

Original Research Article

## Comparison of Feasibility of Ultrasound Guided Erector Spinae Plane Block versus Paravertebral Plane Block in Modified Radical Mastectomies by Anaesthesiology Residents - A Randomised Control Trail

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### ABSTRACT

#### BACKGROUND

This study was conducted to compare the success rates of parasagittal inplane thoracic paravertebral block with USG-guided parasagittal inplane erector spinae plane block. Taking into account: intervention guidance during the process, block simplicity, hemodynamic response to the skin incision, degree of post-operative analgesia, time spent executing the surgery, and potential side effects.

#### METHODS

This was a hospital-based study conducted among 100 patients belonging to ASA class I or II, aged 40 to 65 years and scheduled for modified radical mastectomy under GA after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

#### RESULTS

There was a statistically significant difference in the procedure's execution time between the groups. The p-value was 0.0036. The paravertebral block takes longer to complete than the plane block of the erector spinae. The average heart rate was consistent throughout all time intervals. At all times, the mean arterial pressure was likewise comparable. About postoperative pain, we found that VAS scores were statistically non-significant at four hours after surgery, but that at eight hours, the pain was higher in the PARA group than in the ESPB group, and that difference remained significant for the full twenty-four hours. The median number of guidance interventions in the erector spine plane block was found to be one, whereas in the paravertebral plane block, it was found to be three. This difference between the groups was statistically significant. (P-value < 0.001)

#### CONCLUSION

The ultrasound-guided erector spinae plane block is a safer, more straightforward alternative to the thoracic paravertebral plane block because of its easily identifiable sonoanatomy,

distinct terminus, and lack of critical structures in the needle trajectory. It also results in lower postoperative pain scores.

## KEYWORDS

Feasibility of Ultrasound, Erector Spinae Plane Block, Paravertebral Plane Block, Radical Mastectomies

## INTRODUCTION

According to IASP<sup>[1]</sup> (International Association for Study of Pain), pain is defined as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage." Anaesthesiology places a high value on pain prevention. Pain and discomfort following surgery are among the risks associated with procedures such as a modified radical mastectomy. In order to inhibit the transmission of pain, multimodal postoperative analgesia is necessary. Thirteen percent of breast cancer procedures involve MRM (Modified Radical Mastectomy).<sup>[2]</sup> When opioids are used to treat post-mastectomy pain alone, adverse effects like nausea and vomiting are more common. For 25–40% of patients, inadequate pain management might result in chronic pain syndrome. After thoracic surgery, several regional anaesthetic blocks, such as the TEB (Thoracic Epidural Block), TPVB (Thoracic Para Vertebral Block), intra or extra pleural block, intercostal block, and erector spinae block, are performed. Every one of these blocks has benefits and drawbacks of its own. When executing nerve blocks, ultrasound technology improves the block's quality, speeds up block performance, uses less local anaesthetic, and lowers the risk of complications. Therefore, in this study, we compared the use of ultrasound for post-operative pain treatment in MRM procedures between thoracic Erector Spinae Plane block and para vertebral block.

## Aims and Objectives

To compare the USG-guided parasagittal inplane erector spinae plane block with parasagittal inplane thoracic para vertebral block with regard to success rates, guidance and intervention during the procedure, ease of block, hemodynamic response to a skin incision, intensity of post-op analgesia duration of the procedure and adverse effects if any.

## METHODS

This was a hospital-based study conducted among 100 patients belonging to ASA class I or II, aged 40 to 65 years and scheduled for modified radical mastectomy under GA after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

## Inclusion Criteria

1. ASA physical status I and II.
2. Age 40-65 years, scheduled for a modified radical mastectomy.
3. Patients who are willing to provide written informed consent

## Exclusion Criteria

1. Patient refusal of consent
2. Significant history of allergic disorders
3. Long-standing diabetes mellitus (>5 years)
4. Local infection at any of the puncture sites
5. Coagulation disorders
6. Neurological or psychological problems that may interfere with the proper subjective interpretation of the results.

### Sample Size Calculation

The study carried out by Moustafa et al.<sup>[3]</sup> found that the sample size was calculated as 43 and that, after accounting for 2% more for loss, it was computed as 50 in each group. This was based on the residents' success rate with the procedures, with confidence intervals of 95% and test power of 80%. The sample size was determined using the online App 4 Stats software.

### Study Procedure

Patients were placed lateral, with the operating side above, following intubation. Using a numbered closed envelope procedure, patients were randomly assigned by a third party not involved in the study to one of two equal groups to undergo the scheduled regional anaesthetic block. A sterile sheathed linear ultrasound probe operating between 5 and 13 MHz directed the performance of every block using a sonosite. The region that needed to be blocked received a standard disinfection treatment, and the block was carried out using the subsequent methodology.

The ultrasonic transducer was used in the parasagittal plane for the paravertebral block, around 2.5 cm lateral to the midline, until the fourth thoracic vertebra was identified.

The intended paravertebral space was brought to the centre of the image by adjusting the position of the ultravertebral transducer. A 20-gauge, non-insulated, 100-mm needle was placed at the transducer's caudal edge and progressed straight sagittal to the anterior and cranial regions. The needle tip was observed to enter through the superior costotransverse ligament. Twenty ml of 0.25% bupivacaine was deposited just superficially on the hyperechoic pleural line. The correct injection of local anaesthetic was confirmed by anterior displacement of the underlying pleura.

The ultrasagittal plane lateral to the fourth thoracic spine is where the ultrasound transducer was placed for the erector spinae block. The transducer was moved in a horizontal direction until the transverse process tip was visible. From superficial to deep, three longitudinal muscles were distinguished: the erector spinae, rhomboid major, and trapezius. Twenty millilitres of 0.25% bupivacaine were deposited deep into the muscle after a 20-gauge, non-insulated, 100-mm needle was inserted in a plane from caudad to cephalad until the tip reached the plane deep to the erector spinae. Erector spinae muscle movement upward indicated appropriate local anaesthetic administration.

### Statistical Methods

SPSS software was used to analyse data that had been entered into MS Excel. The results were displayed as tables.

## RESULTS

Duration of Procedure	Group ESPB (in sec)	Group PARA(in sec)	T-Test	P-Value
Mean	158.4	190.3	2.98	0.0036
SD	48.12	58.4		

*Table 1 : Mean Duration of Performing Procedure between the Groups*

The difference in process time between the groups was statistically significant; group PARA required more time for the procedure than group ESPB.

VAS Score	Group ESPB	Group PARA	T-Test	P-Value
4 hour	2.6±0.45	2.4±1.02	1.26	0.207
8 hours	2.8±0.31	3.8±0.98	6.87	<0.01

10 hours	4.5±0.41	5.2±0.94	8.96	<0.01
12 hours	5.1±0.33	6.3±1.45	5.26	<0.01
16 hours	4.2±0.33	4.7±1.4	5.8	<0.01
20 hour	5.1±0.12	6.2±1.6	4.84	<0.01
24 hours	4.8±0.14	5.7±1.45	4.36	<0.01

**Table 2: Mean VAS Score between the Groups**

In terms of postoperative pain, we found that there was no comparable pain four hours after surgery, but eight hours later, we found that group PARA had more pain than group ESPB, and that difference remained statistically significant for the full twenty-four hours.

Success Rate	Median	Min-Max	Man-Whitney	P-Value
Group ESPB	1	0 – 2 times	168**	<0.001
Group PARA	3	2-3 times		

**Table 3: Median Times of Guidance Intervention Score between the Groups**

The study found that the technique worked 1% of the time for guided intervention in the erector spinae plane block and 3% of the time in the paravertebral plane block. There was a statistically significant difference between the groups.

## DISCUSSION

After mastectomies, the best options for managing postoperative pain were thoracic, epidural and paravertebral blocks. However, there are major side effects from the paravertebral block, such as pneumothorax.<sup>[4]</sup> Because this block requires advanced expertise, many physicians are reluctant to perform it. Because of its steadily growing signals since its initial report by Blanco R et al.<sup>[5]</sup> and Forero M et al., ESP and PECS II have the ability to live up to that.<sup>[6]</sup> The initial description of ultrasound-guided ESPB was for the treatment of chronic neuropathic pain in individuals. Nonetheless, a few recent case reports<sup>[7-10]</sup> and randomised controlled studies<sup>[11-13]</sup> have shown that it works well as a postoperative analgesic method and can lower the amount of opioids used after breast surgeries. Forero et al. published the first paper on ESPB (Extracelluar Spinach Biopsy). They found that when a dye is injected deep into the erector spinae muscle plane using ultrasound to guide the procedure, it spreads below and sometimes even above the superior costotransverse ligament.

The main benefit of an ESP block is that it can be accessed without running the danger of a needle-pleura interaction and the consequent pneumothorax. Local anaesthetic is given superficially to the transverse process and deeper into the ES muscle during the ESP block, a fascial plane block.<sup>[14]</sup> The dorsal and ventral rami of spinal neurons are thought to be the main places where ESP block works, which spreads to many dermatomes.

ESP blocks appear to be a promising local treatment for analgesia following breast surgery. When compared to normal treatment, small randomised controlled trials have demonstrated effective analgesia and decreased postoperative opioid intake in patients having breast cancer surgery, including mastectomy.<sup>[15]</sup> A modified pectoral nerve block, as opposed to an ESP block, was shown to result in reduced pain scores and postoperative tramadol intake in a prospective randomised experiment involving radical mastectomy surgery. Larger comparative trials are required to determine the actual benefit and efficacy of this surgery group. Ultrasonography-guided paravertebral block is a sophisticated regional anaesthetic method that requires specialised abilities to move the needle towards the paravertebral area, as various prior investigations have revealed. The improvement of technology for procedures linked to breast surgery is still under discussion. In order to compare the success rates of

parasagittal in-plane erector spinae plane block with parasagittal in-plane thoracic paravertebral block, this study was conducted.

One hundred patients total are included in the study; fifty patients each are randomly assigned to the ESPB and PARA groups.

### **Age Distribution**

The mean age of the patients in both groups did not show statistical significance (p-value = 0.096). The age groups of the two groups were found to be similar. The typical age group in the ESPB group was 52.4 years, whereas in the PARA group it was 55.2 years.

A comparable study by Mona Raafat et al.<sup>[16]</sup> examined the use of Thoracic paravertebral plane block vs. erector spinae plane block for postoperative analgesia in MRM procedures. The mean age of the ESPB group was 37 years, while the TPVB group's mean age was 41 years, a statistically insignificant difference. In a different study, Ahmed M. Elewa et al.<sup>[17]</sup> examined the use of postop analgesics after breast surgeries between Erector spinae plane block and paravertebral block. The mean age group in the ESPB group was 44.9 years, while the TPVB group was 46.6 years.

### **Weight Distribution**

The mean weight of the ESPB group in our study is 58.6 kg, whereas the TPVB group's mean weight is 61.32 kg. This difference is statistically insignificant (p value 0.2214).

A study by Bin Fang et al.<sup>[18]</sup> comparing thoracic paravertebral block after thoracotomy with USG-guided preoperative single-dose erector spinae plane block shows a mean weight of 63.09 kg in the PARA group and 63.27 kg in the ESPB group, which is statistically not significant.

### **Body Mass Index (BMI) Distribution**

The mean BMI in the ESPB group was 24.8 in our study, whereas it was 25.3 in the PARA group. This difference is statistically insignificant (p value = 0.3731).

A comparable study by Mona Raafat et al. examined the function of TPVB and ESPB plane blocks for postoperative analgesia in MRM procedures. The results showed a statistically negligible difference in mean BMI between the two groups, with ESPB having a mean BMI of 28.4 and TPVB having a mean BMI of 27.7.

In a different study, Ahmed M. Elewa et al. evaluated the use of postop analgesics after breast surgeries between erector spinae plane block and paravertebral block. The mean BMI of the ESPB group was 29.3, while the TPVB group's was 28.7, both of which were statistically insignificant.

### **ASA Status Analysis**

In our research, the majority of the patients had ASA grade II physical status, and the physical status of the patients between the groups was also determined to be statistically non-significant (P-value = 0.54).

The ASA grading between the groups in the studies by Aumjit Wittayapairoj et al.,<sup>[19]</sup> Moustafa et al., Piotr Bryniarski et al.,<sup>[20]</sup> A. M. Eldemrdash, E.-S. M. Abdelzaam et al.,<sup>[21]</sup> V Bhavani et al.<sup>[22]</sup> confirmed our findings.

### **Duration of Performing Block Analysis**

The mean time spent executing the process was found to be statistically significant between the two groups in our study (p-value = 0.0036). The average time taken by the PARA group was 190.3 seconds, compared to 158.4 seconds for the ESPB group.

Similar results to ours were discovered in a research conducted by Moustafa et al., which found that the ESPB group required considerably less time ( $4.39 \pm 1.2$  min) to conduct the regional anaesthetic procedure than the PARA group ( $8.18 \pm 2.42$  min), with a p-value of less than 0.0001.

The fact that the erector spinae plane block performance took comparatively less time may further suggest that the Forero et al. method was simple.

### **Time to First Rescue Analgesia Requirement Analysis**

We found that there was no statistically significant difference in the mean duration of the first analgesic required between the groups in our trial (P-value = 0.449). The initial analgesic requirement lasts, on average, 10.2 hours in the ESPB group and 10.5 hours in the PARA group.

In a similar study, Mona Raafat et al. compared the differences between thoracic paravertebral plane block and erector spinae plane block. They discovered that after MRM surgeries, the first request for pain medication came at 6.58 hours for the ESPB group and 6.35 hours for the TPVB group, which is not statistically significant.

In contrast to our study, another study by Ahmed M. Elewa et al. compared the postop analgesic consumption following breast surgeries between erector spinae plane block and paravertebral block. It found that the mean time of first analgesic requirement in the ESPB group was 7.9 hours, while it was 7.5 hours in the PARA group. However, this difference was statistically significant.

### **Hemodynamic Parameters Analysis**

We found that the mean heart rate was statistically not significantly different at baseline, throughout the incision, and thereafter. Similarly, over the course of the monitoring period, the mean arterial pressure in both groups was comparable.

Our findings are corroborated by Moustafa et al.'s observation that there was no significant difference between the two groups' HR or MABP before the surgical incision or during the period of time after the skin incision.

The mean arterial blood pressure and mean heart rate did not differ statistically significantly across the groups, per the research by V. Bhavani et al.

### **Postoperative Pain Analysis**

After 4 hours, post-operative pain was found to be similar in the study group PARA compared to ESPB, but by 8 hours, pain was higher in the former group and it continued for 24 hours (P-value<0.001). This difference was statistically significant.

In a double-blind clinical trial, A. M. Eldemrdash, E.-S. M. Abdelzaam, et al. compared the three primary prolonged analgesia techniques following mastectomy with axillary dissection. They found that the ESPB group's post-operative VAS scores were higher than those of the PARA and SAPB groups (P <0.05).

Another study by V. Bhavani et al. found that the NRS score was lower in the ESPB group than in the PECS II group at the 30th minute, first, and second hour, and that this difference was statistically significant. After an hour, there was no change.

### **Median Guidance Intervention Analysis**

The median frequency of the technique's guide intervention was used to calculate the success rate of the techniques employed in the study.

The median guide interventions for residents in the erector spinae plane block were found to be 1 time in our study, but in the paravertebral plane block, they were 3 times. This difference between the groups was statistically significant (P-value<0.001).

A study by Moustafa et al. observed in their study that ESPB is better than the parasagittal in-plane paravertebral block in cases of modified radical mastectomy. Aside from the techniques they studied, those residents have prior experience with ultrasound-guided peripheral nerve and plane blocks. Additionally, the study found that the ESPB group had a median frequency of guidance and intervention of 0 (0-2) compared to the para group's 2 (0-3), and that this difference in median was statistically significant ( $p$ -value $<0.001$ ).

#### **Postoperative Nausea and Vomiting Analysis:**

The study found that while there was one patient (with an episode of vomiting) in the ESPB group and four patients (three with vomiting and one with nausea) with PONV in the PARA group, there was no statistically significant difference in PONV.

Mona Raafat et al. conducted a similar study that compared the effectiveness of thoracic paravertebral plane blocks and erector spinae plane blocks. They found that 10% of patients in the PARA group and 4% of patients in the ESPB group felt sick and threw up, but neither of these effects was statistically significant.

#### **CONCLUSION**

We can infer from general observations and discussion that the USG-guided erector spinae plane block is superior to the USG-guided paravertebral plane block as has a shorter processing period, is a comparatively simpler block, requires less direct intervention, exhibited a similar hemodynamic reaction to a skin cut, has lower VAS ratings from eight to twenty-four hours, exhibits a similar length of analgesia and has fewer adverse effects, although there is no statistically significant difference between the two groups.

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