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# Effect of preoperative ultrasound-guided thoracic interfacial plane block versus preoperative thoracic erector spinae plane block on acute and chronic pain after modified radical mastectomy: A randomized controlled trial

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**ABSTRACT**

**Background:** More than 50% of individuals who have breast surgery have acute postoperative pain, and 8% among those patients endure persistent severe pain. The purpose of this study was to evaluate the efficiency of ultrasound-guided thoracic inter-fascial plane block (US-guided TIFPB) and ultrasound guided erector spinae plane block (US-guided ESPB) on acute and chronic pain following modified radical mastectomy (MRM) surgeries.

**Methods:** 90 female participants who were hospitalized for unilateral MRM surgery underwent this prospective randomized controlled trial. Patients were split into three equal groups at random: Group I: received preoperative TIFPB, group II: received preoperative ESPB, group III: received preoperative sham block (control group).

**Results:** VAS was considerably lower in group I at 12 h (P1 = 0.029) and when group III is compared with groups I and II at 2, 4, 6, 12, 18 and 24 h ($P < 0.05$). First analgesic requires was greatly delayed in time and total morphine consumption was significantly decreased compared to group III in groups I and II ($P < 0.001$) and was insignificantly different between both groups I and II. Chronic pain 3, 6 months postoperative was markedly decreased in comparison to group III in groups I and II ($P < 0.05$).

**Conclusions:** TIFPB and ESPB were comparable, both were superior to control in terms of lower intraoperative fentanyl consumption, pain score, first analgesic requirement onset is delayed, lower total consumption of morphine, chronic pain 3 and 6 months postoperatively. TIFPB showed a lower pain score at 12 hr. postoperatively compared to ESPB.

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## 1. Introduction

More than 50% of individuals who have breast surgery have acute postoperative pain, and 8% among those patients endure persistent severe pain that ranges from moderate to severe acute. Among the risk elements for developing chronic pain, which over time may cause functional impairments and a deterioration in quality of life, is postoperative pain [1].

The disorder known as post mastectomy pain syndrome (PMPS) has a number of probable underlying causes, such as pectoralis minor syndrome, intercostal neuromas, intercostobrachial nerve injury, and phantom breast pain. Many musculoskeletal pain syndromes, such as Myofascial pain, frozen shoulder, shoulder impingement syndrome, and cervical radiculopathy, which may present concurrently and sometimes overlap with PMPS, further aggravate the condition [2].

A number of studies have demonstrated that regional analgesia offers better functional recovery or superior pain control following breast surgery. Several studies have tried to use multimodal analgesic techniques, such as systemic and regional analgesia, to hasten functional recovery after surgeries [3].

Due to side effects including respiratory depression, vomiting, and nausea, opioid analgesics, which are often used following surgery, have limitations [4]. On the other hand, due to the reduced usage of opioid, alternative thoracic nerve blocks are used to manage pain after breast surgeries have greater analgesic efficacy and lessen nausea and vomiting [5].

Depending on the clinical situation, thoracic interfascial plane blocks (TIFPB) may be carried out; a number of modified techniques have been identified. (These techniques all have the same anatomical target, which is where the cutaneous nerve branches arise) [6].

TIFPB is a procedure that may be used to treat post-thoracotomy syndrome and to reduce thoracic pains in intensive care units. When general anesthesia (GA) is not preferred, TIFPB is a good option [7]. Given their low rate of significant complications and potential to simultaneously block various dermatomes, these novel

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procedures for blocking the serratus intercostal and pectointercostal fascial plane may replace multiple puncture intercostal blocks, epidural blocks, and paravertebral blocks throughout breast surgery. Another advantage is their applicability for outpatient procedures [8].

The widespread inter-fascial regional procedure known as the erector spinae plane block (ESPB) was first developed for treating thoracic neuropathic pain. Local anaesthetic medications pass through many layers of the erector spinae fascia, which runs out from the nuchal fascia in the cranial direction towards the sacrum in the caudal direction, as a result, the block may be effective across a wide region and is applied in many surgical procedures [9].

From T1–2 to T8–12, ESPB may give wide ranges of dorsal and ventral ramus blockage, and it makes it simple to implant a catheter into the injection's accompanying distension. The ESPB may be a potential choice for multimodal analgesia following mastectomy, according to its sensory blocking properties and neuronal innervation of the breast [10,11].

The purpose of this study was to evaluate the efficiency of US-guided TIFPB and US-guided ESPB on acute and chronic pain following modified radical mastectomy (MRM) surgeries.

## 2. Material and methods

90 female participants, ranging in age from 21 to 65 who were hospitalized for unilateral MRM surgery at Tanta University Hospital in Egypt for a 2-year period and had a physical activity I or II in line with the American Society of Anesthesiologists (ASA), underwent this prospective randomized controlled trial.

The Tanta Faculty of Medicine Research Ethics Committee approved the research, (Code:33645/1/20) and registration at clinicaltrials.gov (NCT05176938). Each patient provided a signed statement of informed consent.

Exclusion criteria were individual refusal to share in the study, neurological deficit, bleeding disorders, coagulopathy and patients on anticoagulants or thrombolytic therapy, patient's refusal to cooperate, an infection at the injection site, and a history of LA allergy.

### 2.1. Randomization and blindness

To carry out the randomization, secured numbered envelopes bearing the groups of each patient were used. A nurse who was blinded to the research and did not take part in patient follow-up noticed the number and assigned people to groups. Up until the necessary number of participants were enrolled, the study's inclusion procedure continued. Participants were split into three equal groups at random: Group I: Preoperative TIFPB, group II: Preoperative erector spinae plane block (ESPB), group III: Preoperative sham block (control group).

### 2.2. Preoperative preparation

Prior to surgery, each patient received a preoperative evaluation that included a medical history review, physical assessment, and routine laboratory investigations (such as CBC, liver and kidney function assessments, prothrombin times, INRs, ECGs, blood groups, and blood glucose levels) and the cortisol level.

### 2.3. Intraoperative management

An intravenous line with an 18-gauge cannula was placed as soon as the patient entered the operation room. Ringer's solution, 10 mL/kg, was administered to all participants as a preload. During the surgery, all patients were connected to a monitor that showed a non-invasive blood pressure (NIBP), electrocardiogram, pulse oximetry end-tidal carbon dioxide ($ETCO_2$) and end tidal carbon dioxide ($ETCO_2$).

## 3. Preoperative ultrasound

US machine (Phillips®, Cx-50, Amsterdam, Netherlands) with a superficial probe 5–12 MHz was used. All patients were informed by anesthetic plan, possible complications and they were instructed to report their pain intensity after transport to PACU using visual analogue score (VAS).

### 3.1. Group I: US-guided thoracic interfascial plane block (TIFPB)

A group of patients were positioned in a supine posture with their arms elevated towards their head, and then administered a Serratus intercostal plane block using a probe placed in the midaxillary line, The superficial plane allowed us to identify the Serratus muscle and subcutaneous tissue, whereas the intermediate plane helped us locate the External Intercostal muscles. Finally, in the deep plane, we were able to identify the lug, ribs, and pleura. After the local administration of 3 ml of lidocaine, the needle was progressed in a caudal to cranial orientation. 20 ml of ordinary 0.25% bupivacaine was provided after aspiration to limit intravascular injection. In-plane method was employed up until the needle's tip was inserted between the external intercostals muscle and the serratus anterior muscle.

In order to detect the external intercostal muscle (EIM), 2nd rib, and pectoralis muscles during PIFB, a probe was positioned more than two centimeters from the junction of the sternum and 2nd rib, and away from the sternum's long axis in a direction

parallel to it. After administering 3 ml of lidocaine locally, a 22-gauge spinal needle, the in-plane technique was used to inject a needle in the caudal direction. The needle tip was then placed at the site where the pectoralis muscles attach to the 2nd rib, and following aspiration, 20 ml of bupivacaine 0.25% was given.

### 3.2. Group II: US-guided erector spinae block (ESB)

The participants were seated when they arrived, and sterilization of the patient back done using Povidone-iodine 10% then the US superficial probe was positioned with the longitudinal direction, 3 cm to the side of the fourth spinous process. After identification of the 4$^{th}$ thoracic transverse process. Lidocaine 3 ml of concentration 2% was injected subcutaneously. An echogenic needle was used & advanced in-plane direction until the needle's tip reached the T4 transverse process while being visualized with US, then, a gentle withdrawal of the needle places it in the inter-facial plane underneath the erector spinae muscle. Bupivacaine 0.25%, 20 ml, was given. Below the muscle, the LA has a linear free distribution both cranially and caudally following injection visualized on the US screen indicates successful block performance in the correct facial plane under erector spinae muscle. Sensory block was assessed in both groups I and II by pin brick.

#### 3.2.1. Group III

Control group because only a sham block was administered to participants in this group throughout GA. US-guided erector spinae block was performed with injecting 20 ml saline 0.9% only. We used it to ensure blindness.

### 3.3. Induction of anesthesia

In all groups, intravenous (propofol 2 to 2.5 mg/kg, fentanyl 1micg/kg, atracurium 0.5 mg/kg) was used to produce GA, then intubation was done with an endotracheal tube of appropriate size, and controlled mechanical ventilation was initiated.

### 3.4. Maintenance of anesthesia

Isoflurane minimum alveolar concentration (MAC 1–1.5%) with a mixture of oxygen and air was used to sustain anaesthesia. Incremental dosages of muscle relaxant were given as required until the end, and the respiratory rate and tidal volume were modified to attain $SpO_2$ ≥95% and end tidal $CO_2$ within 32 and 35 mmHg. Increase of the hemodynamic parameters during surgery more than 20% from the baseline necessitate administration of incremental intravenous fentanyl 0.5micg/kg.

### 3.5. Recovery

After completion of surgery, inhalation anaesthesia was switched off and when the patient received adequate breathing a mixture of atropine (0,01–0,02 mg/kg) and neostigmine (0.04–0,08 mg/kg) was given to counteract the muscle relaxant's effects. The ETT was removed when the patients fulfilled the extubation criteria and the patients were transferred to postanesthesia care unit for further follow up & assessment.

Hypotension (MAP decline > 20% of start) was first given ephedrine 10 mg IV, then, if necessary, a bolus of 250 ml ringer acetate solution. Bradycardia (decrease in HR <60 bpm) was managed with atropine 0.01 mg/kg IV.

Hemodynamic variables: HR and MAP were documented prior to block performance and before induction of anesthesia, intraoperatively every 10 min till the termination of surgery and following surgery at T (30 min in post anesthesia care unit (PACU), 2, 4, 6, 12, 24 h).

Postoperative pain was assessed with score of VAS at 30 minutes, 2 h, 4 h, 6 h, 12 h, 18 h, 24 hours, if pain score < 4, paracetamol 1 g was given, If pain score ≥ 4, morphine (0.05 mg/kg) was given, intraoperative incremental consumption of fentanyl, postoperative morphine consumption at 24 h (with a dose of 0.05 mg/kg per dose at the first 24 h after surgery), if VAS ≥ 4, first request for analgesia following surgery, patient satisfaction was rated on a 3-point scale (1 = unsatisfied, 2 = neither satisfied nor unhappy, and 3 = pleased). Cortisol levels before surgery and 6 h postoperative and glucose level before surgery and 20 minutes after surgery then every 8 h for 24 hrs and side events as pneumothorax, bradycardia, hypotension, local anesthetic systemic toxicity (LAST) and failed block) were recorded. The occurrence of chronic pain (3- and 6-months following surgery) was observed in the clinic.

### 3.6. Sample size calculation

The sample size was determined using the MedCalc software version 18.2.1 (MedCalc Software, Ostend, Belgium) based on the findings of Gad et al. [12] each group needed at least 30 patients to identify a substantial variation in the postoperative consumption of morphine for the first 24 h 16.7 ± 7.21 mg with ESP at α- error = 0.05 and power of the study equal to 80%.

### 3.7. Statistical analysis

Statistical analysis was done using the SPSS (Statistical Software for the Social Sciences) version 25 (IBM Inc.,

Chicago, IL, USA). Histograms and the Shapiro-Wilks normality test were used to examine the quantitative variables' distribution. The three groups' parametric variables were compared using the F-test, with the post hoc (Tukey) test used to assess each pair of groups separately. Parametric variables were represented as mean and standard deviation (SD). The Kruskal-Wallis test was used to evaluate non-parametric variables, which were reported as the median and interquartile range (IQR). Mann-Whitney (U) test was then used to compare each pair of groups. Categorical variables were statistically examined using the Chi-square test and presented as frequency and percentage. Statistical significance was defined as a two-tailed $P$ value ≤ 0.05.

## 4. Results

In this research, 123 individuals had their eligibility assessed; 24 patients didn't fulfil the criteria, and nine patients declined to take part. The 90 people that are left were divided into three groups randomly (thirty participants in each). The 90 participants were all followed up and statistically analyzed. Figure 1

Table 1 reveals no significant variation in patient characteristics across the three groups.

By comparing between both groups, I and II, no statistical difference was seen in intraoperative mean MAP and HR at 45, 60, 75, 90 min and at the end. Intraoperative MAP and HR were markedly decreased

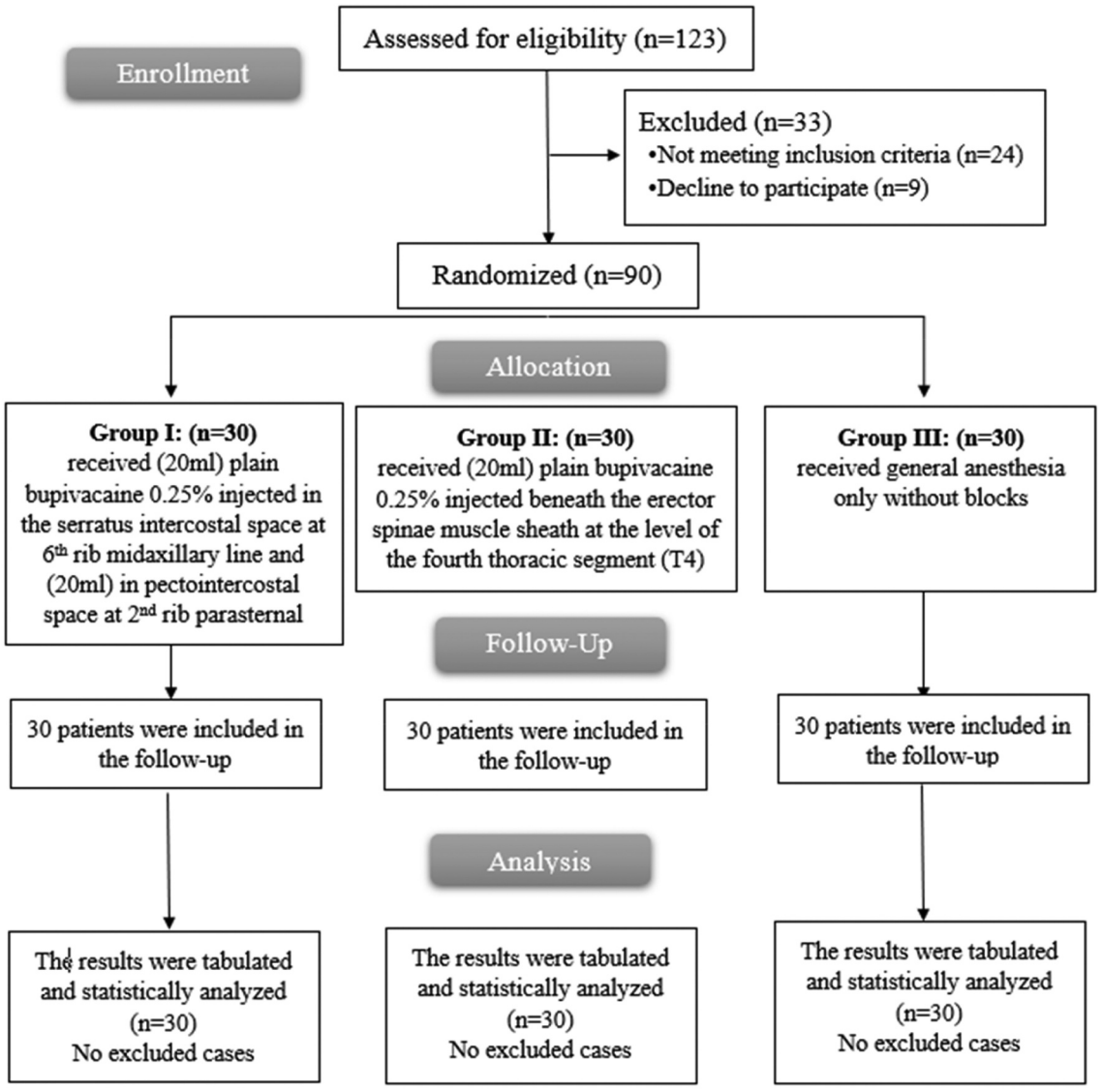


**Figure 1.** Randomized trial flow diagram, including enrollment, intervention allocation, follow up and analysis.

**Table 1.** Patient characteristics among the three groups.

| | Group I ($n$ = 30) | Group II ($n$ = 30) | Group III ($n$ = 30) | P value |
|---|---|---|---|---|
| Age (years) | 56.2 ± 9.99 | 55.57 ± 10.03 | 53.4 ± 10.28 | 0.533 |
| Weight (kg) | 76.7 ± 12.06 | 82.67 ± 11.94 | 78.03 ± 12.87 | 0.149 |
| Duration of surgery (min) | 98.07 ± 5.58 | 96.77 ± 5.76 | 97.7 ± 5.68 | 0.659 |

Data are presented as mean ± SD.

compared to group III in groups I and II at 45, 60, 75, 90 min and at the end (P2, P3 < 0.05). There were no substantial differences in intraoperative MAP and HR among the three groups at baseline, before induction, at 15- and 30-min. Figure 2

By comparing between both groups, I and II, postoperative MAP and HR were markedly reduced compared to group II in group I at 12 h (P1 = 0.043) but no significantly statistical difference was seen at 2, 4, 6, 18 and 24 h. Postoperative MAP and HR were significantly decreased comparison to group III in groups I and II at 2, 4, 6, 12, 18 and 24 h (P2, P3 < 0.05). The differences weren't statistically different enough to significance in postoperative MAP and HR at baseline and PACU among the three groups. Figure 2

There was a substantial variation between the three groups ($P < 0.001$). The median value of intraoperative fentanyl consumption was markedly less in comparison to group III in groups I and II (P2, P3 < 0.001) and was little made a difference between groups I and II. Comparing groups, I and II to group III, the time of initial analgesic demand was greatly delayed, and total morphine consumption was significantly reduced (P2, P3 < 0.001) and was insignificantly contrasting between groups I and II. No significant difference was observed in cortisol levels and random blood sugar among the three groups prior to surgery. There was no significant statistical difference in cortisol levels and random blood sugar between group I and II post-surgery. Cortisol levels were markedly decreased comparison to group III in groups I and II 6 h postoperatively (P2, P3 < 0.001). Random blood sugar was markedly decreased in group III in comparison to groups I and II at 20 min, 8, 16 and 24 h postoperatively (P2, P3 < 0.05). Degree of patient satisfaction was significantly increased comparison to group III in groups I and II (P2 < 0.001 and P3 < 0.001) but there was no significant statistical difference among both groups I and II (P1 = 0.698). Table 2

VAS was markedly reduced as compared to group II in group I at 12 h (P1 = 0.029) but no significantly statistical difference was seen at 2 h, 4 h, 6 h, 18 h and 24 h. VAS was substantial decreased comparison to group III in groups I and II at 2, 4, 6, 12, 18 and 24 h (P2, P3 < 0.05). No significant statistical difference in VAS among the three groups at PACU. Figure 3

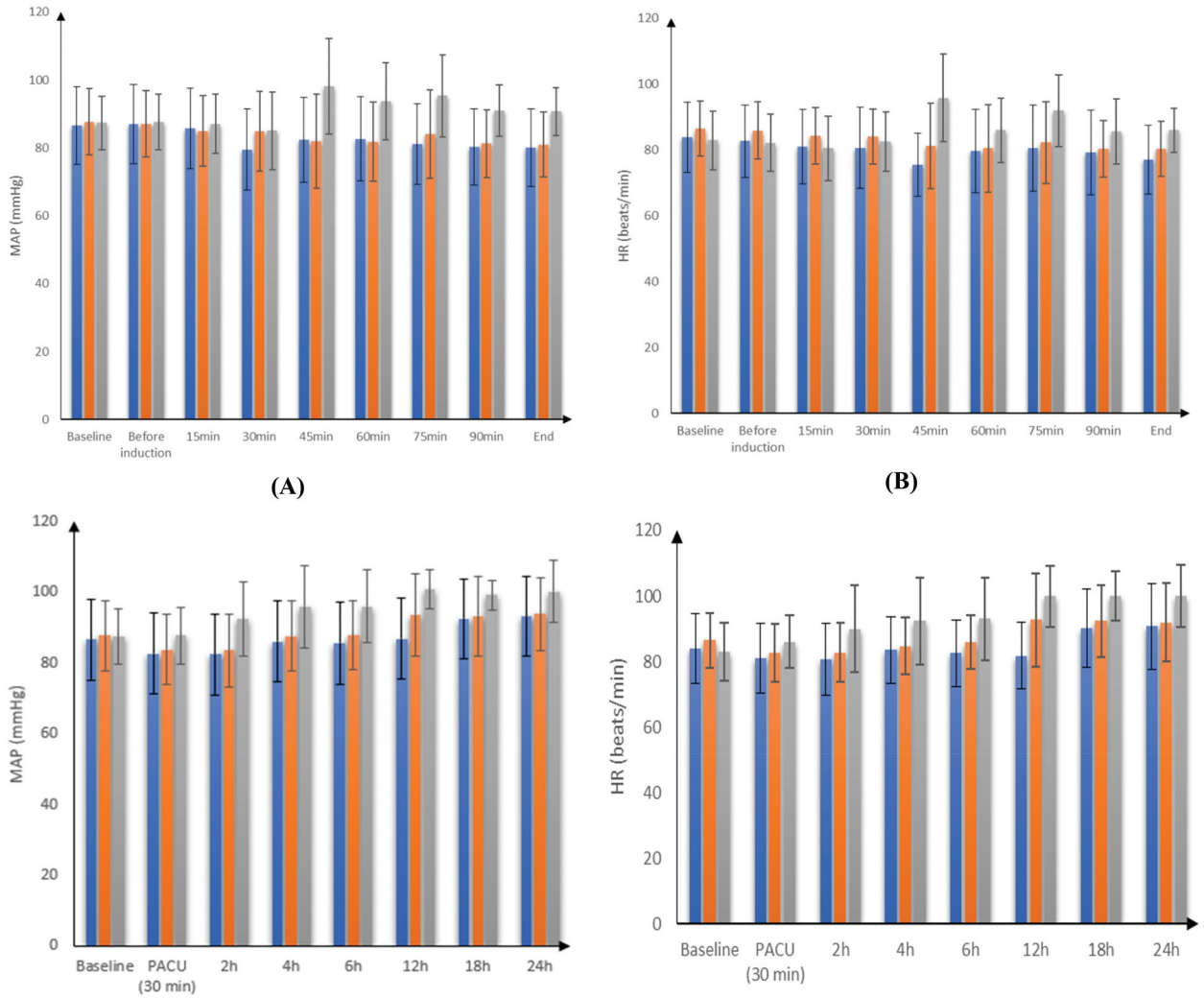


**Figure 2.** Intraoperative (A) MAP, (B) HR and postoperative (C) MAP, (D) HR among the three groups.

**Table 2.** Time of first analgesic requirement (h), total morphine consumption (mg), cortisol levels, random blood sugar and patient satisfaction among the three group.

| | | Group I ($n = 30$) | Group II ($n = 30$) | Group III ($n = 30$) | P value | Significance between groups |
|---|---|---|---|---|---|---|
| Intraoperative incremental fentanyl consumption (mic) | | 0 (0–30) | 0 (0–30) | 30 (30–30) | <0.001* | P1 = 0.409<br>P2 < 0.001*<br>P3 < 0.001* |
| Time of first analgesic requirement (h) | | 18.466 ± 5.19 | 17 ± 4.48 | 4.4 ± 1.52 | <0.001* | P1 = 0.059<br>P2 < 0.001*<br>P3 < 0.001* |
| Total morphine consumption (mg) | | 5.47 ± 2.06 | 6.43 ± 2.25 | 10.87 ± 2.46 | <0.001* | P1 = 0.229<br>P2 < 0.001*<br>P3 < 0.001* |
| Cortisol levels (mcg/dL) | Before surgery | 20.24 ± 5.87 | 18.6 ± 5.96 | 20.01 ± 5.76 | 0.505 | P1 = 0.527<br>P2 = 0.988<br>P3 = 0.621 |
| | 6 h postoperative | 16.82 ± 5.42 | 15.14 ± 5.59 | 31.56 ± 7.79 | <0.001* | P1 = 0.585<br>P2 < 0.001*<br>P3 < 0.001* |
| Random blood sugar (mg/dl) | Before surgery | 88.53 ± 12.98 | 92.5 ± 11.72 | 88.47 ± 12.98 | 0.368 | – |
| | 20 minutes postoperative | 94.7 ± 8.23 | 103.03 ± 17.93 | 145.27 ± 16.74 | <0.001* | P1 = 0.084<br>P2 < 0.001*<br>P3 < 0.001* |
| | 8 h postoperative | 98.87 ± 9.73 | 98.83 ± 9.68 | 123.87 ± 18.73 | <0.001* | P1 = 1<br>P2 < 0.001*<br>P3 < 0.001* |
| | 16 h postoperative | 92.7 ± 8.23 | 97.8 ± 9.73 | 123.67 ± 18.33 | <0.001* | P1 = 0.281<br>P2 < 0.001*<br>P3 < 0.001* |
| | 24 h postoperative | 97.53 ± 21.57 | 97.67 ± 11.05 | 122.33 ± 19.07 | <0.001* | P1 = 1<br>P2 < 0.001*<br>P3 < 0.001* |
| Patient satisfaction in 24 h | Unsatisfied | 2 (6.7%) | 2 (6.7%) | 16 (53.3%) | <0.001* | P1 = 0.698 |
| | Fair | 1 (3.3%) | 5 (16.7%) | 9 (30.0%) | | P2 < 0.001* |
| | Satisfied | 27 (90.0%) | 23 (76.7%) | 5 (16.7%) | | P3 < 0.001* |

Data expressed as median (IQR), mean ± SD or frequency (%), *Significant as *P* value < 0.05, P1: (*P* value between group I and group II), P2: (*P* value between group I than group III), P3: (*P* value between group II and group III).

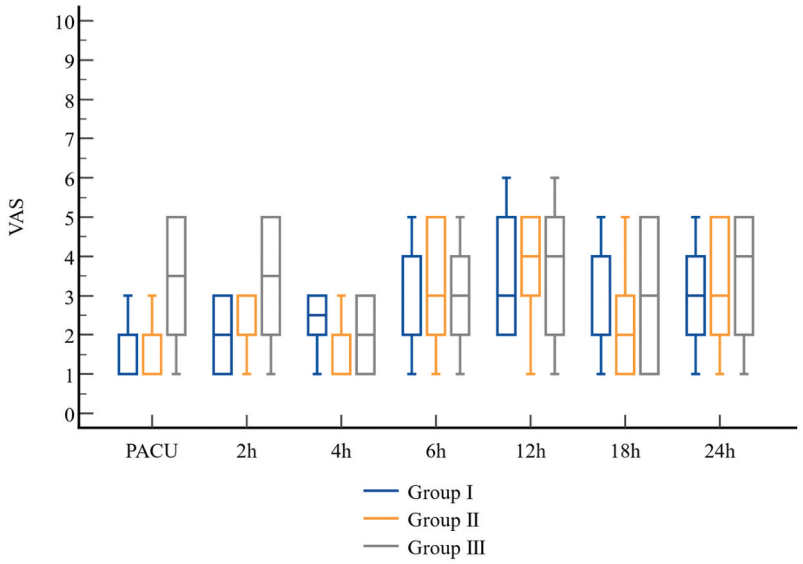


**Figure 3.** VAS among the three group.

The occurrence of chronic pain 3, 6 months postoperative was significantly decreased in group I and group II compered to group III (P2, P3 < 0.05) but there was no statistically significant difference between group I and group II. Drowsiness, dizziness and LAST didn't occur in the three groups. There was no statistically significant difference in adverse events among the three groups. Table 3

## 5. Discussion

The invention of US-guided regional block and innovative regional analgesia methods has improved the effectiveness and safety of perioperative anaesthesia for thoracic surgeries [13].

Regarding MAP and HR, In agreement with our results, Hetta and Rezk [14] compared Pectoralis-serratus inter-

**Table 3.** Occurrence of chronic pain at 3 and 6 months after surgery, and adverse events among the three group.

| | | Group I ($n = 30$) | Group II ($n = 30$) | Group III ($n = 30$) | P value | Significance between groups |
|---|---|---|---|---|---|---|
| Chronic pain 3 months after surgery | | 9 (30.0%) | 11 (36.7%) | 19 (63.3%) | **0.002*** | P1 = 0.583<br>P2 = 0.009*<br>P3 = 0.039* |
| Chronic pain 6 months after surgery | | 7 (23.3%) | 8 (26.7%) | 17 (56.7%) | **0.011*** | P1 = 0.766<br>P2 = 0.008*<br>P3 = 0.018* |
| Adverse events | Bradycardia | 5 (14.3%) | 3 (8.6%) | 2 (5.7%) | 0.455 | —- |
| | Hypotension | 6 (17.1%) | 8 (22.9%) | 7 (20.0%) | 0.738 | —- |
| | Drowsiness | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | —- | —- |
| | Dizziness | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | —- | —- |
| | LAST | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | —- | —- |

Data expressed as mean ± SD and frequency (%), *Significant as $P$ value < 0.05, P1: ($P$ value between group I and group II), P2: ($P$ value between group I than group III), P3: ($P$ value between group II and group III).

fascial plane block against thoracic paravertebral block for radical unilateral mastectomy with axillary excision and found more hemodynamic stability intraoperatively and postoperatively after mastectomy with lower prevalence of hypotension in TIFPB group than in TPVB group.

In contrasts to what we found, Gad et al. [12] compared the ESPB and the PECS block effects during MRM surgery on female patients. ESPB group (E group, $n = 24$) was injected with 20 mL of 0.25% levobupivacaine and 0.5 µg per kg of dexmedetomidine between the transverse process and erector spinae muscle. PECS block group (P group, $n = 23$) got 10 10 mL of 0.25% levobupivacaine and 0.5 g/kg dexmedetomidine, split into 10 mL administered between both the two pectoralis muscles in the inter-fascial plane and 20 mL administered between the serratus anterior and the pectoralis minor. They found that HR and MAP were considerably higher in the ESP group at 2 h, 4 h, 6 h, 12 h, and 24 hours postoperatively in the wards. The deviation from our findings may be attributed to different comparisons.

Regarding intraoperative fentanyl consumption, our results are supported by Singh et al. [15] who analysed randomised controlled studies in a meta-analysis studying opioidsparing effects of the TIFPB. Final analysis included four trials (TIFPB vs. intravenous analgesia). TIFPB demonstrated a 49.20 mcg reduction in consumption of intraoperative fentanyl vs to IVA (95% confidence interval [CI] = 42.67–55.74) (I2 = 98.47%, $P < 0.001$).

Regarding VAS, similar to our findings, Cheruku et al. [16] who studied TIFPB after minithoracotomy to replace the aortic or mitral valve. They documented that in comparison to the individuals in the control group who had not get the block (mean 7.9 ± 2.2), patients who had a TIFPB had a substantially reduced score of VAS on the day of operation (mean 7.4 ± 2.5). ($P = 0.02$).

In contrast to our finding Elzahaby et al. [17] Patients having non-reconstructive breast operations were given pectoral nerve blocks (PECS I and II) and the TIFPB (serratus anterior plane block in conjunction with pecto-intercostal fascial plane block), which was compared for its analgesic effects both intraoperatively and postoperatively. They documented that VAS scores were considerably increased in the serratus anterior combined with pectointercostal compared to PEC as PECS group better and this may be due to different LA and plane above serratus muscle.

Regarding the time of first analgesic requirement, in agreement with our findings, Finnerty et al. [18] compared serratus anterior plane block (SAPB) with ESPB in a randomised clinical study for minimally invasive thoracic surgeries. 60 adult participants having thoracic minimally invasive surgeries were randomised to receive either a single dose of ESPB or SAPB before the procedure, which used 30 ml of 0.25% levobupivacaine. First intravenous opioid analgesic time in recovery, in minutes significantly delayed in ESPB than in SAPB (32.6 (20.6%) vs 12.7 (9.5%); $P = 0.003$).

Our results disagree with Bakeer and Abdallah [19], who compared the analgesic effectiveness of US-guided ESPB and pectoralis block (PECS-II) in patients receiving unilateral MRM in a prospective randomised controlled study. 60 girls scheduled undergo unilateral MRM under GA were the cases of their investigation. The patients were randomly divided into two equal groups: a single-shot PECS-II block and a ESPB. The ESPB was carried out utilising an in-plane approach at level T4. In both blocks, bupivacaine 0.25% was injected at a dosage of 20 ml. They found that considerably more patients in the ESPB group than the PECS group required rescue opioid analgesia after surgery ($P = 0.002$).

Regarding morphine consumption, our results are confirmed by Goeteyn et al. [20] evaluated how interfascial plane blocks affected consumption of morphine and postoperative pain in thoracic outlet decompression. Twenty patients were chosen at random to serve as controls after they did ESB and 10 PECS 2 + 10 PECS 1 blocks. As comparison to the group without a block, postoperative iv consumption of morphine was 43% and 56% less in the PECS 1 + ESB and PECS 2 groups, respectively.

In disagreement with our findings, Bakeer and Abdallah [19], reported that the ESPB group revealed

considerably greater consumption of morphine overall ($P = 0.005$) than PECS-II block group. Different comparison as they compared ESPB with PECS-II whereas we compared it with TIFP may a suitable explanation for this difference. This can be explained by different reginal block techniques.

Regarding cortisol levels, in line with our findings, Siam et al. [21] compared ESPB with GA against conventional GA in surgeries of lumbar spine. 30 adults of each gender who were scheduled for elective lumbar spine surgery under GA were split into 2 equal groups at random, each with 15 individuals; group I received ESPB, while group II received multimodal analgesia (MMA). According to their findings, group I (ESPB) had significantly lower mean serum cortisol levels 4 hours after surgery than group II (MMA).

In contrast to our result Gad et al. [12] reported Cortisol and prolactin levels did not significantly vary between the ESPB and PECS groups at baseline ($P > 0.05$), however there were substantial drops in these levels after 1 and 24 hours postoperatively in the PECS group when compared to ESPB group. Moreover, these hormone levels in each group significantly decreased after 1 and 24 hours postoperatively compared to their baseline levels (P 0.05).

In the same context, Forero et al. [22] evaluated the effectiveness of ESPB in the treatment of post-thoracotomy pain syndrome (PTPS) according to the appearance of chronic pain 3 and 6 months postoperative. A cohort of seven patients with PTPS who had had thoracic surgeries with pneumonectomy or lobectomy for lung cancer underwent the ESPB in a pain clinic setting. The blocks were carried out under ultrasound-guidance by administering 20–30 mL of ropivacaine, either without or with a steroid, into a fascial plane between the transverse processes of the thoracic vertebrae and the deep surface of the erector spinae muscle. After each ESPB, all of the patients received great short-term pain reduction, and 4 of the 7 patients had long-term analgesic benefits lasting at least 2 weeks. The ESPB was used in combination with multimodal analgesia optimisation, which significantly reduced pain for all patients.

In contrast to our result, Ling Xin et al. [23] found There is no substantial variation in the prevalence of CPSP ($P = 1.000$) nor percentage and intensity were found between the ESPB + GA group and the GA group after mastectomy.

Regarding adverse events, in line with our findings, Maria et al. [24] studied the possible development of technique-related complication in 52 cases of supraumbilical surgeries divided into two equal groups where group 1 received serratus intercostal interfascial block and GA, group II received GA only and found no block-related adverse events occurred.

Regarding patient satisfaction, in line with our findings, Kim et al. [25] found higher patient satisfaction in those who received TIFPB+ GA for pain management after mastectomy than those who received GA only.

Limitations: It was a single-center study, and the results may differ elsewhere. The multiple injection sites made patient blinding unfeasible. VAS scores were only evaluated at rest; dynamic scores were not evaluated. The limited duration of analgesia due to single-injection techniques utilized limited the duration of analgesia.

## 6. Conclusions

TIFPB and ESPB provided comparable results, and both were superior to control in terms of lower intraoperative MAP, HR, intraoperative fentanyl consumption, postoperative MAP and HR, lower pain score, delayed time of first analgesic requirement, lower total morphine consumption, higher degree of patient satisfaction, the occurrence of chronic pain 3 and 6 months postoperatively, lower cortisol and random blood sugar levels. TIFPB showed a lower pain score at 12 hr postoperatively compared to ESPB.

## Disclosure statement

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