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Comparative Analysis of Early Recovery Profiles Following General Anesthesia with and without Pectoral Nerve Block2 in Modified Radical Mastectomy

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Abstract **Original Research Article**

***Background*:** Modified radical mastectomy (MRM) is often associated with significant postoperative pain, which can delay recovery and increase opioid requirements. The use of regional blocks like Pectoral Nerve Block II (PECS II) as an adjunct to general anesthesia may enhance postoperative better outcome. ***Methods*:** This randomized controlled study was conducted to compare early recovery profiles, hemodynamic parameters, and postoperative analgesia in patients undergoing MRM under general anesthesia (GA) alone and GA combined with PECS II block at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from September 2021 to October 2022. A total of 60 female patients aged 30–60 years (ASA grade I–II) were randomly assigned into two groups: Group A received GA alone, while Group B received GA with PECS II block. ***Results*:** The demographic characteristics were comparable between the two groups. Pain scores during recovery and 6 hours postoperatively were significantly lower in Group B ($p<0.001$). Group B had a delayed time to first rescue analgesia (144.0 ± 68.9 min vs. 38.0 ± 13.5 min; $p=0.001$) and significantly reduced total pethidine consumption (72.5 ± 7.9 mg vs. 120.0 ± 10.0 mg; $p<0.001$). A higher proportion of patients in Group B achieved a modified Aldrete score >9 (76.7% vs. 20.0%; $p<0.001$) and reported very high satisfaction (73.4% vs. 6.6%; $p<0.001$). Heart rate was consistently higher in Group A during and after surgery ($p<0.05$), while mean arterial pressure showed no significant difference. ***Conclusion*:** The addition of Pectoral Nerve Block II to general anesthesia in modified radical mastectomy significantly improves postoperative pain control, reduces opioid requirement, enhances recovery, and increases patient satisfaction without compromising hemodynamic stability.

Keywords: Modified radical mastectomy, general anesthesia, Pectoral nerve block II, postoperative analgesia, early recovery, patient satisfaction.

INTRODUCTION

Breast cancer is the most common malignancy among women worldwide. Over the past 30 years, developed countries have witnessed higher incidence rates but also improved survival outcomes compared to developing nations [1]. In 2018 alone, approximately 2.1 million new cases of breast cancer were diagnosed globally, accounting for an estimated 627,000 deaths—representing 6.6% of all cancer-related mortality [2]. In Bangladesh, breast cancer remains one of the leading causes of cancer-related morbidity and mortality among women. According to the International Agency for Research on Cancer (IARC), 12,764 new breast cancer cases were reported in Bangladesh in 2018 [3].

General anesthesia is the conventional and most commonly used anesthetic technique for performing mastectomies [4]. However, patients undergoing modified radical mastectomy (MRM) under general anesthesia often experience significant postoperative pain, particularly in the axilla and upper limb. This pain may prolong hospital stays, increase healthcare costs, and lead to postoperative complications [5]. Acute postoperative pain in the chest, shoulder, arm, and axilla is a frequent complaint following breast surgery. If inadequately managed, such pain can persist, resulting in chronic discomfort and reduced shoulder mobility, thereby adversely affecting the quality of life in breast cancer survivors. The likelihood of chronic pain is

especially high among patients undergoing axillary lymph node dissection as part of MRM [6].

Uncontrolled pain not only disrupts physiological homeostasis but may also influence cancer progression through pain-induced immune suppression. Effective acute pain management can help preserve immune function by attenuating the surgical stress response and reducing the requirement for general anesthetics and opioid analgesics [4]. Regional anesthesia offers effective analgesia in the perioperative setting, with several advantages over general anesthesia alone. These include a reduced need for opioids to manage postoperative pain, lower incidence of postoperative nausea and vomiting (PONV), fewer pulmonary complications, and a shortened stay in the post-anesthesia care unit [7].

Various regional anesthetic techniques have been employed in breast surgeries. These include local wound infiltration, thoracic epidural anesthesia, thoracic paravertebral block, thoracic spinal anesthesia, and more recently, ultrasound-guided interfascial plane blocks such as the pectoral nerve (PECS) blocks types I and II, and the serratus anterior plane (SAP) block [4].

The PECS I block is an interfascial block administered between the pectoralis major and pectoralis minor muscles. The PECS II block builds upon this by adding a second injection above the serratus anterior muscle at the level of the third rib [8]. As originally described by Blanco, the PECS II block is relatively easy to learn, provides effective analgesia, and avoids many of the risks associated with thoracic paravertebral block [9]. When combined with general anesthesia, the PECS II block can significantly reduce perioperative opioid requirements. This effect is primarily due to the local anesthetic's action on the targeted nerves, which diminishes intraoperative nociceptive input, reduces muscle spasm, facilitates the maintenance of anesthesia depth, and ultimately minimizes the need for systemic opioids [8].

The objective of this study was to compare the early recovery profiles following general anesthesia with and without pectoral nerve block II in patients undergoing modified radical mastectomy.

METHODOLOGY & MATERIALS

This randomized controlled trial was conducted in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, in collaboration with the Department of General Surgery, at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from September 2021 to October 2022. A total of 60 female patients aged between 30 to 60 years, with ASA physical status I or II and scheduled for elective modified radical mastectomy (MRM) under general anesthesia, were enrolled in the study after obtaining informed written consent. Patients were randomly allocated into two groups of 30 each using computer-generated random numbers. Group A received general anesthesia (GA) only, while Group B received general anesthesia combined with ultrasound-guided pectoral nerve block II (PECS II). Patients with coagulopathy, chest wall deformity, infection at the site of block, hypersensitivity to study drugs, previous breast surgery, or significant comorbidities such as uncontrolled hypertension, cardiac disease, psychiatric or neurological illness were excluded.

All patients underwent standardized general anesthesia. In Group B, PECS II block was performed following induction of anesthesia using ultrasound guidance to administer 10 ml of 0.25% bupivacaine between the pectoralis major and minor muscles, and 20 ml between the pectoralis minor and serratus anterior muscles. Hemodynamic parameters (heart rate, blood pressure) were recorded at regular intervals. Postoperative pain was assessed using the Visual Analog Scale (VAS) for up to 6 hours. Rescue analgesia in the form of intramuscular pethidine (1.5 mg/kg) was provided when VAS > 4. Total pethidine consumption and time to first analgesic request were recorded. Recovery status was evaluated using the Modified Aldrete Score at 5 and 10 minutes postoperatively. Patient satisfaction was recorded using a 3-point Likert scale. Data were analyzed using SPSS version 26. Continuous variables were analyzed using Student's t-test, and categorical data were compared using Chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Comparison of Age, Weight and ASA Grade of the Patients Between the Groups (N=60)

Criteria	Group A (GA) n=30	Group B (GA+PEC) n=30	p-value
Age group (in years)			
30-39	5 (16.7%)	5 (16.7%)	0.691* ns
40-49	16 (53.3%)	13 (43.3%)	
50-60	9 (30.0%)	12 (40.0%)	
Mean ± SD	45.4 ± 7.4	46.4 ± 8.4	0.615** ns
Weight (in kg) (Mean ± SD)	58.9±4.9	61.1±4.5	0.062** ns
ASA grade			
I	23 (76.7%)	24 (80.0%)	0.754* ns
II	7 (23.3%)	6 (20.0%)	

* Chi-square test, ** Independent sample t test, ns=not significant

The mean age of the patients in Group A (GA) and Group B (GA+PEC) were 45.4 ± 7.4 and 46.4 ± 8.4 years respectively. The mean weight of the patients in Group A (GA) and Group B (GA+PEC) were 58.9±4.9 and 61.1±4.5 kg respectively. According to ASA grade, in Group A (GA), 23 (76.7%) were in grade I while in Group B (GA+PEC), 24 (80.0%) were in grade I. There was no significant statistical difference between the groups regarding age, weight and ASA grade as p>0.05 (table 1).

Table 2: Heart Rate (Bpm) at Different Time Interval in Two Groups (N=60)

Different time interval	Group A (GA) (n=30)	Group B (GA+PEC) (n=30)	p-value
Baseline	73.9 ± 4.9	74.6 ± 8.1	0.715 ns
After induction	83.0 ± 9.2	79.2 ± 7.3	0.118 ns
15 minutes intraoperative	91.1 ± 7.1	79.3 ± 10.7	<0.001 s
30 minutes intraoperative	87.2 ± 10.0	76.1 ± 6.9	<0.001 s
45 minutes intraoperative	86.7 ± 6.5	76.8 ± 10.6	<0.001 s
60 minutes intraoperative	88.2 ± 10.9	77.4 ± 5.8	<0.001 s
75 minutes intraoperative	82.4 ± 6.0	78.8 ± 7.9	<0.001 s
90 minutes intraoperative	83.9 ± 10.3	74.1 ± 6.9	<0.001 s
105 minutes intraoperative	84.4 ± 9.5	78.6 ± 7.6	0.002 s
120 minutes intraoperative	83.3 ± 10.8	78.8 ± 4.3	0.102 ns
In recovery period	88.2 ± 11.9	79.3 ± 5.3	0.001 s
After 6 hours	76.1 ± 4.9	72.9 ± 4.8	0.042 s

Independent sample t test was used to measure the level of significance, ns=not significant, s=significant

At baseline, there was no significant statistical difference between the groups regarding the heart rate as p=0.715. However, 15 minutes intraoperative, the mean heart rate was significantly higher in Group A (GA) compared to Group B (GA+PEC) (p<0.001) which persisted in whole duration of surgery, in recovery period and even after 6 hours of surgery (p<0.05) (table 2).

Table 3: Pain Score by Visual Analog Scale (VAS) at Different Time Interval in Two Groups (N=60)

Different time interval	Group A (GA) n=30	Group B (GA+PEC) n=30	p value
Baseline	1.2 ± 0.7	1.0 ± 0.6	0.276 ns
In recovery period	4.3± 0.7	1.2 ± 0.4	<0.001 s
After 6 hours	3.0 ± 0.6	1.2 ± 0.4	<0.001 s

Independent sample t test was used to measure the level of significance, ns=not significant s=significant

At baseline, there was no significant statistical difference between the groups regarding pain score in Visual analog scale (VAS) as p=0.276. In recovery period, the mean of pain score was significantly higher in Group A (GA) compared to Group B (GA+PEC) (p<0.001). After 6 hours of surgery, the pain score remained significantly higher in Group A (GA) compared to Group B (GA+PEC) (p<0.001) (table 3).

Table 4: First Demand of Analgesia and Pethidine Consumption in Two Groups (N=60)

Criteria	Group A (GA)n=30	Group B (GA+PEC) n=30	p value
First demand of analgesia (in minute)	38.0 ± 13.5	144.0 ± 68.9	0.001 s
Pethidine consumption (in mg)	120.0 ± 10.0	72.5 ± 7.9	<0.001 s
Rescue analgesic requirement	18 (60.0%)	5 (16.7%)	<0.001 s

Independent sample t test was used to measure the level of significance, p value was achieved by chi-square test, s=significant

Time requirement of first rescue analgesia (min) for Group A (GA) was 38.0 ± 13.5 minutes and for Group B (GA+PEC) was 144.0 ± 68.9 minutes. This was statistically significant as p value was 0.001. The total Pethidine consumption was 120.0 ± 10.0 mg and 72.5 ± 7.9 mg in Group A (GA) and Group B (GA+PEC) respectively. Significant statistical difference was observed between the groups regarding total Opioid consumption in first 6 hours. In Group A (GA), 18 (60.0%) patients required rescue analgesic while in Group B (GA+PEC), 5 (16.7%) patients required rescue analgesic. The proportion of rescue analgesic was significantly higher in Group A (GA) (p<0.001) (table 4).

Table 5: Comparison of Patients Recovery by the Modified Aldrete Score (N=60)

Modified Aldrete score	Group A (GA) n=30	Group B (GA+PEC) n=30	p-value
9	24 (80.0%)	7 (23.3%)	<0.001 s
> 9	6 (20.0%)	23 (76.7%)	<0.001 s

p value was achieved by chi-square test

In Group A (GA), 6 (20.0%) patients had modified Aldrete score >9 while in group B (GA +PEC), majority 23 (76.7%) patients had modified Aldrete score >9. The proportion of modified Aldrete score of >9 was significantly higher in Group B (GA+PEC) compared to group A (GA) (p<0.001) (table 5).

Table 6: Comparison of Patient Satisfaction Between the Groups (N=60)

Satisfaction	Group A (GA) (n=30)	Group B (GA+PEC) (n=30)	P value
Not satisfied	11 (36.7%)	1 (3.3%)	0.0001[s]
Satisfied	17 (56.7%)	7 (23.3%)	
Very satisfied	2 (6.6%)	22 (73.4%)	

p value was achieved by chi-square test

In Group A (GA), 17 (56.7%) patients were satisfied and only 2 (6.6%) patients were very satisfied while in Group B (GA+PEC), 7 (23.3%) patients were satisfied and majority 22 (73.4%) patients were very satisfied. The proportion of very satisfied patients was significantly higher in Group B (GA+PEC) (p<0.001) (table 6).

DISCUSSION

This randomized controlled study was conducted to compare recovery status, hemodynamic parameters, and postoperative analgesia between general anesthesia (GA) alone and general anesthesia combined with pectoral nerve block II (GA+PEC) in patients undergoing modified radical mastectomy. A total of 60 women with ASA grade I–II undergoing surgery were included. The study demonstrated that combining general anesthesia with pectoral nerve block II significantly reduced postoperative pain and analgesic requirements. Moreover, recovery status was better in the GA+PEC group, while hemodynamic parameters remained comparable between groups. In this study, the mean age of the patients in group A and B was 45.4 (± 7.4) and 46.4 (± 8.4) years respectively which matched the study of Senapathi, *et al.*, & Alsisi *et al.*, [10, 11]. According to ASA grade, majority patients in both group were in grade I which was in accordance with the study of Hamed, *et al.*, [12].

Effective postoperative pain control can prevent the negative psychological and physiological consequences that can occur. It also reduces the need for opioids. In recovery period and after 6 hours of surgery, the pain score remained significantly higher in group A compared to group B (p<0.001) which indicated better pain management in combined general anaesthesia with pectoral nerve block II group. This was in accordance with other studies where they studied PECS block versus general anesthesia during breast cancer surgery [10, 13]. This indicated the beneficial effect of Pectoral nerve block.

Alfy & Foad observed significantly lower VAS pain scores in the PECS blocks group at all postoperative periods [14]. Also, in another study, significantly more patients had mild pain and fewer patients had moderate pain in the block group compared with the controls, both at rest and on movement, at all measured time points [13]. The systematic review and meta-analysis of Jin, et al. found that PECs block was associated with significantly better perioperative pain control [9].

Time requirement of first rescue analgesia (min) for group A was significantly earlier compared to group B. Moreover, the total Pethidine consumption in 6 hours (mg) was significantly higher in group A. This finding was supported by the systematic review and meta-analysis of Jin, *et al.*, [9]. In the study of Alsisi, *et al.*, patients who underwent a pectoral block showed a significant delay in the first analgesic request (p< 0.001) [11]. Another study also reported that the application of a pectoral nerve block led to a significant delay in the first request for postoperative analgesia in breast surgeries (p= 0.008) [15]. In addition, Thomas et al., confirmed the same findings (p = 0.002) [13]. Alfy & Foad also observed that total opioid consumption was significantly lower in combined general anaesthesia with pectoral nerve block II group compared to general anaesthesia group [14]. These results agree with Bashandy and Abbas, as they found that the mean intraoperative fentanyl consumption and the total amount of postoperative morphine were significantly lower in the PECS group than in the general anesthesia group [15]. Moreover, Yuki *et al.*, studied PECS block versus general anesthesia in breast cancer surgery and found that the mean fentanyl consumption was significantly lesser in the PECS group compared with the general anesthesia group, and significantly lower postoperative analgesia in PECS group [16]. In the study of Alsisi, et al., the reported intraoperative fentanyl consumption was markedly reduced in the pectoral block group compared with the controls [11]. This also indicated the advantageous effect of Pectoral nerve block.

In the present study, recovery status was assessed in modified Aldrete score. The proportion of modified Aldrete score of >9 was significantly higher in Group B (GA+PEC) compared to group A (GA) ($p<0.001$). Haemodynamic stability and better pain management might be the reason for better recovery status in Group B (GA+PEC).

Conversely, some other studies showed no significant effect of the pectoral block on the reduction of PONV compared with the controls [17, 18]. This heterogeneity could be attributed to the fact that PONV is a multifactorial problem which could be linked to this problem including perioperative opioid use and duration of anesthesia [18].

Patient satisfaction is an important measure of the quality of health care and is used as an outcome measure in interventional studies [19]. Patient satisfaction was found more in pectoral block group. This could be due to the better pain management in combined group. Significantly better patient satisfaction was reported by other studies also [11, 18].

Limitations and Recommendations

The study had some limitations, including the potential for personal bias and the fact that the anesthetist performing the nerve block was not blinded to the group allocation, which may have influenced the outcomes. Combined general anesthesia with pectoral nerve block II can be safely used for postoperative analgesia in patients undergoing modified radical mastectomy, and future studies are recommended to evaluate its role in preventing post-surgical chronic pain syndrome.

CONCLUSION

This study concluded that the combination of general anesthesia with pectoral nerve block II is safe and effective for patients undergoing modified radical mastectomy. It significantly reduces postoperative analgesic requirements and pain, and it improves recovery status compared to general anesthesia alone. While mean arterial pressure remained similar in both groups, heart rate was significantly higher in the general anesthesia group, indicating better hemodynamic control in the combined group.

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Conflicts of interest
There are no conflicts of interest.

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