**Original Article**

**Comparison of Ultrasound Guided Modified Pectoral Nerve Block 2 versus Erector Spinae Plane Block For Post Operative Pain Relief in Patients Undergoing Modified Radical Mastectomy**

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**Abstract**

**Background:** Breast carcinoma is most common malignancy among female patients. Pain is the most common symptom encountered during post operative period after MRM. Peripheral nerve block is the emerging procedure in anaesthesiology and modified pectoral nerve block 2 and erector spinae plane blocks are given for post operative pain relief in patients undergoing MRM without any side effects.

**Aim and Objectives:** To compare the effect of modified pectoral nerve block 2 and erector spinae plane block in patients undergoing MRM for post operative pain relief.

**Methodology:** It is a prospective randomized comparative study conducted in 64 patients undergoing MRM in tirunelveli medical college and hospital. Age group includes 18-65 years of female sex who have given informed written consent. Preanaesthetic evaluation done, checked for iv access, all monitors connected, hemodynamics before the procedure were noted. Group 1 received modified pectoral nerve block 2 with 0.2% ropivacaine 25ml and group 2 received erector spinae plane block with 0.2% ropivacain 20ml. pain score after the procedure noted by using VAS score[0-10].

**Results:** PEC 2 Group recorded a better VAS Recovery score than the ESP Group (mean: 2.5 versus 3.65). Opioid requirment is lower in PEC 2 Group compared to ESP group.

**Conclusion:** Ultrasound guided regional anaesthesia is playing a major role in terms of providing the patients better post operative care. Modified pectoral nerve block 2 is safe and effective procedure during breast cancer surgeries especially modified radical mastectomy. It shows lower intraop and postoperative opioid consumption than erector spinae plane block.

**Aim of the Study**

- To compare the modified pectoral nerve block 2 with erector spinae plane block for post operative pain relief in patients undergoing modified radical mastectomy.
Materials and Methodology

Study Design
- Prospective randomized comparative study
- Sample size: 64 patients
- Conducted at: Tirunelveli Medical College and Hospital.

Inclusion Criteria
- Age group: 18-65 years of female sex
- Who have given written informed consent
- Undergoing modified radical mastoidectomy.

Exclusion Criteria
- Patients not satisfying inclusion criteria
- Patients with severe cardiovascular, respiratory, hepatic, renal, neurological or metabolic diseases.
- Local infection at the site of block
- Patients with known allergy to local anaesthetics.
- Patient refusal
- Patients with coagulopathies

Ethical Considerations
- After approval from institutional ethical committee, the study will be conducted
- The procedure will be explained in a local language to the patient and informed written consent will be obtained.

Methodology
- Group 1: Modified pec 2 block with 0.2% ropivacaine 25ml.
- Group 2: Erector spinae plane block with 0.2% ropivacaine 20ml.

Preparation for procedure
- Preanaesthetic evaluation
- Informed written consent
- Peripheral iv access
- Equipments and monitors.

Data collation
- Hemodynamics before and after the procedure
- Pain score before and after the procedure by using vas[ 0-no pain; 10- worst pain]

Procedure
- In this randomized prospective comparative study 64 patients scheduled for MRM are included.
- Patients are distributed in two groups through computer generated random numbers table.
- Group 1 patients will receive modified pec2 block given between pectoralis major and pectoralis minor/pectoralis minor and serratus anterior.
- Group 2 patients will receive erector spinae plane block given deep to the erector spinae muscle.

Observation
- Hemodynamics monitoring including heart rate, nibp, respiratory rate and oxygen saturation.
- Visual analog score monitoring before and after the procedure.
- After the procedure vas noted at 0.5,6,12,18,24 hrs post operatively.
Statistical Flow-Chart

Patients assessed for eligibility → Randomised → Patients allocated to Group I → Underwent USG guided ESP block → Lost to follow-up (none) → Number of patients analyzed finally = 32

Patients allocated to Group II → Underwent USG guided PECS block → Lost to follow-up (none) → Number of patients analyzed finally = 32
Results

Age Distribution
The study involves most of the patients above the age category of 60 years with frequency 34.38% among Erector spinae block group and 28.13% among PEC II block group.

| Age   | ESB   | PEC 2 |
|-------|-------|-------|
|       | Frequency | Percentage | Frequency | Percentage |
| 45-49 | 7      | 21.88  | 6        | 18.75      |
| 50-54 | 7      | 21.88  | 9        | 28.13      |
| 55-60 | 7      | 21.88  | 8        | 25.00      |
| >60   | 11     | 34.38  | 9        | 28.13      |
| Grand Total | 32 | 100 | 32 | 100 |

Mean 55.6563
Standard Deviation 6.7995
Median 55
Mode 46

BMI of the study population:
Most of the patients fall into healthy category when the BMI is concerned with frequency 71.88% among Erector spinae block group and 68.75% among PEC II block group.

| BMI      | ESB   | PEC 2 |
|----------|-------|-------|
| Underweight | 1 | 3.13  | 0 | 0.00 |
| Healthy   | 23    | 71.88 | 22 | 68.75 |
| Overweight| 8     | 25.00 | 10 | 31.25 |
| Grand Total | 32 | 100.00 | 32 | 100.00 |

p=0.53
ASA Grade
Almost all of the patients come under the ASA Grade II with the frequency of 93.75% among both the groups.

| ASA Grade | ESB | PEC 2 |
|-----------|-----|-------|
| Grade-3   | 30  | 30    |
| Grade-4   | 2   | 2     |
| Grand Total | 32  | 32    |

p=1
Nausea
Both the group has minimal incidence of nausea and vomiting following the procedure which makes them a better alternative for opioid analgesics.

| Nausea | ESB | PEC 2 |
|--------|-----|-------|
|        | Frequency | Percentage | Frequency | Percentage |
| No     | 29   | 90.63 | 30   | 93.75 |
| Yes    | 3    | 9.38  | 2    | 6.25  |
| Grand Total | 32   | 100.00 | 32   | 100.00 |

p=0.6414

Duration of surgery
The mean time duration of surgery for both the group are almost similar with mean value around of 115min.

| Duration of surgery (min) | Mean  | Standard Deviation | p value |
|---------------------------|-------|--------------------|---------|
| ESB                       | 114.3438 | 10.76916           |         |
| PEC 2                     | 116.0625 | 13.11472           | 0.568754 |
Preoperative Heart Rate

Mean pre-operative heart rate is lesser for erector spinae block than the PEC-II block group

|                | Mean   | Standard Deviation | p value |
|----------------|--------|--------------------|---------|
| ESB            | 83.8125| 5.710418           |         |
| PEC 2          | 118.5313| 6.445726          | 0.634629|

![Graph showing duration of surgery (min) for ESB and PEC 2]

![Graph showing preoperative heart rate for ESB and PEC 2]
Heart rate after Injection

Like the pre-operative heart rate, the heart rate measured after injection of the anaesthetic agent is again found to be higher in PEC-II block group (116.25) than the Erector spinae block group.

| Parameter | ESB     | Mean    | Standard Deviation | p value |
|-----------|---------|---------|--------------------|---------|
| HR after injection |         |         |                    |         |
| ESB       | 85.875  | 83.9375 | 5.523776           | 0.002417|
| PEC 2     | 116.25  | 83.21875| 5.840539           | 1.93E-05|

| Parameter | ESB     | Mean    | Standard Deviation | PEC 2   | Mean    | Standard Deviation | p value |
|-----------|---------|---------|--------------------|---------|---------|--------------------|---------|
| HR 15 min | 79.46875| 83.21875| 4.695464           | 83.1875 | 5.840539| 5.52695 | 1.11E-06|
| HR 30 min | 78.21875| 83.1875 | 5.52695            | 1.11E-06|
| HR 60 min | 77.0625 | 83.1875 | 5.52695            | 1.11E-06|
| HR 75 min | 76.625  | 83.21875| 5.840539           | 1.93E-05|
| HR 90 min | 75.96875| 83.21875| 5.840539           | 1.93E-05|
| HR 2 hr   | 75.6875 | 83.21875| 5.840539           | 1.93E-05|
| HR 3 hr   | 74.6875 | 82.125  | 5.463958           | 0.000129|
| HR 4 hr   | 78.03125| 82.9375 | 5.84718            | 0.00168 |
| HR 5 hr   | 80.40625| 83.5    | 6.064173           | 0.039481|
| HR 6 hr   | 83.1875 | 82.96875| 5.625314           | 0.859473|
Systolic Blood pressure pre-operative period

Systolic Blood pressure in the pre-operative period is almost identical among the two group (approx. 118)

| SBP Preop | Mean   | Standard Deviation | p value |
|-----------|--------|--------------------|---------|
| ESB       | 118    | 5.435843           | 0.722742|
| PEC 2     | 118.5313 | 6.445726         |         |
Systolic Blood pressure after injection

The systolic pressure is found to decrease a bit after injection of the dose in PEC-II block (116.25) but not on the ESP group.

| Parameter | ESB            | Mean   | Standard Deviation | p value |
|-----------|----------------|--------|--------------------|---------|
| SBP 15 min| 109.25         | 7.322083 | 118.375            | 6.068161 | 1.01E-06 |
| SBP 30 min| 108.8125       | 7.136627 | 117.7188           | 6.279688 | 1.63E-06 |
| SBP 60 min| 107.5313       | 6.237164 | 117.9063           | 5.771786 | 3.12E-09 |
| SBP 75 min| 108.9063       | 5.479342 | 116.625            | 4.770541 | 1.07E-07 |
| SBP 90 min| 107.7188       | 7.663211 | 116.9375           | 5.752629 | 9.52E-07 |
| SBP 2 hr  | 109.7188       | 7.05844  | 117.7813           | 6.583138 | 1.36E-05 |
| SBP 3 hr  | 109.25         | 7.530583 | 117.5938           | 6.015353 | 7.29E-06 |
| SBP 4 hr  | 109.4375       | 5.999664 | 117.125            | 5.762784 | 2.14E-06 |
| SBP 5 hr  | 111.625        | 5.868176 | 117.625            | 5.884644 | 0.000129 |
| SBP 6 hr  | 113.9375       | 7.335013 | 117.25             | 6.355084 | 0.058088 |
Diastolic Blood pressure pre-operative period
Diastolic Blood pressure in the pre-operative period is identical in the groups
(Mean value of 80)

|                | Mean   | Standard Deviation | p value |
|----------------|--------|--------------------|---------|
| DBP Preop      |        |                    |         |
| ESB            | 80.15625 | 4.925964           | 1       |
| PEC 2          | 80.15625 | 4.033004           |         |

DBP Preop
Diastolic Blood pressure after injection

Diastolic Blood pressure after injection seems to reduce following PEC-II block(mean of 79.09375) but not for ESP group.

| Parameter | ESB Mean | ESB Standard Deviation | PEC 2 Mean | PEC 2 Standard Deviation | p value |
|-----------|---------|------------------------|------------|--------------------------|---------|
| DBP 15 min | 74.71875 | 4.820885 | 78.875 | 3.498848 | 0.000205 |
| DBP 30 min | 74 | 4.758693 | 79.5 | 3.885457 | 3.93E-06 |
| DBP 60 min | 73 | 4.778986 | 79.1875 | 3.745427 | 2.77E-07 |
| DBP 75 min | 72.65625 | 4.756045 | 78.59375 | 3.545641 | 4.12E-07 |
| DBP 90 min | 73.1875 | 5.006045 | 79.21875 | 3.405256 | 4.56E-07 |
| DBP 2 hr | 74.40625 | 5.387317 | 78.65625 | 3.375523 | 0.000353 |
| DBP 3 hr | 75.53125 | 5.339955 | 79.3125 | 3.67588 | 0.001608 |
| DBP 4 hr | 76.65625 | 5.319528 | 78.96875 | 3.771578 | 0.049215 |
| DBP 5 hr | 78.3125 | 5.509157 | 79.1875 | 3.37388 | 0.446468 |
| DBP 6 hr | 79.3125 | 5.509157 | 78.84375 | 3.538811 | 0.686896 |
**SpO2 pre-operative period**

SpO2 in the pre-operative period almost identical in the 2 groups

| SpO2 Preop | Mean    | Standard Deviation | p value  |
|------------|---------|--------------------|----------|
| ESB        | 98.9375 | 0.840027           | 0.350294 |
| PEC 2      | 99.125  | 0.751343           |          |
SpO2 after injection:
SpO2 after injection not altered following the blocks in both the groups.

| SpO2 after injection | Mean   | Standard Deviation | p value |
|----------------------|--------|--------------------|---------|
| ESB                  | 98.9375| 0.840027           | 0.350294|
| PEC 2                | 99.125 | 0.751343           |         |
Visual Analog Score at recovery

PEC-II group recorded a better VAS recovery score than the ESP group (mean value 2.5 vs 3.65625)

| VAS at recovery | Mean   | Standard Deviation | p value |
|-----------------|--------|--------------------|---------|
| ESB             | 3.65625| 1.180743           | 0.000105|
| PEC 2           | 2.5    | 1.04727            |         |
### Parameter

| Parameter | ESB | PEC 2 | p value |
|-----------|-----|-------|---------|
| VAS recovery 1 hr | 3.5625 | 2.28125 | 2.47E-05 |
| Mean | Standard Deviation | Mean | Standard Deviation |
| VAS recovery 2 hr | 3.6875 | 2.03125 | 2.07E-08 |
| VAS recovery 4 hr | 4.0625 | 2.1875 | 2.33E-06 |
| VAS recovery 6 hr | 4.21875 | 2.34375 | 1.23E-06 |

Visual analog recovery score is the symbolic representation of the alleviation of post-operative pain. The comparison between the groups revealed the PECTORAL NERVE BLOCK-II performed better than the ERECTOR SPINAЕ BLOCK in all the recorded periods namely,

- 1 hour
- 2 hours
- 4 hours
- 6 hours

Hence giving the absolutely better outcome of PEC-II block compared with ESR block.

Opioid requirement at recovery:

Again pectoral block II group gives a standout performance in terms of post-operative requirement of opioid drugs (mean of 3.125 for PEC-II) on comparison with Erector Spinae Group (mean 17.96875 for ESP group)

| Opioid req (mg) at recovery | Mean | Standard Deviation | p value |
|-----------------------------|------|--------------------|---------|
| ESB                         | 17.96875 | 22.21084 | 0.001126 |
| PEC 2                       | 3.125 | 10.53029 |         |
### Parameter Table

| Parameter                  | ESB                      | PEC 2                      | p value   |
|----------------------------|--------------------------|----------------------------|-----------|
| Opioid req (mg) recovery 1 hr | 10.9375 (16.72537)       | 3.90625 (11.19723)         | 0.052593  |
| Opioid req (mg) recovery 2 hr | 9.375 (17.67767)         | 7.03125 (15.85516)         | 0.57863   |
| Opioid req (mg) recovery 4 hr | 11.71875 (19.03348)      | 9.375 (17.67767)           | 0.611586  |
| Opioid req (mg) recovery 6 hr | 10.9375 (17.89023)       | 3.125 (8.400269)           | 0.028956  |
Discussion
Satisfactory postoperative pain management is a critical part in surgical patient care. Compelling postoperative pain not only further develops the patient's degree of comfort and fulfillment yet additionally is related with earlier mobilization, less cardiopulmonary complications, decreased danger of thromboembolism, earlier return of bowel function, faster recovery, and reduced hospital costs. Traditionally, opioid analgesics that follows up in treating postoperative pain. While narcotic drugs, including morphine, hydromorphone, fentanyl, and meperidine, are exceptionally successful analgesics, they are likewise connected with various adverse effects that incorporate drowsiness, respiratory depression, cardiac instability including hypotension and bradycardia, and nausea, vomiting, pruritus, and constipation
A modification of PVB block is ESP block which was introduced by Forero et al. He used this simple interfascial plane block in cases of severe neuropathic pain post trauma/malignancy/thoracotomy. The local anaesthetic deposited between the two muscles (rhomboidus major and erector spinae) is speculated to penetrate anteriorly through costotransverse foramina and enter the thoracic paravertebral space. The ventral and dorsal rami and rami communicants get subsequently blocked.
In 2019 Altiparmik et al. published a study where they compared PECS block with ESP in 40 patients undergoing MRM surgery. They concluded PECs block is better than ESP block with lower tramadol intake and lower pain scores in the postoperative period. They analysed median pain scores were significantly lower in PECS group at the postoperative 60th min, 120th min, 12th hour and 24th hour. They speculated that the better analgesic profile was due to the blockade of medial, lateral pectoral and long thoracic and thoracodorsal nerves. These results were similar to our studies.
As per the study by Orcun Sercan et.al, Postoperative VAS scores were significantly lower which is same as that of our study in both groups. No block-related complications were observed in their study which reflected our study as well.
In a study by Gürkan et al., 32% of patients in an ESP group and 40% of patients in a control group had nausea in the postoperative period. The incidences of nausea in the present study were very similar to those reported by Gürkan et al.
Postoperative opioid consumption is believed to be the most important reason for PONV, with a reported incidence as high as 79% following opioid use. In the present study, the ESP and PEC II block performed with a higher concentration of bupivacaine significantly reduced postoperative tramadol consumption and rescue analgesic consumption.
Bakshi et al. have reported difficulty during surgery due to fluid filled spaces after PECS block. We did not encounter this problem in any of our patients. This could be explained due to the time gap between the block and the surgery (>30 minutes) which could have led to the absorption of local anaesthetic.
Singh et al., in their study, reported less pain scores and less morphine usage in patients receiving ESP preoperatively in MRM surgeries. Results of Sinha et al showed, total morphine consumption in 24 hours was less in PEC II (4.40 ± 0.94 mg), compared to ESP group (6.59 ± 1.35 mg; P = 0.000). The mean duration of analgesia in patients of PEC II was 7.26 ± 0.69 hours while that in the ESP was 5.87 ± 1.47 hours (P value = 0.001). 26 patients in group II (PECS) had blockade of T2 as compared to only 10 patients in group I. (P value = 0.00). There was no incidence of adverse effects in either group.
Du H et al. observed the hemodynamic parameters, that is, MAP, HR, and SpO2 preoperatively, at intraoperative 30 minutes and postoperatively and observed modest elevation of MAP and HR same as our study.
Conclusion
Ultrasound guided Modified Pecs block or PEC-II Block is a safe and effective analgesic procedure during breast cancer surgeries especially modified radical mastectomy with or without reconstruction. It shows lower intra and postoperative opioid consumption than Erector spinae block procedure, and has better alleviation of post-operative pain which is evident in the form of better Visual Analog scales.

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