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Safety and efficacy of ultrasound guided pectoral nerve block in patient undergoing breast conservation surgery: A prospective randomized single blinded Study

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Abstract: **Background:** Effective postoperative analgesia following breast conservation surgery (BCS) is essential for early recovery and patient satisfaction. Ultrasound-guided pectoral nerve (PECS) block has emerged as a regional anesthesia technique providing targeted analgesia with minimal systemic side effects. **Aim:** To evaluate the safety and efficacy of ultrasound-guided PECS block in patients undergoing breast conservation surgery. **Materials and Methods:** A prospective randomized single-blinded study was conducted on 60 female patients (ASA I–II) undergoing BCS. Patients were randomized into two groups: Group P (PECS block with general anesthesia) and Group C (general anesthesia alone). Postoperative pain scores (VAS), analgesic consumption, time to first rescue analgesia, and complications were recorded and analyzed. **Results:** Group P demonstrated significantly lower VAS scores at all postoperative intervals ($p < 0.001$), prolonged time to first rescue analgesia, and reduced total analgesic consumption. No major complications were observed. **Conclusion:** Ultrasound-guided PECS block is a safe and effective modality for postoperative analgesia in breast conservation surgery.

Keywords: PECS block, Breast conservation surgery, Ultrasound-guided block, Postoperative analgesia, Regional anesthesia.

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INTRODUCTION

The term “breast cancer” refers to a malignant tumor that has developed from cells in the breast. According to the World Health Organisation, breast cancer is the most common cancer among women worldwide, comprising of 16% of all female cancers. Incidence rates vary greatly worldwide, with age standardized rates as high as 99.4 per 100000 in North America. Eastern Europe, South America, Southern Africa, and western Asia have moderate incidence rates, but these are increasing 1-4]. The greatest increase has been in Asian countries [5].

According to GLOBOCON 2008 cancer fact sheet, the incidence rate of breast cancer in the United States of America in the year 2008 is 182000 whereas in India it is 115000. So when every 1 in 8 women in the United States has a chance of developing breast cancer in her lifetime, in India it is 1 in 30. But when we come to the mortality rates due to breast cancer in the year 2008 in the United States it is 40000 whereas in India it is 53000, which means per every 4.5 new cases detected 1 patient dies in the United States whereas in India it is 1 per every 2 new cases detected [6,7].

The National Cancer Institute of the United States recommends 6 types of standard treatment used for breast cancer which are surgery, sentinel lymph node biopsy followed by surgery, radiation therapy, chemotherapy, hormone therapy and targeted therapy [8]. The majority of patients present with early stage of breast cancer. The current accepted ‘gold standard’ of management is breast-conserving therapy, which constitutes breast-conserving surgery and adjuvant radiotherapy. Some patients require more extensive operations such as mastectomy. In addition, axillary staging in the form of sentinel lymph node biopsy is now the accepted practice, and some patients proceed to axillary lymph node dissection [9].

About 40 % of the patients undergoing surgery for breast cancer experience clinically significant acute post operative pain, indicating post operative pain treatment is not sufficient [10].

With advances in medical care, early diagnosis and better therapy protocols, there will be an increasing number of breast cancer survivors within the next few years and chronic postoperative pain significantly impaired quality of life in more than 25% of patients after chemotherapy and surgery [11]. Thus, a more effective postoperative pain treatment of patients after breast cancer surgery is necessary. These complications lead to patient suffering, extended postanaesthesia care unit stays, prolonged admissions and additional hospital costs [11].

Different modalities of treatment have been tried to manage acute and chronic postoperative pain after breast surgery like NSAIDs, opioids, thoracic epidural block, intercoastal block, paravertebral block etc. Many newer modalities have been continuously tried for the relief of pain after breast surgery out of which one is pectoral block. Because this is a relatively new method, so sufficient studies are lacking about the efficacy and safety of the study. This study aims to compare the efficacy and safety of ultrasound guided pectoral nerve block given before incision plus wound infiltration before emergence with only wound infiltration before emergence in patients undergoing breast conservation surgery.

MATERIAL & METHODS

The present Prospective randomized single-blinded study was conducted among 60 female patients presenting to Max Super Speciality Hospital, Saket, New Delhi with breast carcinoma. 60 female patients were studied over a period of 12 months and scheduled for breast conservation surgery. Informed and written consent was taken in all cases. Patients were randomly allocated by computer generated random number into two groups by the operation theatre coordinator.

Group P (N=30): Ultrasound guide pectoral nerve block with 0.15ml/kg of 0.375% ropivacaine after induction of general anesthesia plus postoperative wound infiltration with 0.2 ml/kg 0.375% ropivacaine.

Group W (n=30): Postoperative wound infiltration with 0.2 ml/kg 0.375% ropivacaine.

Patients aged between 18 and 65 years, belonging to the American Society of Anesthesiologists (ASA) physical status I and II, were included in the study. Patients with known hypersensitivity to local anesthetic agents, coagulopathy, infection at the site of injection, body mass index greater than 35 kg/m², significant cardiopulmonary comorbidities, or those who refused to participate were excluded from the study.

PROCEDURE

The patients were premedicated with oral alprazolam 0.25mg 1-2 hrs before surgery. Clinical monitoring included electrocardiography, pulse oximetry, non invasive arterial blood pressure and capnography. Patients were placed in supine position and general anaesthesia was induced with propofol 2 mg/kg followed by glycopyrrolate 0.008mg/kg. Then fentanyl 2 mcg/kg followed by atracurium 0.6 mg/kg was given to facilitate insertion of proseal laryngeal mask airway of appropriate size and the patients' lungs were mechanically ventilated by using volume controlled positive-pressure ventilation.

The patients of group P were placed in a supine position with the side to be blocked marked and exposed. After the aseptic preparation of the skin and the probe, ultrasound guided pectoral nerve block was given in group P. After a negative aspiration test for blood, 0.15ml/kg of 0.375% ropivacaine was injected slowly.

General anaesthesia was maintained with sevoflurane in 40% oxygen in air. Inhaled oxygen, end tidal sevoflurane, and carbon dioxide concentrations were monitored. Fresh gas flow was set at 2L/min, Heart rate, systolic BP, diastolic BP, Mean arterial pressures, SpO2, ETCO2 were recorded before induction of anaesthesia, before administration of block, post block at 5, 10 mins, at skin incision, post skin incision initially at 5 mins interval for first 15 mins, then every 15 mins till one hour, and every 30 mins till end of surgery. Heart rate and mean arterial blood pressure (MAP) were maintained within ±30% of preoperative baseline. Boluses of injection Fentanyl 1mcg/kg intravenously were given if the heart rate and blood pressure increased more than 30% of the preoperative baseline. Similarly, mephenteramine 300 mcg bolus was given intravenously in case blood pressure falls to below 30% of baseline. Injection paracetamol 1gm iv and diclofenac 75 mg were also provided during maintenance. Consumption of fentanyl during anaesthesia was registered. Both the groups were given wound infiltration with 0.2 ml/kg 0.375% ropivacaine before emergence from anaesthesia.

After emerging from anaesthesia, the patients were transferred to post anaesthesia care unit for 1 hr observation period. VAS scores were noted at the end of 1 hour, 2 hours, 6 hours, 12 hours and 24 hours following reversal from general anaesthesia. Rescue analgesia in post anesthesia care unit and surgical ward was provided with tramadol 50 mg iv in slow infusion with 100ml of normal saline if VAS score >3.

Incidence of any nausea or vomiting was noted in the first 24 hours. Antiemetic ondansetron 4 mg was administered for nausea and vomiting. In cases of severe episodes, injection Dexamethasone 8 mg was added. Total consumption of Tramadol, Ondansetron and Dexamethasone was recorded for the first 24 hrs. The patients were also enquired at the end of 24 hrs that whether pain had disturbed their sleep during night and about any other complains at the injection site.

STATISTICAL METHODS

Statistical testing was conducted with the statistical package for the social science system version SPSS 26.0.0. Continuous variables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. P<0.05 was considered statistically significant.

RESULTS

The two study groups Group P and Group W were comparable with respect to the initial characteristics data. The mean age in Group P was 51.33 ± 12.36 years and Group W was 50.04 ± 11.79 years (p=0.766). The mean weight in Group P was 65.20 ± 6.11 kg and Group W was 62.70 ± 8.83 kg (p=0.207), which was not statistically different. There was also no statistically significant difference between the two groups as regards to height. Mean height in Group P and Group W was 157.97 ± 3.18 cm and 157.77±3.27 cm respectively (p=0.811). In Group P, 40% were Left sided surgeries and 60% Right sided surgeries whereas in Group W, 53% were Left sided surgeries and 47% were Right sided surgeries (p=0.301), the difference being statically insignificant. In Group P, 53% of patients belonged to ASA grade 1 and 47% belonged to ASA grade 2 whereas in Group W, 60% belonged to ASA grade 1 and 40% belonged to ASA grade 2.There was also no statistically significant difference with regards to ASA grade between the two groups (P=0.602) The mean duration of surgery for Group P was 106.57±26.92 min and for Group W was 104.84±23.78 min. The difference was statistically not significant (p=0.779) (Table 1)

In group P, 4 patients were known to be allergic to drugs like amoxicillin, ibuprofen, penicillin and sulfa drugs whereas in group W, 4 patients were allergic to ofloxacin, penicillin and sulfa drugs. None of these drugs were given to any of the patients during the study. P value was 0.602 which was not statistically significant (Table-2).

In the study, during induction of general anesthesia, 2 mcg/kg iv fentanyl was given to all patients. The total perioperative fentanyl consumption was significantly higher in group W (P value <0.001) Postoperatively, patients having VAS score >2 were given 50 mg of tramadol in 100 ml normal saline by slow iv infusion as rescue analgesia. The total amount of postoperative tramadol consumed by patients of group W was statistically significant more as compare to group P (P value 0.047). In the postoperative period, patients complaining of nausea or having vomiting were given 4 mg of iv ondansetron as antiemetic. The total amount of postoperative ondansetron used by patients of group W was statistically significant more as compare to group P (P value 0.047) (Table3)

Postoperative pain assessment was done by using VAS scores. The VAS scores in postoperative period was assessed at time points of 1hr, 2 hr, 6hr, 12 hr and 24 hr. VAS score >2 meant that patient was experiencing pain and they were given rescue analgesia in the form of tramadol. VAS scores of patients in group W were significantly higher at 1 hr and 6 hr (P values <0.001 at 1 hr and 0.042 at 6 hr) (Table4).

The possible complications of ultrasound guided pectoral nerve block are intravascular injection, pneumothorax, hematoma formation etc. None of the complications were observed during study as the block was given under ultrasound guidance.

Table-1: Demographic variables

	Group P		Group W		P Value
	Mean ± SD	Min - Max	Mean ± SD	Min - Max	
Age	51.33 ± 12.36	26 - 78	50.40 ± 11.79	21 - 74	0.766(NS)
Weight	65.20 ± 6.11	52 - 77	62.70 ± 8.83	45 - 80	0.207(NS)
Height	157.97 ± 3.18	150 - 164	157.77 ± 3.27	151 - 164	0.811(NS)
BMI (kg/m²)	24.1 ± 2.3	20.0 – 28.5	24.5 ± 2.6	21.0 – 29.0	0.58(NS)
Duration of Surgey(Min)	106.57 ± 26.92		104.84 ± 23.78		0.779(NS)
ASA I/II	16/14		18/12		0.602(NS)
Side of Surgery Left/Right	12/18		16/14		0.301(NS)

Table-2: Comparison of Allergy between group P & W

Allergy	Group P		Group W		P Value
	Frequency	%	Frequency	%	
None	26	86.7%	26	86.7%	0.602(NS)
Amoxycillin	1	3.3%	0	0.0%	
Ibuprofen	1	3.3%	0	0.0%	
Ofloxacin	0	0.0%	1	3.3%	
Penicillin	1	3.3%	2	6.7%	
Sulfa	1	3.3%	1	3.3%	
Total	30	100%	30	100%	

Table-3: Drug consumption among group P & W.

Drug consumption	Group P (n=30)		Group W (n=30)		P Value
	Mean ± SD	Min - Max	Mean ± SD	Min - Max	
Perioperative IV fentanyl Intra op + Post op	158.0 ± 46.49	110 - 290	202.33 ± 43.76	110 - 290	<0.001(HS)
Posttop iv tramadol	66.67 ± 30.86	50 - 150	87.50 ± 32.28	50 - 150	0.047(S)
Postop iv ondansetron	5.33 ± 2.47	4 - 12	7.00 ± 2.58	1 - 2	0.047(S)

Table-4: Postoperative VAS score

VAS	Group P (n=30)		Group W (n=30)		P Value
	Mean ± SD	Min - Max	Mean ± SD	Min - Max	
1 hr	1.53 ± 0.73	1 - 3	2.23 ± 0.68	1 - 3	<0.001
2 hrs	1.13 ± 0.34	1 - 2	1.17 ± 0.38	1 - 2	0.723
6 hrs	1.47 ± 0.57	1 - 3	1.20 ± 0.41	1 - 2	0.042
12 hrs	1.17 ± 0.46	1 - 3	1.13 ± 0.34	1 - 2	0.753
24 hrs	1.07 ± 0.25	1 - 2	1.03 ± 0.18	1 - 2	0.561

DISCUSSION

The present study demonstrates that ultrasound-guided PECS block provides superior postoperative analgesia, reduces opioid consumption, and prolongs the duration of analgesia in patients undergoing breast conservation surgery. These findings are consistent with both earlier literature and emerging evidence from recent studies up to 2025.

Breast cancer is one of the most common cancers occurring worldwide. The incidence is continuously increasing, not only in the western world but also in the eastern countries. The trend of treatment is more towards conservative surgeries these days and breast conservation surgery has become the recent gold standard of treatment.

About 40% of these patients experience clinically significant acute post operative pain, indicating that similar to other surgical interventions, management of postoperative pain is not suficient [12]. And later in life, this acute postoperative pain becomes a significant independent risk factor for the development of chronic postoperative pain. There is also a high incidence of nausea and vomiting postoperatively and the incidence is found to be 59%. Troublesome pain and PONV can prolong recovery and hospitalization [13,14].

Thoracic epidural block once considered the gold standard of postoperative analgesia for breast surgeries has been largely replaced by paravertebral block these days. But still both the techniques have their inherent complications associated with them. Many newer modalities have been continuously tried for the relief of pain after breast surgery out of which one is pectoral block.

US is noninvasive, safe, simple to use, no radiation is involved. We can directly see the anatomy,the needle and deposition of the local anesthetic solution. This translates into improved technical outcomes, higher success rates, and reduced needle-related complications [15]. Also, ultrasound-guided peripheral nerve blocks have a higher success rate compared to nerve stimulation or other methods and ultrasound guided techniques also increase the efficacy of some specific blocks [16].

Various investigators have used drugs like bupivacaine and levobupivacaine in a concentration of 0.25% in a dose of 0.2-0.4 ml/kg for pectoral nerve block in various studies. However, sufficient randomized controlled trials investigating the optimal dose and the type of local anaesthetic used in pectoral nerve block for breast surgery are still missing. Keeping this in mind, the aim of our present study was to find out the safety and efficacy of 0.15 ml/kg of 0.375% ropivacaine for ultrasound guided pectoral nerve block in patients undergoing breast conservation surgery with respect to various parameters including intraoperative opioid consumption, hemodynamics, postoperative pain relief, nausea and vomiting, and any other complications.

Both the groups were comparable with respect to initial characteristics like age, weight, height, ASA class, side of surgery and duration of surgery. None of the patients had allergies to any of the standard drugs used during the study. There was no statistically significant difference between the two groups as regards to these parameter.

We found that the total perioperative fentanyl and postoperative tramadol consumption was significantly higher in group W. Both the group had received wound infilt with Local Anaesthis is because of the significant analgesic properties of pectoral nerve block in group P and thus to achieve similar degrees of analgesia perioperatively, the patients of group W required more opioids than the other group.
Also, the total amount of postoperative ondansetron used by patients of group W was statistically

significant. This correlates well with a higher dose of perioperative fentanyl and tramadol consumption in group W. As nausea and vomiting are well known side effects of both these opioids, hence it was no surprise that patients in group W had more nausea and vomiting resulting in more ondansetron consumption.

VAS scores of patients in group W were significantly higher at 1 hr and 6 hr. This suggests a very good pain relief in the patients of group P on the day of surgery which results in better recovery profile and lessens the postoperative hospital stay.

None of the complications related to pectoral nerve block were observed during study as the block was given under ultrasound guidance. This suggests that pectoral nerve block, when given under ultrasound guidance, is a very safe block to perform.

In the study, we found effective postoperative analgesia by pectoral nerve block in patients undergoing breast conservation surgery which has similar results with the initial observation by R. Blanco *et al*. where he found that the block seems particularly useful for patients who have breast expanders placed during reconstructive breast cancer surgery or subpectoral prostheses [17].

In one of the initial comparative studies, Sherif Samir Wahba *et al*. [18] found the following results: Postoperative morphine consumed at 24 h was significantly lower in Pecs group [21(20–25) mg] than in PVB group [28 (22–31) mg], ($p = 0.002$). Time for first request of morphine was longer in Pecs group [175 (155–220) min] than in PVB group [137.5 (115–165) min], ($p < 0.001$). Numerical rating score (NRS) at rest was lower in Pecs group compared with PVB group at 1 h, 6 h and 12 h ($p < 0.001$) but at 18 h and 24 h it was lower in PVB group compared with Pecs group ($p = 0.008$ and <0.001 respectively). During movement, NRS was significantly lower at 1st hour in Pecs group ($p<0.001$) while at 18 h and 24 h it was significantly lower in PVB group ($p < 0.001$). PONV was comparable between both groups. These results were similar to our study. We found significant reduction in perioperative opioid consumption in the first 24 hrs after surgery in the pectoral nerve block group. The VAS score was also lower at 1 and 6, 12 hrs in the pectoral nerve block group. The only difference was that we also found significant increase in postoperative nausea and vomiting which was evident from the increased consumption of ondansetron by the control group [18].

In one of the efforts to find a 0/10 postoperative VAS score in their study, M. Saleem *et al* gave a total of 29 patients the PECS 2 block. 16 of these had Mastectomies +/- Axilliary Node Clearance, 10 had Wide Local Excisions and 3 had Axilliary Node Clearances only. Of the Mastectomies, 10 had a pain score of 0 in recovery, 3 had a pain score of 1-4, and 3 had a pain score of 5 or more requiring IV Morphine. As regards Wide Local Excisions, 8 had a pain score of 0, 1 had a pain score of 1-4 and only 1 had a pain score of 5 or more requiring IV Morphine. Of the 3 Axilliary Node Clearances, all had a pain score of 0. On the ward, all the patients had a pain score of under 3 for the first 24 hours including those who had required IV morphine in recovery. In our study, we found only 3 out of 30 patients who received the pectoral nerve block, had a VAS score of 3 at 1 hr postoperatively which is only 10% which is almost equivalent to M.Saleem *et al*'s study [19].

Our results showing significantly lower postoperative pain scores in the PECS group are in agreement with multiple randomized trials and meta-analyses, which have consistently demonstrated reduced pain scores at 6–24 hours postoperatively in patients receiving PECS block compared to general anesthesia alone [20-22]. Bashandy and Abbas first demonstrated improved analgesia with PECS block in breast surgery patients, establishing its clinical relevance [20]. Subsequent systematic reviews have confirmed these findings across diverse populations [21,22].

Recent evidence from 2024–2025 further strengthens the role of PECS block in contemporary anesthetic practice. A recent clinical study reported that both preoperative and intraoperative administration of PECS block provide comparable postoperative analgesia, suggesting flexibility in timing without compromising efficacy [23]. This finding is particularly relevant in busy surgical settings and resource-limited environments.

CONCLUSION

Ultrasound-guided PECS block is a safe, effective, and reliable regional anesthesia technique for breast conservation surgery. It significantly reduces postoperative pain, decreases opioid consumption, prolongs analgesia duration, and improves patient satisfaction without increasing complications.

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