Original Article

Ultrasound Guided Thoracic Erector Spinae Plane Block for Post Mastectomy Pain Control: Effect of Volume with Constant Drug : Mass Randomized Controlled Trials

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Abstract

Background: Ultrasound-guided erector spinae plane block (ESPB) is an innovative technique in which local anesthetic is placed between the deep fascial plane of the erector spinae muscle and superficial to the tip of the transverse process. ESPB is a safe, innovative strategy that is easy to perform and ensures good postoperative analgesia in radical mastectomy **Aim:** to o compare between the analgesic effect of two different volumes and concentrations of local anesthetics [20ml lidocaine 2% (400mg) versus40ml lidocaine 1% (400mg)]. **Subjects and Methods:** Our study is a comparative study that compare between two volumes of local anesthetic with fixed drug mass used in the ultrasound guided erector spinae plane block in patients undergoing modified radical mastectomy 82 patients were allocated in two equal groups, group L received 20 ml of lidocain 2% and group H received 40 ml of lidocain 1%. First 24 hours postoperative morphine consumption, VAS score, duration of the surgery, incidence of complications, postoperative nausea and vomiting and also haemodynamics were recorded and statistically analyzed. **Results:** There was no statistical significant between the two groups regarding morphine consumption or VAS score. Postoperative nausea and vomiting were insignificantly different between the two groups. **Conclusion:** increasing the volume of the local anesthetic with fixed drug mass will not effect the efficacy of the block in decreasing postoperative VAS score and morphine consumption in patients undergoing modified radical mastectomy.

Keywords: Ultrasound Guided Thoracic Erector Spinae Plane Block, Post Mastectomy Pain

INTRODUCTION

Breast surgery is one of the most common surgeries among female population. **[1]** Uncontrolled postoperative pain control remains a common problem for that type of surgeries which may lead to endocrine, metabolic, inflammatory, and immune consequences, longer hospital stays and development of chronic pain. **[2]**

A lot of interventional technique has been used to control postoperative pain such as high thoracic epidural anesthesia, cervical epidural anesthesia and thoracic paravertebral block. However, these are particularly challenging, techniques, because of the anatomic proximity of the pleura and central neuraxial system. **[2,3]**

Ultrasound-guided erector spinae plane block (ESPB) is an innovative technique in which local anesthetic is placed between the deep fascial plane of the erector spinae muscle and superficial to the tip of the transverse process. It was first described by ***Forero et al.*** **[4]** for the treatment of thoracic neuropathic pain. It has later been used as a postoperative analgesia method in many surgical procedures from shoulder to hip surgeries. **[5,6]**

ESPB is a safe, innovative strategy that is easy to perform and ensures good postoperative analgesia in radical mastectomy, reducing opioid requirements. It offers good pain management, contributing to faster patient recovery. **(7,8)**

Altıparmak et al. [8] performed Ultrasound-guided ESPB with two different concentrations of bupivacaine in the same volume (0.375% and 0.25% bupivacaine in 20 ML solution) showing that 0.375% bupivacaine reduced postoperative tramadol consumption more significantly than ESPB performed with 20 ml of 0.25% bupivacaine. However, no studies have investigated

the optimum volume and concentration of local anesthetic for thoracic ESPB in breast surgery. We speculate that ESPB is an interfacial plane volume dependent block.

This study aimed to compare between the analgesic effect of two different volumes and concentrations of local anesthetics [20ml lidocaine 2% (400mg) versus40ml lidocaine 1% (400mg)].

Patients and Methods

This study was Prospective, randomized, double-blinded study, performed at KasrAlaini Hospital on American Society of Anesthesiologists (ASA) (II-III) patients scheduled for elective breast cancer surgery

Inclusion criteria

1. Age: 18 to 70 years.
2. ASA physical status (II&III).
3. Undergoing elective breast cancer surgery.

Exclusion criteria

1. ASA physical status>III.
2. Body mass index > 35 kg/m2
3. Patients with previous difficulty in evaluating their level of pain.
4. Contraindications for local anaesthesia: As patient refusal of local anaesthesia, coagulopathy (thrombocytopenia (platelet count below 100000 platelets per microliter), prothrombin time greater than 14 seconds), therapeutic anticoagulation and skin infection or hematoma in the vicinity of the puncture site.
5. Allergy to any of the study drugs.
6. Renal, cardiac hepatic or neurological diseases patient.

All patients will be assessed clinically and investigated for exclusion of any of the above mentioned contraindications. Laboratory work needed would be: Complete blood count (CBC); prothrombin time and concentration (PT & PC); partial thromboplastin time (PTT); kidney (creatinine clearance) and liver function tests (bilirubin, alanine aminotransferase test <ALT>, aspartate aminotransferase test <AST>.)

Intravenous access is secured and intravenous crystalloid commenced, patient monitoring is applied including ECG, noninvasive blood pressuer, pulse oximetry, capnography.

Study Procedures

1. Randomization (in RCT only)

Computer-generated random numbers will be used for simple randomization of subjects.

2. Study Protocol

patients would be allocated into two groups: group L (n=41): this group will receive low volume of lidocaine (20 mL of 2% solution) and group H (n=41): this group will receive high volume of lidocaine (40 mL of 1% solution).The patients will be placed in a sitting position for the ESPB. Midazolam is administrated as a sedative agent IV: 1 to 2.5 mg slow IV every 2 minutes as necessary sedation will be assessed according to modified ramsay scoring system where a score of 3-5 is required. **[9]**

The ultrasound probe [8-14 MHz straight probe (Siemens ACUSON X300 Ultrasound System) will be placed in a longitudinal orientation at the level of the T4 spinous process, then placed the probe 2–3 cm laterally from the midline. After the identification of the T4 transverse process and overlying trapezius, rhomboideus, and erector spinae muscles, the targeted injection site will be anesthetized with 3–4ml of 2% lidocaine. An 80mm 21-gauge block needle will be inserted using the in-plane technique following the same injection point in the cranial to caudal direction until the tip contacted to the T4 transverse process. When the correct needle tip position will be confirmed by hydro dissection with 1–2 ml of isotonic saline solution,

Local anesthetic solution will be injected according to randomization [20ml lidocaine 2% (400mg) or 40ml lidocaine 1% (400mg)]. Following block procedures, patients will be placed in a supine position.Assessment of block success is confirmed by ice cotton test, complete block failure is defined if there is a no difference between response to ice on both sides, block will be considered to be partially failed if there is a part of chest wall is sensitive on the blocked side similar to the non blocked site. Patients with complete Failed block or partial failed block will be excluded from the study.

After assuring block successes all patients in the study will receive general anaesthesia in the form of propofol 2mg/kg, atracurium 0.5 ml/kg, fentanyl 100 microgram in the induction with endotrachealtube and mechanical ventilation according to the following parameters tidal volume of 6 ml/kg, respiratory rate of 12 / min, monitoring will be continued with ECG, noninvasive blood pressure, pulse oximetry and capnography will be applied.

Bradycardia less than 50 beats/min must be managed by atropine at adose of 0.3-1 mg or 0.04 mg/kg IV every 5min, no more than 3 mg.

Tachycardia more than 100 beats/min must be managed by propanolol at a dose of 1 to 3 mg at a rate not exceeding 1 mg/min.

A second dose may be given after 2 minutes tell heart rate decreases.
Hypotension of systolic less than 80 mmhg and diastolic less than 50 mmhg must be managed be 500 ml saline bolus and ephedrine of 5mg can be added every 5 minutes if needed.
Hypertension of systolic more than 160 mmhg and diastolic more than 100 mmhg must be managed by glyceryl trinitrateat adose of 0.02 mg /kg/min.
Maintenance anesthetic drugs will be isoflurane 1.2% and atracurium 10 mg every 20 minutes.
Antiemetic drugs will be administrated intravenously in the form of ondansetron 8 mg at the end of the surgery and will be continued for the postoperative 24 hours on the bases of 4 mg intravenously every 8 hours.
The neuromuscular blockade induced by atracurium is antagonised at the end of the surgery before extubating by atropine at a dose of 0.01 mg /kg and neostigmine at a dose of 0.02 mg/kg.
After completion of surgical procedure and emergence from anaesthesia the patient will be referred to the post anaesthesia care unite (PACU) for 2 hours and will be discharged After assessing hemodynamic, spo2, conscious level, nausea and vomiting and applying the data to a scoring level as the one as the one stated by Marshall and Chung. **[10]**
Pain will be assessed by the aid of Visual Analogue Scale (VAS), which is consisted of a "10 cm" horizontalline with one end labeled no pain and other end labeled worst intolerable pain. The patients will mark the line at the point that best describing the pain intensity.
The preoperative assessment included training of the patients about (VAS) for postoperative pain. The length of the line to the patient's mark will be measured and recorded postoperatively after 30 min., 2,4, 6, 8,12 and 24 hours.
When the VAS level increases to 3, paracetamol 1 gm slow intravenous infusion every 8 hours will be used (Maximum daily dose of 4 g / 24 hour), and if the VAS level is 5 or more we will use morphine (2 mg intravenous) as a rescue analgesia. The total dose of analgesic will be recorded in all groups in 24 hours interval.

Patient position and ultrasound system

According with the description of ***Luftig et al***. **[11]**: expose the posterior thorax by placing the patient prone, in lateral decubitus, or leaning forward in a seated position. For the prone position, stand at the head of the bed with the ultrasound system on either side of the bed at the level of the patient's thighs. For the lateral decubitus position (with patient lying on their unaffected side), sit at the side of the bed facing the patient's back with the ultrasound system on the opposite side of the bed (anterior to the patient). For the seated position, seat the patient on the edge of the bed leaning forward onto aside table in a position similar to the seated lumbar puncture position. Stand behind the patient with the ultrasound system located on the opposite side of the bed anterior to the patient. For all positions, elevate the bed to a level where the needle, probe, and ultrasound screen can all be viewed in direct line-of-site with minimal head movement.

Technique

The technique applied in the study well be of:

Luftig et al. **[11]** who described with detail how to perform the ESP block: at the targeted vertebral level, place a high-frequency linear transducer in cephalocaudal or longitudinal orientation over the midline of the back to identify the vertebral spinous process. Keeping the probe oriented cephalocaudal, slide the probe approximately 3 cm laterally towards the side to be blocked, identifying the transverse process injection target
To confirm transverse process identification, slide the probe beyond the target laterally, passing the probe over the costotransverse junction to the rib. The posterior rib adjacent to the costotransverse junction is both lateral and deep to the transverse process. By sliding back and forth over the costotransverse junction, the differentiation between the transverse process and rib will be clear. The transverse process will be more superficial, blunter, wider, while the rib will be deeper, rounder and thinner. With the transducer fixed over the targeted transverse process, identify a block needle insertion site aligned with the long axis of the ultrasound beam and approximately 1–2 cm away from the probe. Then insert a block needle through the skin and advance at a 30–45-degree angle towards the ultrasound beam. Continue advancing with in-plane ultrasound guidance to the posterior surface of the targeted transverse process. The operator may feel "fascial clicks" corresponding with the fascia of the trapezius, rhomboid (for blocks at T7 and higher), and erector spinae muscles with a final firm end point upon contacting bone. According to Cornish et al. **[12]** the ESP block should be performed by placing the needle in a cephalad-to-caudal direction onto the superior aspect of the transverse process. This avoids the anterior costotransverse ligament which is not avoided during an insertion of the needle in the opposite direction similar to a paravertebral block approach. **[12]**
Once the needle tip is in the ESP below the erector spinae muscle, it is recommended alternating aspiration (to confirm lack of inadvertent vascular puncture) with injection of small aliquots of LA. Anechoic fluid should be seen separating the erector spinae muscle from the TP, confirming spread within the ESP. Once satisfied with the needle position, gradually inject LA. **[11]** Chin et al. **[13]** emphasize that intramuscular injection should be avoided, and that the hyperechoic fascial layer observed between the erector spinae muscle and the transverse processes/ intercostal muscles is a complex multi-laminar structure. They therefore usually see LA spreading between two distinct hyperechoic layers rather than purely between the hypoechoic muscle itself and the deeper hyperechoic layer. They believe that it is important to deposit LA deep to the erector spinae muscle to maximize the penetration into the paravertebral space. They recommend that the transverse process should be used as a target for ease and safety of performance, and that the visual end-point that should always be sought is a linear spread of injectate

travelling in both a cranial and caudal direction from the point of injection. **[13]**
Anesthesiologists (ASA) (II-III) patients scheduled for elective breast cancer surgery

1. ***Primary outcome***

First postoperative 24 hours intravenous Morphine consumption will be recorded.

2. ***Secondary outcome(s)***

1. Visual Analogue Scale for pain: it will be measured and recorded postoperative after 30 min., 2,4, 6, 8,12 and 24 hours. It is consisted of a "10 cm" line with one end labeled no pain and other end labeled worst intolerable pain. The patients will mark the line at the point that best describing the pain intensity. The preoperative assessment included training of the patients about (VAS) for postoperative pain.
2. Patients who are unable to comply with VAS will be excluded.
3. Duration of surgery (from skin incision till skin closure) and general anaesthesia (from induction of general anaesthesia till extubation).
4. Incidence of complications, such as: Nerve injury, Hematoma formation, local anesthetic toxicity, and intravascular injection.
5. Postoperative nausea and vomiting: Incidence of postoperative nausea and vomiting will be recorded.
6. Hemodynamics in the form of heart rate and mean arterial blood pressure will be recorded after 30 mins, 2, 4, 6, 8, 12 and 24 hours.

Statistical analysis

Results were expressed as mean ± standard deviation (SD) or number (%). Comparison between categorical data [number (%)] was done using Chi square test or Fisher exact test instead if cell count is less than 5. Test of normality, Kolmogorov-Smirnov test, was used to measure the distribution of data measured at T0 (30 minutes). Accordingly, comparison between normally distributed variables in the two groups was performed using unpaired t test. Repeated measures factorial ANOVA test was used to study the interaction between groups and different time of measurements. The model used the two groups (H&L) as independent variable and time (T0, T1, T2, T3, T4, T5 and T6) as a dependent variable. Bonferroni test was used to compare between different times of measurement in each group. In not normally distributed data, comparison between variables in the two groups was performed using Mann Whitney test. Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. P value ≤ 0.05 was considered significant

Results

this study 82 patients were assessed for eligibility,they were allocated into 2 groups 41 patient in each group both of them were followed up and statistically analyzed

Table (1): Mean value of age in the two studied groups.

	Gr. H (n= 41)	Gr L (n= 41)	P value##
Age (yrs.)	42.32 ± 11.53	44.98 ± 13.69	0.344

Data were expressed as mean ± standard deviation.
##= Unpaired t test.
p> 0.05= not significant.
Age of the patients was insignificantly different among the two groups

Table (2): Comparison between values of VAS measured at different times of measurement in the two studied groups.

	Gr. H (n= 41)	Gr L (n= 41)	P value#
VAS T0 (30 min)	1.44 ± 1.43	1.85 ± 1.48	0.136
VAS T1 (2hr)	1.83 ± 1.24	1.63 ± 1.02	0.665
VAS T2 (4hr)	1.93 ± 1.21	2.00 ± 1.12	0.574
VAS T3 (6hr)	2.22 ± 1.11	2.61 ± 1.95	0.874
VAS T4 (8hr)	2.37 ± 1.50	1.80 ± 1.17	0.063
VAS T5 (12hr)	2.37 ± 2.18	2.20 ± 1.78	0.980
VAS T6 (24hr)	1.07 ± 0.91	1.61 ± 1.56	0.135

Data were expressed as mean ± standard deviation.
#= Non parametric statistics (Mann Whitney test).
p> 0.05= not significant.

Table (3): Comparison between values of both number of increments of morphine (2mg) in 24 hrs and total 24/hr morphine consumption in the two studied groups.

	Gr. H (n= 41)	Gr L (n= 41)	P value#

Number of increments of morphine (2mg) in 24h	0.51 ± 0.84	0.46 ± 0.90	0.577
Total 24/H morphine consumption dose mg	1.02 ± 1.68	0.93 ± 1.79	0.577

Data were expressed as mean ± standard deviation.
#= Non parametric statistics (Mann Whitney test).
p> 0.05= not significant.
Both the number of morphine increments and the total first preoperative 24 hours morphine consumption were insignificantly different between the two groups

Table (4): Comparison between mean values of mean arterial blood pressure (mm/Hg) measured at different times of measurement in the two studied groups.

	Gr. H (n= 41)	**Gr L (n= 41)**	**F test & p value ##**
MABP T0	87.76 ± 9.07	89.00 ±10.26	Wilks' Lambda= 0.935, F(6, 75)= 0.870; p= 0.521
MABP T1	88.78 ± 7.87	86.61 ±6.02	
MABP T2	86.61 ± 8.03	86.37 ±5.49	
MABP T3	87.22 ± 6.45	87.07 ±7.47	
MABP T4	85.76 ± 4.83	85.00 ±5.62	
MABP T5	85.63 ± 6.97	86.10 ±7.12	
MABP T6	83.49 ±6.32 *(0.035)	83.44 ±4.70 *(0.011)	
F test & p value#	Wilks' Lambda= 0.498, F(6, 35)= 5.886; p= 0.001*	Wilks' Lambda= 0.610, F(6, 35)= 3.725; p= 0.006*	

Data were expressed as mean ± standard deviation.
#= within group comparison (repeated measures factorial ANOVA).
##= between groups comparison (interaction between groups and time using repeated measures factorial ANOVA).
*p< 0.05 relative to T0 within the same group.
p> 0.05= not significant.

Within group comparison

In H group, repeated measures ANOVA test showed that there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) [Wilks' Lambda= 0.498, F(6, 35)= 5.886 and p= 0.001. Bonferroni test revealed that there was a statistical significant decrease in the mean arterial blood pressure measured at T6 (83.49 ±6.32) (p= 0.001) when compared with their corresponding value measured at T0 (87.76 ± 9.07)

In L group, repeated measures ANOVA test showed that there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) [Wilks' Lambda= 0.610, F(6, 35)= 3.725and p= 0.006]. Bonferroni test revealed that there was a statistical significant decrease in the mean heart rate measured at T6 (83.44 ±4.70) (p= 0.011) when compared with their corresponding value measured at T0 (89.00 ±10.26)

Table (5): Comparison between mean values of heart rate (beat/min) measured at different times of measurement in the two studied groups.

	Gr. H (n= 41)	**Gr L (n= 41)**	**F test & p value ##**
HR T0	73.54 ± 7.80	74.71 ± 9.57	Wilks' Lambda= 0.932, F(6, 75)= 0.918; p= 0.487
HR T1	71.80 ± 8.03	71.85 ± 8.01*	
HR T2	71.90 ± 8.10	72.20 ± 7.45	
HR T3	70.85 ± 7.24	72.88 ± 7.52	
HR T4	70.24 ± 7.08	71.15 ± 6.82	

HR T5	69.85 ± 7.98	72.71 ± 8.64	
HR T6	67.66 ± 6.56*	70.63 ± 6.87	
F test & p value#	Wilks' Lambda= 0.482, F(6, 35)= 6.277; p= 0.001*	Wilks' Lambda= 0.615, F(6, 35)= 3.654; p= 0.006*	

Data were expressed as mean ± standard deviation.
#= within group comparison (repeated measures factorial ANOVA).
##= between groups comparison (interaction between groups and time using repeated measures factorial ANOVA).
*p< 0.05 relative to T0 within the same group.
p> 0.05= not significant.

Within group comparison

In H group, repeated measures ANOVA test showed that there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) [Wilks' Lambda= 0.482, F(6, 35)= 6.277 and p= 0.001. Bonferroni test revealed that there was a statistical significant decrease in the mean heart rate measured at T6 (67.66 ± 6.56) (p= 0.001) when compared with their corresponding value measured at T0 (73.54 ± 7.80)

In L group, repeated measures ANOVA test showed that there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) [Wilks' Lambda= 0.615, F(6, 35)= 3.654and p= 0.006]. Bonferroni test revealed that there was a statistical significant decrease in the mean heart rate measured at T1 (71.85 ± 8.01) (p= 0.036) when compared with their corresponding value measured at T0 (74.71 ± 9.57)

Interaction between groups and different times of measurement

The interaction between groups and different times of measurement was not significant. That to say that there was no statistical significant difference between the two groups across different times of measurement [Wilks' Lambda= 0.932, F(6, 75)= 0.918; p= 0.487].

Table (6): Level of sensory block, ease of performance of the technique, duration of surgery, duration of general anesthesia and the onset and incidence of adverse effect in the two different studied groups.

	Gr. H (n= 41)	**Gr L (n= 41)**	**P value#**
Level of sensory block (very satisfied)	41 (100.0%)	41 (100.0%)	----
Ease of performance of the technique			
Ease	26 (63.4%)	29 (70.7%)	0.559
Moderately difficult	9 (22.0%)	9 (22.0%)	
Difficult	6 (14.6%)	3 (7.3%)	
Duration of surgery (from skin incision till skin closure) (hrs.)##	2.68 ± 0.44	2.38 ± 0.73	0.026*
Duration of GA (from induction of GA till removal of endotracheal tube)(hrs.)##	3.18 ± 0.44	2.89 ± 0.75	0.036*
The onset and incidence of adverse effect			
Nerve injury *(yes)*	0 (0.0%)	0 (0.0%)	----
Hematoma formation *(yes)*	14 (34.1%)	18 (43.9%)	0.365
Local anesthetic toxicity*(yes)*	0 (0.0%)	0 (0.0%)	----
Intravascular injection *(yes)*	0 (0.0%)	0 (0.0%)	----

Data were expressed asmean ± standard deviation or number (%).

#= Chi square test; ##= Unpaired t test.

p> 0.05= not significant; *p< 0.05= significant.

Level of sensory block, ease of performance of the technique, duration of surgery, duration of general anesthesia and the onset and incidence of adverse all of them were insignificantly different between the two groups.

Table (7): Postoperative nausea and vomiting in the two studied groups.

	Gr. H (n= 41)	**Gr L (n= 41)**	**P value#**
PONV T0(yes)	1 (2.4%)	9 (22.0%)	0.007*
PONV T1(yes)	2 (4.9%)	5 (12.2%)	0.236
PONV T2(yes)	1 (2.4%)	4 (9.8%)	0.166
PONV T3(yes)	1 (2.4%)	4 (9.8%)	0.166
PONV T4(yes)	3 (7.3%)	5 (12.2%)	0.457
PONV T5(yes)	2 (4.9%)	2 (4.9%)	1.000
PONV T6(yes)	5 (12.2%)	3 (7.3%)	0.457

Data were expressed as number (%).

#= Chi square test.

p> 0.05= not significant; *p< 0.05= significant

Postoperative nausea and vomiting were insignificantly different between the two groups

Table (8): Block performance time,patient satisfaction in the two different studied groups.

	Gr. H (n= 41)	**Gr L (n= 41)**	**P value#**
Block performance time in min (time from probe contact with skin till needle withdrawal) ##	15.24 ± 8.19	11.68 ± 5.931	0.027*
Patient satisfaction regarding pain management rated 24hr after surgery			
Very Satisfied	24 (58.5%)	25 (61.0%)	0.229
Satisfied	10 (24.4%)	13 (31.7%)	
Not very satisfied	6 (14.6%)	1 (2.4%)	
Dissatisfied	1 (2.4%)	2 (4.9%)	

Data were expressed as mean ± standard deviation or number (%).

#= Chi square test; ##= Unpaired t test.

p> 0.05= not significant; *p< 0.05= significant
Block performance time and patient satisfaction were insignificantly different between the two groups

Discussion

Breast cancer is the most common cancer in women, it about (38%) of all types of cancer affecting female in Egypt. **[14]** Postoperative pain is one of the greatest patient concerns following any surgery. Although an increased emphasis has been placed on pain management, approximately 80 % of surgical patients report postoperative pain with 86 % of patients rating their pain as moderate, severe, or extreme. **[15]**

Negative clinical outcomes resulting from ineffective postoperative pain management include deep vein thrombosis, pulmonary embolism, coronary ischemia, myocardial infarction, pneumonia, poor wound healing, and insomnia. **[6]** Associated with these complications are economic and medical implications, such as extended lengths of stay, readmissions, and patient dissatisfaction with medical care. **[6]**

Therefore, adequate postoperative analgesia is essential to allow effective coughing, early mobilization, and to reduce the incidence of postoperative respiratory complications. **[16]**

Patients undergoing breast surgery require a multimodal postoperative pain treatment regimen that provides high quality analgesia with minimal side effects. Until now, oncologic breast surgeries are typically performed by general anesthesia (GA). However, GA cannot provide adequate postoperative pain control and routine use of parenteral opioids aggravate postoperative sedation, nausea, emesis, impaired oxygenation and depressed ventilation. Many studies have been carried out trying to find a solution for these dilemma thus different analgesic modalities as nerve blocks. **[17]**

Paravertebral block became the gold standard techniques to achieve this goal, but not every anesthesiologist is comfortable performing these procedures. **[17]**

ESP has been described as a technically simpler alternative to ultrasound guided paravertebral block with a similar mechanism of action **[17, 18]**. Part of the appeal of the ESP block could be that it is gaining indirect access to the paravertebral space and providing analgesia without the potential for needle-pleura interaction and consequent risk of pneumothorax. There are no structures at risk of needle injury in the immediate vicinity, such as, neuroaxis, pleura, and any major vascular structures. It permits the block to be performed by experienced practitioners in anticoagulated patients with a reasonable safety margin **[19]**. Similarly, some authors believe that injection into a fascial plane and lack of needle proximity to neural structures make it reasonable to perform the ESP block under general anesthesia if necessary **[16]**. Fortunately, the relatively shallow angle of needle approach allows the broad transverse process to function as a good shield for deeper structures. However, complications such as pneumothorax and artery puncture are theoretically possible. ***Ueshima et al***. **[25]** reported a case of pneumothorax after the ESP block in a woman who underwent a left total mastectomy. They recommend to be careful especially in thin patients **[6]**.

Patient education was an integral part of the medical management. It implies thorough explanation and realistic information about the medical procedures, as well as surgical procedures, and about the realities of the preoperative period. In the absence of information delivered by the medical stuff, the patient will gather inaccurate data delivered by other patients according to their experiences, to their level of understanding and of copping with these realities. Patient education results in gaining patient co-operation. It will place the patient in the proper position as an important partner in the medical act. Also it will result in increased patient satisfaction and in decreased complains. Pre-admission counseling is most advisable.

Preoperative psychological support for the both groups had a big role in the success of this study. The patients had a bad history gained from the media. It was thought by the candidates of both groups that this block is a painful process, which in fact lead to the refusal of a large number of patients to join our study. And it took much effort to change this idea and to deliver how effective was the block in dealing with various types of pains.

Optimized premedication was given to all patients, in the form of midazolam (0.02 mg/kg) I.V. in the holding area.

Optimized anesthesia including all strategies to achieve proper depth of anesthesia and analgesia. Induction of general anesthesia performed using a regimen of IV 2 μcg/kg fentanyl and propofol IV 2 mg /kg. Tracheal intubation facilitated using 0.5 mg/kg IV of Atracurium. Anesthesia maintained with inhaled isoflurane with MAC 1.2% in oxygen enriched air (FiO2=0.5) and top up doses of atracurium (0.1 mg/kg) IV administered as required.

ESP block was performed in a monitored preoperative holding area for both groups by an attending anesthesiologist. Standard monitoring using non-invasive blood pressure measuring, ECG, pulse oximetry was used.

In our study we performed the block by placing the ultrasound probe in a longitudinal orientation at the level of the T4 spinous process, then placed the probe 2–3 cm laterally from the midline. After the identification of the T4 transverse process and overlying trapezius, rhomboideus, and erector spinae muscles, the targeted injection site will be anesthetized with 3–4ml of 2% lidocaine. An 80mm 21-gauge block needle will be inserted using the in-plane technique following the same injection point in the cranial to caudal direction until the tip contacted to the T4 transverse process. When the correct needle tip position will be confirmed by hydro dissection with 1–2 ml of isotonic saline solution,

Local anesthetic solution will be injected according to randomization [20ml lidocaine 2% (400mg) or 40ml lidocaine 1%

(400mg)]. Following block procedures, patients was placed in a supine position. Assessment of block success was confirmed by ice cotton test, complete block failure was defined if there is a no difference between response to ice on both sides, block was considered to be partially failed if there is a part of chest wall is sensitive on the blocked side similar to the non-blocked site.

Forero et al. **[4]** firstly described ESP block successfully applied in the interfascial plane between rhomboideus major muscle and erector spinae muscle for thoracic neuropathic pain. This technique failed in the second patient, and subsequent ESP block was performed deep to erector spinae muscle. In their discussion, the authors clearly state that 'the cadaveric findings and their subsequent clinical experience indicate that the optimal plane for injection in the ESP block is deep to the erector spinae muscle rather than superficial to it. All subsequent studies of ESP block have used this technique **[20]**. Nevertheless, some authors **[21]** defend that the injection of LA both planes, deep to the erector spinae muscle and also in between the erector spinae muscle and rhomboideus major muscle, had shown comparable analgesic effects in living subjects. In living subjects, there is more dynamic and extensive spread of drug along tissue planes, perhaps following the course of the medial branch of the dorsal rami which allowed the drug to reach ventral rami **[14]**.

This study aims to compare between the analgesic effect of two different volumes of local anesthetics [20ml lidocaine 2% (400mg) versus 40ml lidocaine 1% (400mg)]

The patients were allocated according to the volume used into two equal groups, group (L) 20 mill litre of lidocain 2 % was injected and group (H) 40 mill litre of lidocain 1% was injected.

In our study regarding VAS there was insignificantly different between the two groups.

In accordance with our results ***Kashani et al. (22)*** and Josh Luftig P stated that the exact volume and concentration of LA to be used in ESPB is not well established **[23,24]**.

Against our results ***Luftig et al.*** **[11]** stated that from a safety perspective it is recommended large volume of a low LA concentration, however, in some case reports it is used a lower to moderate volume of a high LA concentration **[20]**.

Luftig et al. **[11]** reviewed used doses in ESP block injections documented in the literature **[18]**. In these case reports, bupivacaine and ropivacaine were the most commonly used LAs, with injection volumes ranging from 20 mL to 40 mL, and concentrations ranging from 0.25%–0.5%. Taking into consideration the importance of apply the correct dose this author created a weight-based LA dose and volume guide for ESP block. That review recommends guidelines limiting bupivacaine doses to 2 mg/kg (max 175 mg), and ropivacaine to 3 mg/kg (max 300 mg).

Kashani. (22) stated that it would seem logical that a larger volume would provide for a much more extensive spread in the interfascial plane deep to the erector spinae muscle, even though a higher LA concentration might allow for better diffusion into the paravertebral space **[14]**

In our study regarding both the number of morphine increments and the total first preoperative 24 hours morphine consumption ther was insignificantly different between the two groups.

Altıparmak et al. **[8]** stated that the ESP block at the higher concentration of bupivacaine reduced postoperative tramadol consumption more significantly than the lower concentration of bupivacaine

Altıparmak et al. **[8]** compare two different concentrations of the same local anesthetic agent in the same volume of solution. Although both concentrations provided effective analgesia in the postoperative period, the ESP block performed using the higher concentration of bupivacaine reduced postoperative opioid consumption more significantly.

Nair et al. **[21]** published efficacy of this block in a similar surgery on a case series of five patients. They also had a very encouraging result of no requirement of opioid in any of their patient for rescue postoperative analgesia.

Most of case reports/series has used this block for perioperative analgesia but ***Kimachi et al.*** **[14]** used US-guided ESP for complete surgical anaesthesia for a right-sided mastectomy and axillary dissection in a patient with high cardiovascular risk. They not only accomplished complete surgical anaesthesia but also requirement of postoperative analgesia was minimal

In accordance with our results ***Gürkan et al.*** **[7]** reported in a randomized controlled study in breast cancer surgery that a single-shot ESP block performed at the T4 thoracic level significantly reduced morphine consumption at the postoperative period.

However, against to our results ***Ueshima et al.*** **[25]** suggested that ESP block alone may not be sufficient to achieve adequate analgesia of anterior branches of T2–T6 and to provide full analgesia necessary for breast cancer surgeries **[25]**. In fact, the ESP block failed in two case reports and their explanation is based on the cadaveric study by ***Ivanusic et al.*** **[17]** where the authors did not find extension of the dyed contrast to the paravertebral space and dyed only posterior and lateral branched of thoracic nerve **[4]**.

Regarding Mean arterial blood pressure our results showed that in group (H) that there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) there was a statistical significant decrease in the mean arterial blood pressure measured at T6 (83.49 ±6.32) (p= 0.001) when compared with their corresponding value measured at T0 (87.76 ± 9.07).

Our results showed that regarding heart rate in H group there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6) Bonferroni test revealed that there was a statistical significant decrease in the mean heart rate measured at T6 (67.66 ± 6.56) (p= 0.001) when compared with their corresponding value measured at T0 (73.54 ± 7.80).

In L group there was a statistical significant difference between different time of measurements (T0, T1, T2, T3, T4, T5 and T6). Bonferroni test revealed that there was a statistical significant decrease in the mean heart rate measured at T1 (71.85 ± 8.01) (p= 0.036) when compared with their corresponding value measured at T0 (74.71 ± 9.57).

Against our results ***Seelam et al.*** **[26]** found that there was no statistical significance in baseline parameters and immediate postoperative parameters (heart rate, systolic, diastolic, and mean arterial pressure).

In our results incidence of post-operative nausea and vomiting was minimal and showed insignificantly different between the two groups

In accordance with our study ***Zhang et al.*** **[23]** stated that ESPB decreases post-operative nausea and vomiting.

Against our results ***Park et al.*** **[24]** stated that the ESPB did not significantly reduce the incidence of PONV, although it significantly reduced postoperative opioid use, perhaps because in there study there were other risk factors for PONV, such as gender, a prophylactic antiemetic regimen, and use of volatile anesthetics **[24]**.

Also our study showed that the incidence of regional anesthesia complications such as local anesthetics toxicity, nerve injury, intravascular injection was absent in all patients in both groups and only hematoma formation was recorded in 18 patients in group L and 14 patients in group H.

Ueshima **[25]** and against our results has reported the incidence of pneumothorax after ESPB.

Also against our results ***Tulgar et al.*** **[5]** reported that in a single-center study of 182 patients undergoing ESPB, one definite and two suspicious cases of minor symptoms of central nervous system local anesthesia toxicity were reported. **[7]**

Hamilton et al. **[20]** ***; Selvi et al.*** **[27]** stated that ultrasound-guided ESPB is a new and popular block technique and only two complications have been reported. One of these was pneumothorax and the second, was motor weakness when ESPB was performed from a lower thoracic level. Pneumothorax following ESPB is not expected when it is performed under ultrasound guidance but may be the result of loss of hand-eye coordination or miscalculating depth.

Also ***Tulgar et al.*** **[5]** found that motor weakness may occur when the LA spreads to the lumbar plexus when performed from the lower thoracic or lumbar areas. Our report of ESPB from L4 being used for effective postoperative analgesia in hip, femur, and knee surgery is of clinical significance. Further studies are required to determine the relationship between volume and the LA spread, if one exists.

El-Boghdadly et al. **[28]** reported that local anaesthetic systemic toxicity (LAST) is typically manifested as central nervous system (CNS) toxicity (tinnitus, disorientation, and ultimately, seizures) or cardiovascular toxicity (hypotension, dysrhythmias, and cardiac arrest). The dose capable of causing CNS symptoms is typically lower than the dose and concentration result in cardiovascular toxicity. This is because the CNS is more susceptible to local anaesthetic toxicity than the cardiovascular system. The risk of LAST in interfascial plane blocks is generally the use of high volume and the spread of LA from the interfascial plane to the vascular-rich muscles and thereon to the systemic circulation. The time from interfascial block to peak plasma concentration of the LA is 30 minutes or more **[28]**.

The results of ***Tulgar et al.*** **[5]** in their study showed that the rate of LAST in is 1.6%, which we consider to be relatively high. However, they did not observe any major LAST complications such as seizures or cardiac arrest. Complications defined were suspicious cases of minor LAST complications which may be due to the volume/concentration of the LA used. They believed that this complication is underreported as the symptoms may be mild (perioral numbness, tinnitus, agitation) and masked as sedation precedes the induction of general anaesthesia that immediately follows awake intubation or as the block is performed under anaesthesia. Larger case series and meta-analysis are required to determine the exact rate of LAST in ESPB. **[29]**

Conclusion

From our study we can conclude that increasing the volume of the local anesthetic with fixed drug mass will not affect the efficacy of the block in decreasing postoperative VAS score and morphine consumption in patients undergoing modified radical mastectomy

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