Original Article

A Comparative Study of Pectoral Nerve Block with Conventional Opoid Analgesia to Improve Analgesia After Breast Cancer Surgery

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Abstract:
Background: Breast cancer is a common cancer in women of a productive age group. Modified radical mastectomy (MRM) with axillary clearance of lymph nodes is traditionally performed under general anesthesia. For postoperative pain management different analgesic modalities used. The pectoral nerves (Pecs) block is a novel technique to block the pectoral, intercostobrachial, third to sixth intercostals, and the long thoracic nerves. This study compare Pectoral nerve block with conventional opoid analgesia to improve post operative analgesia after breast cancer surgery. **Material and methods**: This prospective, randomized, control trail study included 60 patients scheduled for breast cancer surgery under general anaesthesia belonging to ASA class I and ASA class II from 1st January 2019 to 30th June 2019 at CMH Dhaka. Patients were randomly divided into two groups with 30 patients in each group. In group P, patients received both general anesthesia and ultrasound guided pectoral nerve blocks. In group G, patients received only general anesthesia with opoid analgesia. Then hemodynamic stability, intensity of pain and analgesic requirement were evaluated. The summarize data was presented in the table and chart. **Result**: In this study the difference in respect to demography was not statistically significant (p>0.05) between two groups. Postoperative heart rate and other hemodynamic status were evaluated at 2h, 6h, 12h & 24h after surgery and found more attenuated in group-P. At 6 hr after, mean heart rate was 90.7±8.2 beat/min in group P and 98.5±7.7 beat/min in group G. 2 hr after surgery blood pressure was more stabilize in group-P than group-G; mean systolic blood pressure was 102.3±4.8 mmHg and 113.6±11.2 mmHg in group P and group G respectively. The difference was statistically significant. At 6 hr after, mean systolic blood pressure was 107.4±6.2 mmHg in group P and 109.5±6.8 mmHg in group G. At 12 hr after, mean systolic blood pressure was 108.2±5.1 mmHg and 109.6±5.6 mmHg in group P and group G respectively. At 6 hr and 12 hr after surgery difference was statistically non significant (p>0.05) between two groups. In this study mean verbal pain score was 5.1±0.43 and 8.2±0.72 in group P & group G respectively. The difference was statistically significant. Six hours after the surgery, both groups showed downward trends of the pain VAS, but significantly in group P. So overall finding suggested that, pectoral nerve blocks reduced the postoperative pain significantly. **Conclusion:** Present study shows that pectoral nerve blocks is an effective agent for alleviation of post operative pain and Opioids requirement
Keywords: Breast cancer, Opoid, Analgesia, Pectoral nerve block

Introduction:

Breast cancer is the most common malignancy in women and its incidence has steadily increased over the last decade. Despite the latest advances in breast cancer surgery, this procedure is frequently associated with postoperative pain, nausea and vomiting, which lead not only to increased patient's suffering, but also to a prolongation of hospital stays and related costs[1]. General anaesthesia is the conventional, most

frequently used anaesthetic technique. Various regional anaesthetic techniques interventions have also been used for breast surgeries; these include local wound infiltration, thoracic epidural anaesthesia, thoracic paravertebral block, thoracic spinal anaesthesia, and more recently, ultrasound-guided interfascial plane blocks such as pectoral nerve (PECS) blocks type 1 (Block between pectoralis major muscle and minor muscle) and 2 (Block in the pectoral muscle and the serratus plane block (SPB)[2].

Acute postoperative pain originates from the skin, subcutaneous tissue or pectoral muscles, and is an integral risk factor in the development of chronic post-mastectomy pain[3,4]. Regional anaesthesia techniques have provided better quality acute pain control which reduced chronic pain. Effective acute pain control preserves immune function by suppressing the surgical stress response and by decreasing the need for general anaesthetics and opioids. Opioids especially morphine inhibit cellular and humoral immune functions which may contribute to higher rates of postsurgical local recurrence and/or metastasis[5]. Postoperative nausea and vomiting (PONV) is a serious concern in female patients, and use of morphine or other opioid analgesia may contribute to this.

Pectoral nerve block (PNB) is a relatively simple and effective presurgical procedure that targets the two medial and lateral pectoralis nerves, branches of the brachial plexus and responsible motor innervation of pectoralis major and minor muscles (Pecs I)[6]. The pectoral nerve block (PNB) is mainly used in breast surgical procedures that require breast expanders or subpectoral prosthesis, which are usually associated with marked postsurgical pain due to the stretching of the pectoralis major. The employment of this technique together with other pain control measures helps reduce postsurgical muscle spasm and associated pain due to the nerve block of pectoralis major.Intraoperative and postoperative pain management and haemodynamic stability maintenance is pivotal part for anaesthetics care. Opoids causes several complications. Therefore pectoral nerve block is considered alternative technique for reduction of Opoids consumption. Therefore this study was conducted to compare pectoral nerve block with conventional opoid analgesia to improve analgesia after breast cancer surgery.

Material and methods:

This prospective randomized control trial study was conducted among 60 patients scheduled for breast cancer surgery under GA in Combined Military Hospital (CMH), Dhaka. Total 60 patients of ASA class I, II & scheduled for breast surgery were selected. The patients were divided into two groups (Group-P and Group-G), 30 (thirty) by random card sampling. In group P, patients received both general anesthesia and ultrasound guided combined pectoral nerve blocks. In group G, patients received only general anesthesia with opoid analgesia.

In both groups after arrival at the operation theater, base-line parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), SpO2, ECG were measured noninvasively. All the patient were premedicated with Inj Midazolam (3mg) and Inj omeprazole (40mg) parenterally before surgery. General anesthesia was induce with I/V Fentanyl (2 µgm /kg), Propofol (2mg/kg) and Vencuronium bromide (0.1mg/kg) and airway were secured using appropriate size of endotrachial tube. All patient received slow infusion of paracetamol 1gm and IV ondenserton 4mg at the end of the operation. During the surgery the need for additional analgesia was judged clinically using standard blood pressure, heart rate, sweating and temperature. An increase in blood pressure more than 20% from base line visible sweating and lacrimation indicated need for additional analgesia. Intravenous fentanyl 1mcg/kg was administered for additional analgesia.

In Group P, patient was positioned supine with the upper arm ipsilateral to the site of surgery kept abducted, externally rotated and bend right angled at elbow joint. Then the PECS (I and II) blocks was performed by investigator using a 90–100 mm block needle (UniPlexNanoLine, Sprotte,10 cm) and a high frequency linear ultra sound probe (6–13 MHz) (Sonosite M Turbo).

In Group G, patients was given general anesthesia only as described above and PECS block not be administered to these patients. At the end of surgery, neuromuscular blockade was reversed with injection neostigmine (0.05mg/kg) and Atropine (0.02mg/kg) patients were shifted to postanesthetic care unit (PACU). Once the patient is fully awake and able to communicate, VAS pain score were evaluated. Pain intensity

was measured using VAS scale at rest and during abduction of the ipsilateral upper limb at 30min, 1h, 2h, 3h, 4h, 5h, 6h, and 12h and at 24h after surgery. If VAS score is ≥4 then IV Fentanyl 25µg was given as bolus dose. Fentanyl consumption in the first 24h was noted for both groups. Post-operatively, pain was assessed using visual analogue scale (VAS). 0: No pain, 2–4: Mild pain, 5–7: Moderate pain, 8–10: Worst pain. Pain was assessed every 30 min post-operatively for the first 2h then hourly up to 6h. Duration of analgesia was the time from onset of sensory block at T10 till the patient complained of pain or first demand for rescue analgesic when VAS was ≥4. Rescue analgesic IV Fentanyl 25µg was given when patient requested for analgesic or VAS >4. Sedation score, VAS and haemodynamic parameters were observed at 30 min, 60 min, 2nd, 3rd, 4th, 5th, 6th, 12th and 24th hour post-operatively.

Results:

60 patients (30 in each group) were included in this prospective randomized control trial.

Table-I: Comparison of patients demography in both groups (n=60)

Variables	Number of patients		Total & Percentage	p value
	Group P n(%)	Group G n(%)		
Age (years)				
20-34	4(13.3%)	5(16.6%)	9(15.0%)	
35-50	19(63.3%)	21(70.0%)	40(66.6%)	0.471^{ns}
>50	7(23.3%)	4(13.3%)	11(18.3%)	
Mean ±S.D.				54.7±9.3
Body mass index (kg/m^2)				
23.1–25.0	17(56.7%)	15(50.0%)	32(53.3%)	
25.1–30.0	9(30.0%)	10(33.3%)	19(31.7%)	0.101^{ns}
>30.0	4(13.3%)	5(16.7%)	9(15.0%)	
ASA status				
I	19(63.3%)	18(60.0%)	37(61.7%)	0.790^{ns}
II	11(36.6%)	12(40.0%)	13(21.7%)	

ns= not significant
p value reached from unpaired t-test, Chi square test.

Table-I shows the difference was not statistically significant (p>0.05) between groups in respect of age distribution, body mass index and ASA status.

Table-II: Evaluation of heart rate amongst the study subjects (n=60)

Heart rate (beat/min)	Group P n(%)		Group G n(%)		P value
	Mean	±SD	Mean	±SD	
Baseline	86.7	±9.4	85.9	±7.1	0.258^{ns}
Range (min-max)	80	-110	81	-105	
2hr after	87.7	±11.2	92.0	±11.9	0.074^{ns}
Range (min-max)	75	-110	85	-110	
6hr after	90.7	±8.2	98.5	±7.7	0.001^{s}
Range (min-max)	80	-105	90	-110	
12hr after	94.2	±7.8	96.9	±7.4	0.206^{ns}
Range (min-max)	80	-110	86	-110	
24hr after	87.1	±5.8	86.9	±6.1	0.328^{ns}
Range (min-max)	80	-110	81	-105	

Table–II shows at baseline no significant difference of heart rate alteration was detected in between groups; After6hr, mean heart rate was 90.7±8.2 beat/min in group P and 98.5±7.7 beat/min in group G. The difference was statistically significant (p<0.05) between two groups. So it is found that heart rate was more stabilize those patients getting Pectoral nerve blocks than others.

Table-III: Distribution of Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) (n=60)

Blood pressure	Group P n (%)		Group G n (%)		P value
	Mean	±SD	Mean	±SD	
Systolic BP (mmHg)					
Baseline	108.3	±5.8	109.6	±6.3	1.246^{ns}
2hr after	102.3	±4.8	113.6	±11.2	0.001^{s}
6hr after	107.4	±6.2	109.5	±6.8	0.083^{ns}
12hr after	108.2	±5.1	109.6	±5.6	0.467^{ns}
24hr after	112.3	±8.7	109.6	±6.7	1.071^{ns}
Diastolic BP (mmHg)					
Baseline	60.7	±7.4	58.6	±6.5	0.856^{ns}
2hr after	64.5	±8.2	65.4	±5.6	1.023^{ns}
6hr after	62.1	±6.5	64.3	±5.9	0.895^{ns}
12hr after	61.5	±7.3	63.5	±7.1	0.901^{ns}
24hr after	62.7	±6.4	59.6	±6.1	0.921^{ns}

Table–III shows at baseline, the difference of mean systolic BP was statistically non significant (p>0.05). 2hr after surgery blood pressure was more stabilize in group-P than group-G; The difference was statistically significant (p<0.05). DBP was not significant (p>0.05) between two groups.

Table-IV:Assessmentof pain sensation using Visual Analogue Scale (VAS) (n=60)

VAS score	Group P n (%)		Group G n (%)		P value
	N	%	n	%	
2 hr After surgery					
1-3	7	23.3	1	3.3	
4-6	15	50.0	12	40.0	
7-10	8	26.6	17	56.7	
Mean±SD	5.1	±0.43	8.2	±0.72	0.001^{s}
6 hr after surgery					
1-3	20	66.7	5	16.7	
4-6	9	30.0	21	70.0	
7-10	1	3.3	4	13.3	
Mean±SD	3.8	±0.41	6.7	±0.62	0.001^{s}
12 hr after surgery					
1-3	22	73.3	18	60.0	
4-6	8	26.7	12	40.0	
7-10	0	0	0	0	
Mean±SD	2.91	±0.23	3.8	±0.27	0.832^{ns}
24 hr after surgery					
1-3	23	76.7	21	70.0	
4-6	7	23.3	9	30.0	
7-10	0	0	0	0	
Mean±SD	2.01	±0.08	2.76	±0.17	1.832^{ns}

Table-IV shows patients in the Group-G had higher VAS, during the second hours (P = 0.001), compared with the groups-P. The difference was statistically significant. Six hours after the surgery, both groups showed downward trends of the pain VAS, but significantly in group P. At the 12th hour and 24th hour, almost all patients had mild pain.

Table-V: Evaluation of any adverse events (n=60)

Complication	Number of Patient Group G n(%)	Group P n(%)	P value
Hypersensitivity or rash	0	0	
Hypotension	0	0	
Nausea, vomiting	7(23.33%)	4(13.33%)	0.402^{ns}
Cardiovascular collapse	0	0	
Myoclonus	0	0	

Table-V shows nausea and vomiting was lower for the placebo group, compared with the groups-G; however, this difference was not statistically significant (P=0.402). In both groups, nausea and vomiting scores decreased after the 6th hour, reaching even zero after 12 hours.

Table-VI: Trends of Analgesic requirement (Fentanyl) amongst the study population (n=60)

Analgesic requirement (Inj. Fentanyl)	Group P n(%)		Group G n(%)		p value
	Mean	±SD	Mean	±SD	
No. of patients	7(23.3%)		20(66.7%)		0.0001^{s}
Time of 1st demand of analgesic (min)	196.5	±16.2	98.7	±25.2	0.0001^{s}
Total analgesic requirement in 24 hrs (µg)	95.4	±12.3	228.5	±35.8	0.0001^{s}

Table-VI shows the mean (±SD) amount of Inj. Fentanyl used in the group-G was significantly more than in the Group-P (95.4±12.3 µg; P=0.001) and the difference was statistically significance (p<0.05). Post operatively1st demand of analgesia was earlier in group-G. The difference was statistically significant (p=< 0.0001).

Discussion:

This prospective, randomized, control trail study was conducted among 60 patients undergone breast cancer surgery in CMH. Patients were randomly divided into two groups with 30 patients in each group. In group P, patients received both general anesthesia and ultrasound guided combined pectoral nerve blocks. While studying the distribution of cases by age it was found that majority of the patients i.e. 66.6% (n=40) were

between 35-50 years, mean age was found to 54.7±9.3 years. It was observed that almost two third (63.3% & 60.0%) patients had ASA grade I in group P and group G respectively. The difference was not statistically significant (p>0.05) between two groups.

Breast cancer requires various surgical interventions like lumpectomy or mastectomy along with axillary lymph node clearance. General anaesthesia is the conventional, most frequently used anaesthetic technique. Various regional anaesthetic techniques interventions have also been used for breast surgeries; these include local wound infiltration, thoracic epidural anaesthesia, thoracic paravertebral block, thoracic spinal anaesthesia, and more recently, ultrasound-guided interfascial plane blocks such as pectoral nerve (PECS) blocks type 1 and 2 and the serratus plane block (SPB)[1]. Regional anaesthesia provides effective anaesthesia and analgesia in the perioperative setting. Although the beneficial analgesic effect of regional block is well known, data are emerging for the other potentially beneficial effects of regional anaesthesia and analgesia on other perioperative outcomes[7].

These include decreased need for opioids for controlling post-operative pain, decreased post-operative nausea vomiting (PONV), fewer post-operative pulmonary complications and decreased duration of post-anaesthesia care unit stay[8].

In this study no significant difference of heart rate, SBP, DBP was detected in between groups at baseline. Postoperative heart rate and other haemodynamic status were evaluated at 2h, 6h, 12h & 24h after surgery and found more attenuated in group-P. Present study shows that, at 2 hr after mean heart rate was 87.7±11.2 beat/min and 92.0±11.9 beat/min in group P and group G respectively. At 6 hr after, mean heart rate was 90.7±8.2 beat/min in group P and 98.5±7.7 beat/min in group G. 2 hr after surgery blood pressure was more stabilize in group-P than group-G; mean systolic blood pressure was 102.3±4.8 mmHg and 113.6±11.2 mmHg in group P and group G respectively. The difference was statistically significant. But following that systolic blood pressure was maintained almost similar in both groups of patients. At 6 hr after, mean systolic blood pressure was 107.4±6.2 mmHg in group P and 109.5±6.8 mmHg in group G. At 12 hr after, mean systolic blood pressure was 108.2±5.1 mmHg and 109.6±5.6 mmHg in group P and group G respectively. At 6 hr and 12 hr after surgery difference was statistically non significant (p>0.05) between two groups.

In this study mean verbal pain score was 5.1±0.43 and 8.2±0.72 in group P & group G respectively. The difference was statistically significant. Six hours after the surgery, both groups showed downward trends of the pain VAS, but significantly in group P. Mean score was 3.8±0.41 and 6.7±0.62 in group P & group G respectively. At the 12th hour AND 24th hour, almost all patients had mild pain. So overall finding suggested that, pectoral nerve blocks reduced the postoperative pain significantly.

Studies have shown that when used in conjunction with opioid-based general anesthesia, nerve blocks can reduce postoperative pain and opioid requirement[9]. The use of TPVB during breast surgery presents a number of advantages for women as it is associated with a reduction in post-surgical complications. Several studies showed that patients who receive TPVB experience reduced levels of postoperative pain, have a decreased need for opioids after surgery and therefore suffer less nausea and vomiting, and eventually shorten their hospital stay, compared to patients who receive general anesthesia. Of note, TPVB is particularly important for patients undergoing complicated procedures, such as unilateral or bilateral mastectomy followed by immediate reconstruction, as they usually experience more complications after surgery. In addition, TPVB seems to be associated with benefits regarding avoidance of immunosuppression and inflammation[10]. Single-injection paravertebral block (PVB) has been shown to be an alternative to general anesthesia for breast surgeries[11]. Recent studies have found greater opioid sparing and analgesic benefits of the PECS block (a combination of PECS 1 and 2 blocks) over the PVB[12-14].

Although most studies found significant decrease in postoperative opioid requirement, none have tried to avoid opioids altogether. OFA techniques are currently gaining acceptance over the world, especially in areas of bariatric surgery and oncosurgery. The benefits include avoiding respiratory depression, central muscle rigidity, pharyngeal muscle weakness, obstructed breathing, negative inotropism, nausea, vomiting,

ileus and constipation, urinary retention, tolerance and addiction, dizziness, and excessive somnolence[9]. Previous study argued that Pecs block offers significant advantages in terms of post-operative pain relief, post-operative rescue drug consumption, PONV and overall patient satisfaction[15].

Conclusions:

Present study concluded that pectoral nerve (Pecs) block based general anesthesia without any opioids is safe and effective. It appears to reduce postoperative analgesic requirement and post operative nausea and vomiting, improves the surgical experience for the patient, and may allow earlier discharge.

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