidine, or fentanyl.

- Altered coagulation profile or active anticoagulant therapy.

Sample Size

The sample size was calculated using the formula for comparison of two means:

$$n = \frac{2\sigma^2(Z_{\alpha/2} + Z_{\beta})^2}{d^2}$$

where n represented the sample size per group, σ represented the pooled standard deviation, d represented the expected difference between the two group means, Zα/2 was 1.96 for a 95% confidence interval, and Zβ was 0.84 for 80% study power. Based on the calculation, 100 patients were enrolled, with 50 patients allocated to each group.

RANDOMIZATION AND BLINDING

Anaesthetic Technique & Procedure:

All patients underwent standard preoperative evaluation and fasting. Upon arrival in the operating theatre, standard monitoring (electrocardiography, non-invasive blood pressure, pulse oximetry) was attached, and baseline parameters were logged. [3,6]

Under aseptic precautions, an ultrasound-guided PEC block was performed using a high-frequency linear transducer placed below the lateral third of the clavicle. Hydrodissection was performed to identify the tissue planes between pectoralis major/minor muscles (PEC I) and pectoralis minor/serratus anterior muscles (PEC II), where the prepared study drug volume (15 mL total) was deposited after negative vascular aspiration. [3,6]

Primary Objectives:

- Time to First Rescue Analgesia: Duration (in hours) from block performance to the patient's first request for supplemental pain medication.
- Postoperative Pain Quality (VAS): Visual Analogue Scale scores evaluated across immediate (0–2 hours) and extended (4–12 hours) post-procedure recovery windows.

Secondary Objectives:

- Total 24-Hour Analgesic Requirement: Quantified cumulative rescue analgesic consumption over the first 24 postoperative hours.
- Hemodynamic Stability: Monitoring Heart Rate (HR) and Mean Arterial Pressure (MAP) post-incision and throughout the monitoring window.
- Safety Profile: Documentation of severe adverse events (e.g., profound bradycardia, severe hypotension, hypoxemia, or respiratory depression).

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS Statistics software. Continuous parameters were expressed as Mean pm+/- Standard Deviation (SD) and compared using the independent Student's t-test. Categorical variables were expressed as frequencies (%) and analyzed using the Chi-Square test or Fisher's exact test. A p-value < 0.05 was defined as statistically significant, and $p < 0.001$ as statistically highly significant.

RESULTS

All 100 randomized patients completed the protocol requirements (n = 50 in Group C and n = 50 in Group F). Baseline demographic profiles (age, gender distribution, ASA physical status) were comparable between the two study cohorts with no statistically significant differences ($p > 0.05$).

Table 1. Baseline Demographic Characteristics of the Study Population

Parameter	Group C (Clonidine) (n=50)	Group F (Fentanyl) (n=50)	p-value	Statistical Significance
Age (years), Mean\pm SD	36.4 \pm 8.2	35.8 \pm 7.9	0.712	Not Significant (p > 0.05)
Gender (Male/Female), n (%)	0 / 50 (100%)	0 / 50(100%)	1.000	Not Significant (p > 0.05)
BMI{kg/m}2), Mean \pm SD	23.8 pm 2.4	24.1 pm 2.6	0.551	Not Significant (p > 0.05)
ASA Physical Status (I / II), n	32 / 18	30 / 20	0.683	Not Significant (p > 0.05)

Table 2. Comparison of Block Characteristics between the Study Groups

Parameter	Group C (Clonidine) (n=50)	Group F (Fentanyl) (n=50)	p-value
Sensory block onset (min)	9.12 pm 1.15	6.45 pm 0.92$	0.010
Motor block onset (min)	12.30 pm 1.40	8.80 pm 1.10	<0.001
Sensory block duration (min)	568.8 pm 67.2	309.0pm 50.4	<0.001
Motor block duration (min)	480.0 pm 55.0	245.0pm 42.0	<0.001

Table 3. Time to First Rescue Analgesia

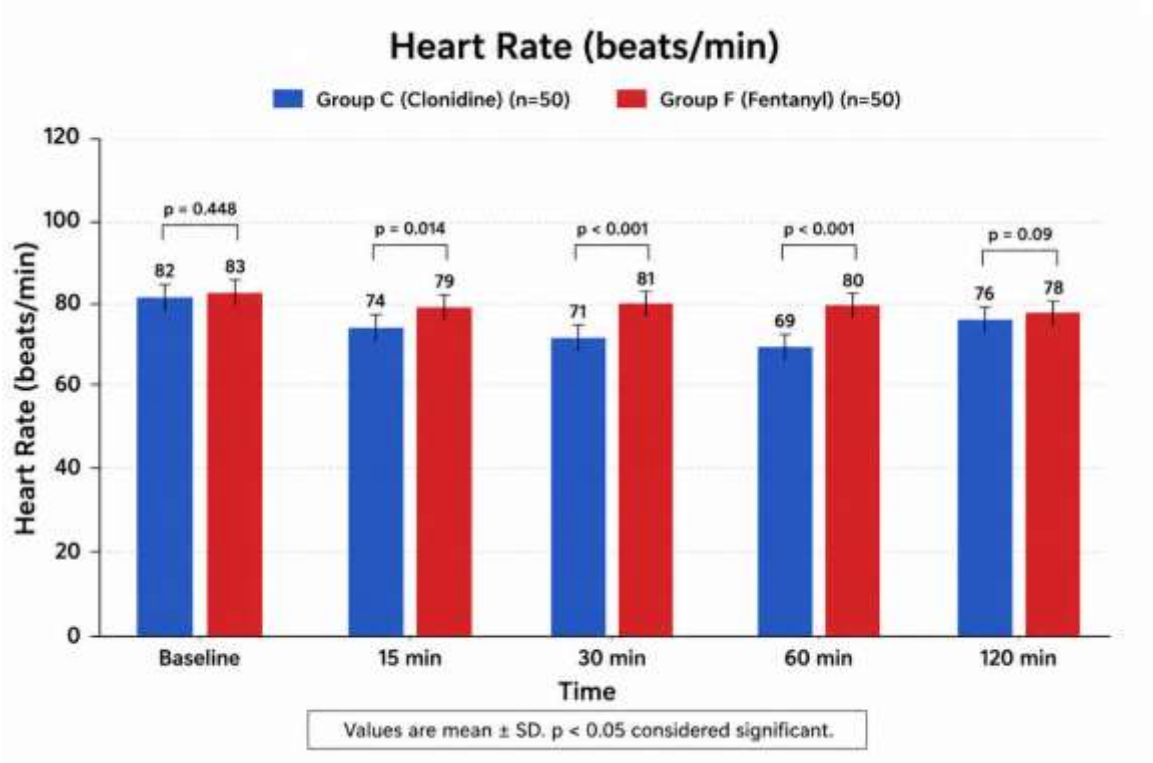
Parameter	Group C (Clonidine) (n = 50)	Group F (Fentanyl) (n = 50)	p-value
Rescue analgesia (minutes)	568.8 ± 67.2	309.0 ± 50.4	<0.001*

Rescue analgesia (hours)	9.48 ± 1.12	5.15 ± 0.84	<0.001*

*Significant ($p < 0.05$)

Comparison of Hemodynamic Parameters

Figure 1: Heart rate



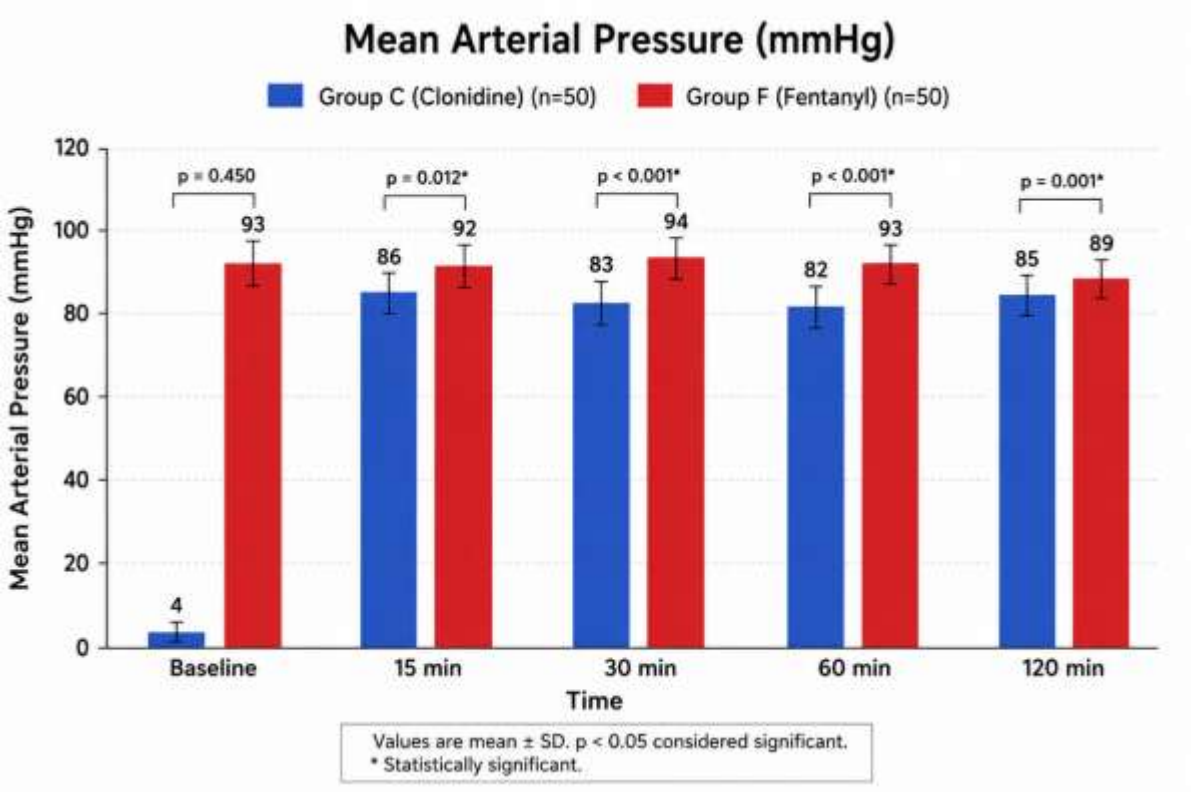


Figure 2: Mean Arterial Pressure

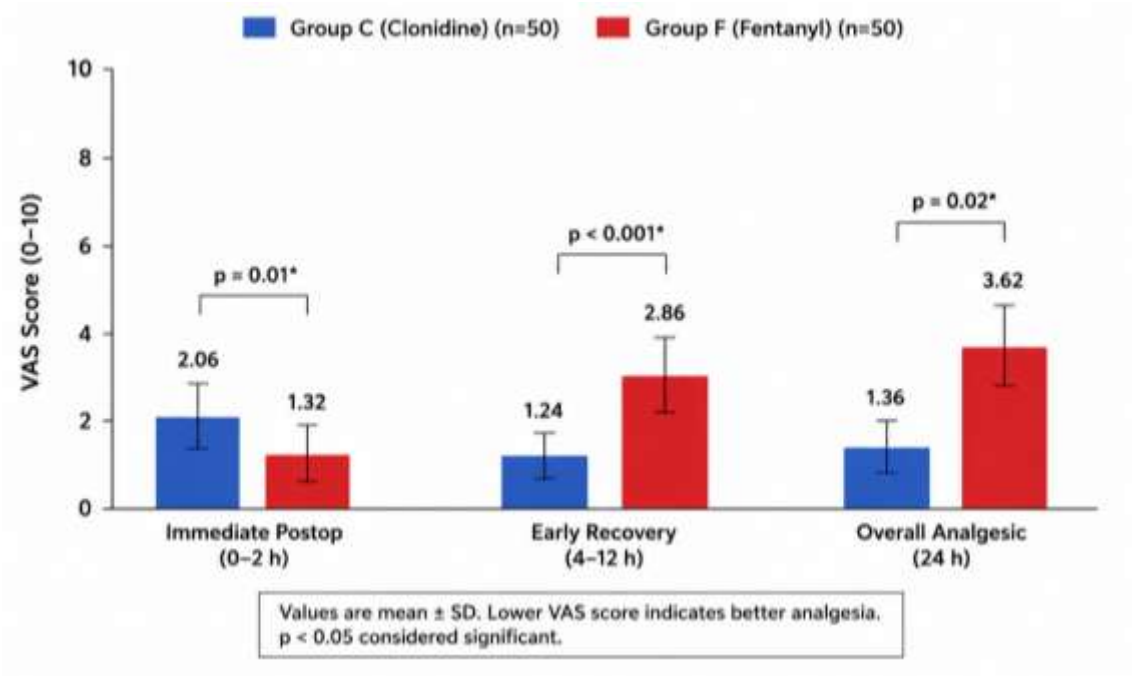


Figure 3: Postoperative pain (VAS score) between study groups

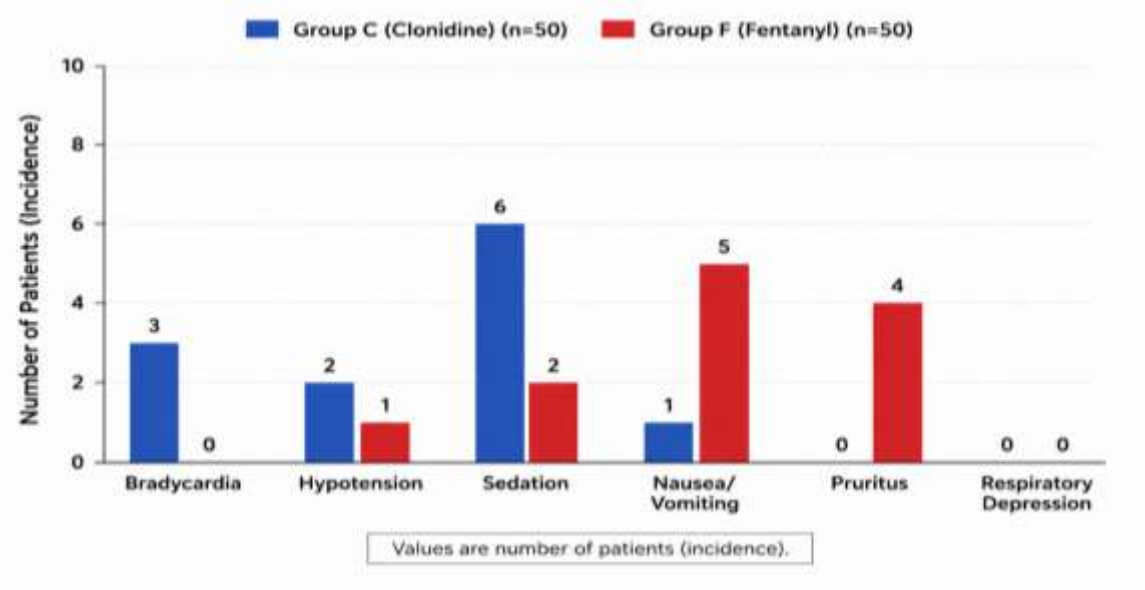


Figure 4: Comparison of Adverse Effects

Table 4: Summary of Primary and Secondary Outcomes

Outcome	Group C (Clonidine)	Group F (Fentanyl)
Sensory onset	**9.12 ± 1.15 min**	**6.45 ± 0.92 min**
Motor onset	**12.30 ± 1.40 min**	**8.80 ± 1.10 min**
Sensory duration	**568.8 ± 67.2 min**	**309.0 ± 50.4 min**
Motor duration	**480.0 ± 55.0 min**	**245.0 ± 42.0 min**
Rescue analgesia	**9.48 ± 1.12 h**	**5.15 ± 0.84 h**

DISCUSSION

The ultrasound-guided PEC block has transformed pain management strategies in breast surgery by interrupting the lateral and medial pectoral nerves [3,4,6], providing target-specific analgesia while mitigating systemic side effects associated with general opioids. The inclusion of adjuvants aims to extend block longevity and optimize analgesia dynamics. [3,6]

The present study demonstrates key clinical trade-offs between clonidine and fentanyl as adjuvants to 0.5% levobupivacaine in PEC blocks:

1. **Analgesic Longevity & Overall Consumption:** Clonidine demonstrated a marked advantage in analgesic duration,

nearly doubling the time to first rescue analgesia () relative to fentanyl. This extension significantly lowered total 24-hour postoperative rescue analgesic demand. Clonidine's prolonged action is attributed to hyperpolarization of peripheral nerve membranes via -adrenoceptor activation and direct hyperpolarization-activated cation current () inhibition. These findings align with similar peripheral and plexus block trials demonstrating prolonged block duration with clonidine. [4,5,8,10]

2. **Phase-Specific Analgesic Profile:** Fentanyl facilitated faster block onset and delivered superior VAS pain suppression during the immediate post-operative phase (;). However, its effect waned more rapidly, leading to higher pain scores during the extended window. In contrast, clonidine maintained lower VAS pain scores throughout the extended recovery window (;). [7,9,10,11]
3. **Hemodynamics and Tolerability:** Clonidine provided favorable hemodynamic stability, suppressing sympathetic post-incision surges in heart rate and blood pressure without causing severe clinical bradycardia or hypotension. Neither cohort exhibited severe complications such as respiratory depression or hypoxemia, confirming both adjuvants are safe for outpatient breast surgery settings. [4,7,11]

CONCLUSION

Clonidine combined with 0.5% levobupivacaine in ultrasound-guided PEC blocks for minor breast surgeries provides superior overall clinical utility compared to fentanyl. While fentanyl provides faster onset and better immediate pain control (0–2 hours), clonidine delivers:

- **Significantly longer-lasting postoperative analgesia** (mean 9.48 hours vs. 5.15 hours).
- **Superior extended pain control** across the critical 4–12 hour recovery window.
- **Lower total 24-hour rescue analgesic requirements.**
- **Superior post-incision hemodynamic stability** with an excellent safety profile.

Clonidine represents a preferred, highly effective adjuvant when sustained postoperative pain control is desired.

LIMITATIONS

- The study evaluated minor breast surgeries; results may vary in major oncological breast procedures like modified radical mastectomies requiring broader coverage.
- Fixed single-dose regimens () were evaluated; comparative dose-ranging studies could further clarify minimal effective dosing for both agents.

ETHICAL CLEARANCE: Approved by Institutional Ethics Committee, K. H. Patil Institute of Medical Sciences & Hospital, Gadag

CONFLICT OF INTEREST: Nil

FUNDING: Departmental Funding

REFERENCES

1. Abdelzaam, E. M., Abd Alazeem, E. S. Efficacy of dexmedetomidine as an adjuvant to bupivacaine in the ultrasound-guided serratus anterior plane block for postmastectomy analgesia. Egyptian Journal of Anaesthesia, 2020; 36(1): 319-323. doi: TEJA-2020-0119
2. Routray SS,Raut K, Pradhan A, Dash A, Soren M. Comparison of intrathecal clonidine and fentanyl as adjuvant to hyperbaric bupivacaine in subarachnoid block for lower limb orthopedic surgery. Anesthesia: Essays and Researches.2017;11(3):589.
3. Tavares Mendonça F, deAssisFeitosaJuniorA, NogueiraH, RoncolatoH, SousaGoveia C.Efficacy of type-I and type-II pectoral nerve blocks (PECSI and II)in patients undergoing mastectomy: a prospective randomized clinical trial. Anaesthesiology Intensive Therapy.2022;54(4):302-309
4. Bashandy GM, Abbas DN. Pectoral nerves (PECS) I and II blocks in multimodal analgesia for breast cancer surgery: A

randomized clinical trial. BrJAnaesth.2015;114(4):686-693.

5. Soni S, Kumar S, Sharma JP. Comparison of fentanyl vs. clonidine as adjuvants to bupivacaine in nerve blocks for upper limb and thoracic wall surgeries: A prospective randomized study.IndianJAnaesthes.2019;63(5):378-384
6. El-Sabae HH, El-Kersh MA, Mostafa MM. Ultrasound-guided pectoral nerve block (PECII) using levobupivacaine with or without clonidine in patients undergoing modified radical mastectomy. Egyptian J Anaesth.2022;38(1):142-149.