Ultrasound Guided Pectoral Nerve Block-2 Versus Modified Serratus Anterior Plane Block For Postoperative Analgesia In Breast Surgeries

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BACKGROUND AND AIM :- Pectoral nerve block-2 (PECS-2) and modified serratus anterior plane (MSAP) block are newer interfascial modalities for postoperative pain relief in breast surgeries. Limited evidence comparing their analgesic efficacy is available. Hence, the present study was designed to compare postoperative analgesic efficacy of PECS-2 and MSAP block in breast surgeries.

METHODS :- Sixty patients of ASA grade I & II were randomly allocated into two groups. Group P(n=30) was given ultrasound guided PECS-2 block and Group S(n=30) was given ultrasound guided MSAP block using 0.25% levobupivacaine with 1 mg butorphanol. Two groups were compared for mean block time, VAS scores, duration of analgesia, number of rescue analgesic doses. Patients were followed up for 24 hours postoperatively for haemodynamic parameters, sedation score, surgeon satisfaction score and patient satisfaction score.

RESULTS :- Mean block time, time to see needle in the desired plane was 7.20±0.94 minutes in group P and 6.14±0.71 minutes in group S, time to observe the spread of local anaesthetic in the desired plane was 13.56±1.45 seconds in group P and 6.33±0.88 seconds in group S (P=0.001). Duration of analgesia was more in group P (14.12±4.12 hours) than group S (12.44±3.28 hours) (p>0.05), but difference was statistically nonsignificant. Number of rescue analgesic doses, haemodynamic parameters and sedation score were comparable in both the groups.

CONCLUSION :- PECS-2 block and MSAP block provide effective and comparable postoperative pain relief with limited need for postoperative analgesics and short hospital stay in patients undergoing breast surgeries.
INTRODUCTION:
Modified radical mastectomy is associated with moderate to severe postoperative pain which could be due to the direct noxious injury to the tissues. Failure to provide adequate analgesia can lead to increased opioid requirement, delayed recovery and sometimes chronic postsurgical pain which negatively affects the quality of life.[1] Hence, the concept of preemptive analgesia came into existence. Ultrasound guided Pectoral Nerve Block is a novel superficial nerve block described by Blanco, which provides effective analgesia during and after ambulatory breast surgeries.[2] In PECS-1 block, local anaesthetic is deposited between Pectoralis major and pectoralis minor muscles to target medial pectoral nerve and lateral pectoral nerve.[2, 3] To expand the utility of this interfascial nerve blocks, Blanco et al proposed a modification of PECS-1 block with PECS-2 block, with the aim of blocking the axilla and at least two lateral cutaneous branches of intercostal nerves mainly T2-T4, by injecting local anaesthetic in two planes, one deep injection between pectoralis minor muscle and serratus anterior muscle and second injection is given between the pectoralis major muscle and pectoralis minor muscle. To provide complete analgesia to the lateral part of thoracic wall, serratus anterior plane (SAP) block technique was developed by Blanco where local anaesthetic solution was injected either in superficial plane or deep plane blocking the lateral cutaneous branches of ventral rami of thoracic intercostal nerves, providing analgesia from T2 to T9 dermatomes of hemithorax,[4] but the thoracodorsal nerve supplying latissimus dorsi is spared. In 2017, Rakh et al in described a modified SAP Block technique where thoracodorsal nerve supplying latissimus dorsi was also blocked.[5] MSAP block was more convenient and easy to perform as the entire breast tissue remained far away from ultrasound transducer thus providing better visibility of relevant anatomy and easy advancement of needle in the plane. Scanty literature is available, comparing the analgesic efficacy of PECS-2 block and MSAP block. The present study was designed to compare the ultrasound guided pectoral nerve-2 block versus modified serratus anterior block for providing postoperative analgesia in breast surgeries. The primary aim was to compare mean block time, duration of analgesia, number of rescue analgesic doses and VAS scores. Secondary aim was to compare hemodynamic parameters, sedation score, surgeon satisfaction score and patient satisfaction score.

MATERIALS AND METHODS
After obtaining approval from the Institutional Ethics Committee, this prospective randomized study was conducted in 60 adult female patients belonging to American Society of Anaesthesiology (ASA) grade I & II, aged 18-60 years scheduled for breast surgeries under general anaesthesia. A written informed consent was taken from patients before enrolling in this study. Patients were randomly allocated into two groups of 30 each using computer generated random numbers. Group P received ultrasound guided pectoral nerve block-2 and Group S received ultrasound guided modified serratus anterior plane block. The patients having allergy to LA, bilateral reconstructive breast surgeries, liver dysfunction, coagulopathy, renal dysfunction, psychiatric disorder, pregnant or lactating mothers and morbidly obese (BMI >40 kg/m²) were excluded from the study. The same anaesthesiologist monitored and followed up the patients after performing the block, so double blinding was not possible. All patients were examined a day before surgery and a detailed pre-anaesthetic checkup was done. Patients were trained to interpret and use visual analogue scale. Patients were kept nil orally at least six hours prior to the surgery and tablet alprazolam 0.25 mg orally was given a night before surgery. On arrival in the operating room, an intravenous line was secured with 20G intravenous cannula & infusion with ringer lactate (RL) was started. Multiparameter monitors were
attached and baseline heart rate (HR), blood pressure (BP), respiratory rate (RR), pulse oximetry (SpO2) & electrocardiography (ECG) were recorded and continuous monitoring was done both during intraoperative and postoperative period. Injection midazolam 1 mg, injection butorphanol 1 mg and injection glycopyrrolate 0.2 mg were given intravenously before induction of general anaesthesia. Patients were pre-oxygenated with 100% O2 and injection propofol 2 mg/kg intravenously was given. Trachea was intubated with appropriate size of endotracheal tube after giving Injection succinylcholine 1.5 mg/kg intravenously. GA was maintained with 50% O2 and 50% Nitrous Oxide, isoflurane and injection vecuronium. After giving general anaesthesia, either PECS-2 or MSAP block was performed. In group P, PECS-2 Block was performed using 30 ml of 0.25% levobupivacaine + 1 mg Butorphanol. 10 ml of study drug was deposited between pectoralis major and pectoralis minor muscle after negative aspiration and confirmed with hydrodissection. 20 ml of study drug was deposited in the plane between pectoralis minor and serratus anterior muscle. In group S, Modified SAP Block was performed using 30 ml of 0.25% levobupivacaine + 1 mg butorphanol. A 22 G, stimuplex A needle was inserted in plane from posteromedia to anterolateral direction, toward posterior axillary line till it reached the plane between lattissimus dorsi and serratus anterior muscle. After confirming the placement of needle tip with hydrodissection and negative aspiration, 30 ml of study drug solution was injected in this plane. While performing the block in either PECS-II or MSAP, mean block time was noted by recording the time to see the needle in the desired plane and time taken to observe spread of LA in the plane from the start of block. After performing the block, surgery was allowed to start after 15 minutes in each group. Paracetamol infusion 15 mg/kg intravenously was given intraoperatively for analgesia. At completion of surgery, residual neuromuscular blockade was reversed by appropriate dose of injection myopyrrolate (glycopyrrolate + neostigmine) and patients were extubated and shifted to postoperative ward. Postoperative Analgesia was assessed by using VAS score with 0 as no pain and 10 being the worst pain. VAS was assessed postoperatively at 1 hour interval for first 4 hours and then 2 hourly till 16 hours and then 4 hourly till 24 hours. Duration of analgesia was taken from the time of administering the block till VAS score was >3 and patient demanded rescue analgesia in the form of injection diclofenac sodium 75 mg intramuscularly and if needed, injection tramadol 50 mg intravenously. Number of doses of rescue analgesia were noted. Any side effect and complications were noted. Sedation score was measured at 1 hour interval till 4 hours, 2 hour interval till 16 hours and 4 hour interval till 24 hours using Ramsay sedation score. Surgeon satisfaction score and patient satisfaction score were generated at the end of surgery.

**STATISTICAL ANALYSIS**
Duration of analgesia was taken as the outcome measure of interest for the purpose of sample size calculation. Sample size was calculated taking the duration of analgesia. Sample size was calculated keeping in view at most 5% risk with minimum 80% power and 5% significance level. Data was recorded in a Microsoft excel spread sheet and analysed using statistical package for the social sciences (SPSS version 24.00 Armonk, NY:IBM Corp.). Continuous data was presented as mean with standard deviation. Categorial data was expressed as percentages. Numerical variables were normally distributed and were compared using Chi Square test for non-parametric data and Student’s ‘t’ test for parametric data. The results were then analysed and compared to previous studies.
Fig. 1: Consort diagram

**Observations and Results:**
In the present study, 60 female patients were enrolled in two groups of 30 each. Both groups were comparable with respect to demographic profile and duration of surgery as shown in table 1.

**Table 1: Demographic profile of patients in group P and group S**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Group P(n=30)</th>
<th>Group S(n=30)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mean Age (in years)</td>
<td>47.60±7.74</td>
<td>46.53±8.40</td>
<td>0.611  (NS)</td>
</tr>
<tr>
<td>2.</td>
<td>ASA grade</td>
<td>I 16 (53.33%)</td>
<td>I 12 (40%)</td>
<td>0.300 (NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II 14 (46.67%)</td>
<td>II 18 (60%)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Mean BMI kg/m2</td>
<td>24.12±2.34</td>
<td>25.17±2.47</td>
<td>0.096  (NS)</td>
</tr>
<tr>
<td>4.</td>
<td>Mean Duration of surgery (in min)</td>
<td>89.83±2.41</td>
<td>90.60±2.23</td>
<td>0.20   (NS)</td>
</tr>
</tbody>
</table>
### Table 2: Block characteristics in group P and group S

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Group P (n=30)</th>
<th>Group S (n=30)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Time to see needle in the desired plane (in minutes)</td>
<td>7.20±0.94</td>
<td>6.14±0.71</td>
<td>0.001</td>
</tr>
<tr>
<td>2.</td>
<td>Time to observe the spread of the LA in the desired plane (in seconds)</td>
<td>13.56±1.45</td>
<td>6.33±0.88</td>
<td>0.001</td>
</tr>
<tr>
<td>3.</td>
<td>Mean duration of analgesia (in hours)</td>
<td>14.12±4.12</td>
<td>12.44±3.28</td>
<td>0.085</td>
</tr>
<tr>
<td>4.</td>
<td>Total number of doses of rescue analgesia</td>
<td>1.03±0.18</td>
<td>1.13±0.34</td>
<td>0.159</td>
</tr>
</tbody>
</table>

The mean block time was significantly lesser in group S as compared to group P. Time to see the needle in the desired plane and time to observe the spread of local anaesthetic in the desired plane was significantly lesser in group S as compared to group P. (Table 2). VAS scores remained less than 3 in both the groups till 10 hours and the difference in the VAS scores was statistically nonsignificant (p>0.05). In group S, VAS started increasing at 11th hour and was more than 3 at 12 hours (3.07±0.50) as compared to (2.54±0.63) in group P. The difference in the mean VAS at 12th hour was highly significant between the two groups (p=0.00). In group P, VAS started increasing at 13th hour and was more than 3 at 14th hour (3.25±0.47) and was significantly more than group S (2.82±0.58) at this time (p=0.00). Later on, VAS remained comparable in the two groups at all measured intervals till 24 hours. (Fig. 2)

#### Fig. 2: Mean VAS score in two groups at different time intervals in postoperative period.

Mean duration of analgesia was more in group P (14.12±4.12 hours) as compared to group S (12.44±3.28 hours), but the difference was statistically nonsignificant (p=0.085). Number of doses of rescue analgesia were comparable in both the groups. (Table 2)
Fig. 3: Mean sedation score in two groups at different time intervals in postoperative period.

Mean sedation score reached a maximum of score 2 in both the groups and remained comparable at all measured intervals with the difference being statistically nonsignificant (p>0.05). (Fig. 3) Haemodynamic parameters remained stable and comparable throughout the study period in both the groups. No side effects and complications were noted. Surgeon satisfaction score and patient satisfaction score were comparable in both the groups.

DISCUSSION
Ultrasound guided nerve blocks are being commonly used for effective postoperative analgesia in patients undergoing breast surgeries. These interfascial blocks are easy to perform, safe and reliable with lesser complications. In PECS-2 block, medial pectoral nerve, lateral pectoral nerve and intercostal nerves supplying T2-T4 dermatomes are blocked whereas, there is sparing of thoracodorsal nerve supplying latissimus dorsi muscle. In MSAP block thoracodorsal nerve is also blocked thus providing excellent postoperative analgesia for breast surgeries. This approach is easy to perform as the entire soft tissue of breast is far away from the field, thus providing better visibility of anatomy and easy advancement of needle. Based on the hypothesis that MSAP block is easy and reliable to perform with effective postoperative analgesia, the present study was designed to compare the analgesic efficacy of ultrasound guided pectoral nerve block-2 and ultrasound guided modified serratus anterior plane block. In the present study, mean time taken to perform the block was significantly less in MSAP block (6.14±0.71 minutes) as compared to PECS-2 block (7.20±0.94 minutes). However, the duration of postoperative analgesia was prolonged in PECS-2 block (14.12±4.12 hours) as compared to MSAP block (12.44±3.28 hours) but the difference in the duration of analgesia was not statistically significant. Number of doses of rescue analgesia demanded by patients in both the groups during postoperative period was also comparable (1.03±0.18 in group P vs 1.13±0.34 in group S). Haemodynamic parameters remained stable and comparable in both intraoperative and postoperative period. As injection butorphanol was used as an adjuvant to 0.25% levobupivacaine, the sedation was also noted in both the groups. Sedation score was also comparable between two groups at all measured intervals. In the postoperative period, patients as well as surgeons were satisfied with both the block techniques. Serratus anterior plane block is more superficial and easier to identify the plane by placing the ultrasound probe on the 5th rib in midaxillary line. Here, single needle insertion is done as compared to PECS-2 block where double needle insertion is required. Hence, mean time required to perform the SAP block is less than PECS-2 block. This fact is supported by the study done by Khemka R and Chakraborty A,[5] where they observed that time to perform the block was 6.09±1.14 min. In the present study, mean block time was 6.14±0.71 minutes in MSAP block group, which is comparable to the above study. Time taken to perform the block in PECS-2 block in the present study was 7.20±0.94 minutes, which is comparable to the mean block time (7.34±1.1min) in the study conducted by
Hamed IG et al. [6] Jain et al. [7] also observed that mean block time was significantly less in SAPB group (8.53±3.82 min) as compared to PECS group (13.63±3.8 min). In the present study, the duration of analgesia in PECS-2 group was 14.12±4.12 hours, which is almost comparable to the study done by Hamed IG et al. [6] using 20 ml of 0.25% bupivacaine and observed that the duration of analgesia was 14±4.54 hours in PECS group. Similar results were reported by Sercan O et al. [8] Wahba SS and Kamal SS [9] used 15-20 ml of 0.25% bupivacaine in pectoral nerve block group and observed that duration of analgesia was 175(155.0-220.0) min which is less as compared to the present study. This difference may be due to the lesser volume of the local anaesthetic used without an adjuvant. The duration of analgesia in MSAP group was 12.44±3.28 hours in the present study. Aslan G et al. [10] and Rahimzadeh P et al. [11] compared analgesic efficacy of SAP block with control group. Duration of analgesia was 5.50±0.71 hours in the study done by Aslan G et al. [10] and 323.5±49.7 min in the study done by Rahimzadeh P et al. [11] Duration of analgesia in the above two studies is less which may be attributed to the fact that injection butorphanol was used as an adjuvant to local anaesthetic in the present study. Similar results were reported by different studies comparing PECS-2 block and SAP block performed for postoperative analgesia in breast surgeries. In the present study, number of doses of rescue analgesia demanded by patients in the postoperative period was comparable in group P (1.03±0.18) and group S (1.13±0.34). Sercan et al. [8] observed that dose of rescue analgesia administered was less in PECS group as compared to control group. Number of doses of rescue analgesia required was less in PECS group as compared to PVB group in a study done by Hamed IG et al. [6] Magoon R et al. [12] compared SAPB and PECS block and observed that doses of rescue analgesia in both groups were comparable. No side effects and complications were observed and surgeon satisfaction score and patient satisfaction score was comparable in both the groups.

LIMITATIONS:

In the present study, double blinding was not possible as the anaesthesiologist performing the block was also monitoring the block parameters. It was difficult to assess any block failure as the block was performed after giving general anaesthesia. Pain referring to dermatome levels could not be properly evaluated owing to the surgical site wound dressing in the postoperative period. Patients were not followed up for a longer period to detect any chronic postmastectomy pain. Another limitation of the study was that the catheter was not inserted at the block site to prolong postoperative analgesia.

CONCLUSION:

Both PECS-2 block and MSAP block are effective and safe techniques for postoperative analgesia in patients undergoing breast surgeries. However, duration of analgesia was slightly more in PECS-2 block than MSAP block. But MSAP block was easier to perform as compared to PECS-2 block.

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