Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

Adjuvants to Bupivacaine in Thoracic Paravertebral Block for Prolongation of Postoperative Analgesia After Unilateral Breast Cancer Surgery

[*]Dr. Chandan Kumer Ghosh[1], Prof. Dr. Sabina Yeasmeen[2], Dr. Rajat Shuvra Das[3], Dr. Mohammed Sharif Uddin Siddique[4], Dr. Naushin Hammad Pushan[5], Dr. Mohammad Musfiqur Rahman[6], Prof. Dr. AKM Faizul Hoque[7]

[1]Anaesthesiologist, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Faridpur Medical College, Faridpur, Bangladesh

[2]Professor, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, Bangladesh

[3]Assistant Professor, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, Bangladesh

[4]Consultant, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, Bangladesh

[5]Medical Officer, Department of Medicine, Dhaka Community Medical College & Hospital, Dhaka, Bangladesh

[6]Research Assistant, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Dhaka Community Medical College & Hospital, Dhaka, Bangladesh

[7]Professor, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, Bangladesh

Corresponding Author: Dr. Chandan Kumer Ghosh, Anaesthesiologist, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Faridpur Medical College, Faridpur, Bangladesh.

(Received: 27 September 2025 Revised: 05 October 2025 Accepted: 01 November 2025)

KEYWORDS

Fentanyl, Dexamethasone, Magnesium sulfate, Bupivacaine, Thoracic paravertebral block, Postoperative analgesia.

ABSTRACT:

Background: Breast cancer is the most common malignancy in women, and surgery often results in significant postoperative pain. Thoracic paravertebral block (TPVB) with local anesthetics can provide effective analgesia, and adding suitable adjuvants may further prolong pain relief. The aim of this study was to compare the effectiveness of fentanyl, dexamethasone, and magnesium sulfate as adjuvants to bupivacaine in thoracic paravertebral block for prolonging postoperative analgesia after unilateral breast cancer surgery.

Methods: This randomized controlled trial was conducted at BSMMU on 90 female patients undergoing unilateral breast cancer surgery. Patients were allocated into three groups (n=30): Bupivacaine with fentanyl (100 µg), dexamethasone (10 mg), or magnesium sulfate (80 mg). Ultrasound-guided TPVB was performed at T4, and outcomes included VAS pain score, time to first analgesic, opioid consumption, and complications.

Results: The mean age of patients was comparable among the groups (Group-F: 39.9±6.2, Group-D: 39.7±6.2, Group-M: 39.8±6.2 years). Onset of sensory block was faster in Group-F (8.17±1.14 min) than in Group-D (9.02±1.68 min) and Group-M (8.93±1.52 min), though not statistically significant. Heart rate and systolic blood pressure remained stable across groups, with 13.3% of Group-M experiencing perioperative hypotension. Postoperative pain scores (VAS) were significantly lower in Group-F at 2, 6, and 12 hours compared to Group-D and Group-M. The duration of analgesia was longest in Group-F (447.5 min) versus Group-D (432.6 min) and Group-M (437.8 min), although the difference was not statistically significant. Overall, fentanyl provided superior pain control and prolonged analgesia.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

Conclusion: In this study fentanyl is better than dexamethasone and magnesium sulfate but dexamethasone and magnesium sulfate both are also an effective adjuvant for prolongation of postoperative analgesia in thoracic paravertebral block after unilateral breast cancer surgery.

Introduction

Breast cancer is the most common diagnosed malignancy and the leading cause of cancer deaths in women [1]. It remains a dreadful cancer of women in Bangladesh. Breast malignancy is a hidden burden which accounts for 69% death of women. In Bangladesh, the overall incidence of breast cancer is estimated at 22.5 cases per 100,000 females across all age groups, and among women aged 15–44 years, breast cancer is the most prevalent cancer, with a rate of 19.3 per 100,000, surpassing all other cancer types [2]. Despite the advancement, breast cancer surgery is associated with moderate to severe postoperative pain. Postoperative pain after breast cancer surgery have a number of shortcomings such as poor recovery, prolonged hospital stays, increased cost, effect on patient's psychology and chronic persistent pain if acute postoperative pain is not adequately controlled [3]. The management of acute postoperative pain is required not only for patient's satisfaction but for better outcomes like enhanced recovery, decreased length of hospital stay, decreased opioid consumption, early mobilization, early discharge of patients and reducing the cost of burden.

Surgical removal of the breast cancer is the mainstay of current treatment. General anesthesia is the conventional used anesthetic technique but regional anesthetic techniques have also been used for breast surgeries. Whether general anesthesia or regional technique is chosen, optimal analgesia is an integral part of enhanced recovery after surgery to improve patients' outcomes [4]. Conventionally systemic opioid is the primary analgesic option after surgery. However, opioid administration is associated with nausea, vomiting, constipation, respiratory depression, hyperalgesia and immunosuppression [5]. Consequently, clinicians are striving to reduce opioid consumption. To reduce acute postoperative pain and complications associated with opioid, regional analgesic techniques are regarded as the best choice [6].

Pre-emptive analgesia has the potential to be more effective than a similar analgesic treatment initiated after surgery. Regional anesthetic technique as preemptive analgesia has multiple effects. It may decrease anesthetic requirement, immediate postoperative pain may be reduced, the development of chronic pain may be prevented and perioperative opioid consumption may be reduced [7].

Various regional anesthetic interventions have been used for breast surgeries; these include local wound infiltration, thoracic epidural anesthesia, thoracic spinal anesthesia, interfascial plane blocks such as pectoral nerve (PECS) blocks type 1 and 2, serratus plane block (SPB) and thoracic paravertebral block [8]. Among them ultrasound-guided thoracic paravertebral block (TPVB) has become increasingly popular for postoperative analgesia after breast surgery. In a study sixty-eight female patients undergoing elective unilateral modified radical mastectomy were enrolled. Patients were randomized to receive preoperative ultrasound-guided TPVB with 0.5% ropivacaine (TPVB group, n=34) or 0.9% saline (Control group, n=34). It showed preoperative TPVB decreased the area under the curve of the visual analog scale pain scores over 24 h, reduced postoperative 24-h morphine consumption, prolonged the time to first rescue analgesia, shortened the length of post-anesthesia care unit stay, lessened postoperative nausea and vomiting, and improved the patient satisfaction [9].Thoracic paravertebral nerve block (TPVB) is a promising option to the classic multimodal analgesia in breast surgery as it enhances surgical anesthesia and postoperative analgesia [10].

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

The risk of TPVB-related complications is low with ultrasound guidance compared to the blind technique [11]. Consequently, ultrasound-guided TPVB is now considered the gold standard for managing post-breast surgical pain. However, incomplete postoperative pain relief can hinder recovery [12]. Optimal anesthetic outcomes aim to enhance patient-perceived recovery and analgesia while minimizing opioid consumption. Various adjuvants have been used with local anesthetics to prolong analgesia, improve block quality, and reduce anesthetic-related adverse effects.

Several drugs—including fentanyl, dexmedetomidine, clonidine, morphine, verapamil, midazolam, tramadol, alfentanil, sufentanil, and dexamethasone—have been co-administered with bupivacaine to enhance block characteristics. However, many are associated with adverse effects such as nausea, vomiting, and hypotension [6]. Among them, magnesium sulfate, dexamethasone, and fentanyl are considered effective adjuvants that enhance analgesic efficacy and prolong block duration with fewer complications. Although various studies have evaluated these agents individually or in combination, comparative data, particularly from Bangladesh, remain limited [3].

Fentanyl, a potent opioid, prolongs sensory and motor blockade by binding to opioid receptors in the dorsal horn via diffusion into epidural and subarachnoid spaces and reduces postoperative pain and rescue analgesic requirements [13, 14]. Dexamethasone, a long-acting glucocorticoid, provides prolonged analgesia by reducing inflammation and inhibiting pain signal propagation [15]. Magnesium sulfate, an NMDA receptor antagonist, prevents calcium influx, reducing central sensitization and postoperative pain [16, 17].

Objective of the Study

The objective of this study was to show the comparison of the effectiveness of fentanyl, dexamethasone and magnesium sulfate as adjuvants to bupivacaine in thoracic paravertebral block for prolongation of postoperative analgesia after unilateral breast cancer surgery under general anesthesia.

Methodology & Materials

This observational study was carried out in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, BSMMU, Dhaka, during the period from October 2022 to September 2023. The study population included women aged 25 to 60 years undergoing unilateral breast cancer surgery at BSMMU after fulfillment of the eligibility criteria. A total of 90 patients were enrolled, with 30 patients in each group. The inclusion criteria were ASA grade II and III patients with a diagnosis of breast cancer without metastasis, aged 25–60 years, Mallampatti class I or II, and scheduled for elective surgery under general anesthesia with controlled ventilation. Patients were excluded if they had hypersensitivity to study drugs, chest wall deformity, coagulopathy, use of anticoagulants, infection at the block site, previous breast surgery, or breast cancer with metastasis.

After obtaining ethical approval and informed written consent, baseline demographic and clinical data were collected. Patients were randomly allocated into three groups: Group-F received fentanyl 2 ml (100 mcg) plus 18 ml 0.5% plain bupivacaine, Group-D received dexamethasone 2 ml (10 mg) plus 18 ml 0.5% plain bupivacaine, and Group-M received magnesium sulfate 2 ml (80 mg) plus 18 ml 0.5% plain bupivacaine. Patients were kept nil per oral for 8 hours before surgery, VAS was explained preoperatively, and standard monitors were applied on arrival in the operating room. Preoperative HR, BP, and SpO_2 were recorded, IV access was secured, and a thoracic paravertebral block was performed at T4 under ultrasound guidance using an in-plane technique with a 22-gauge insulated needle. Proper drug spread was confirmed by anterior displacement of pleura, and block success was checked by pinprick at T2–T6 dermatomes. General anesthesia was induced with fentanyl, propofol, and suxamethonium, and maintained with halothane, nitrous oxide, and oxygen. Standard monitoring and

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

fluid management were continued throughout surgery, with treatment of hypotension or bradycardia as required. At surgery completion, neuromuscular blockade was reversed with neostigmine and atropine. Postoperatively, patients were monitored, VAS scores were recorded at fixed intervals, and pethidine was given as rescue analgesic if VAS ≥4. The duration of analgesia, time to first analgesic request, opioid consumption, hemodynamic changes, and complications were documented. Data were analyzed using SPSS version 23 with descriptive statistics, one-way ANOVA, and chi-square tests, with significance set at $p<0.05$.

Results

Table I: Different parameters of demographic variables of the study groups (n=90)

Variables	**Group F (n=30)**	**Group D (n=30)**	**Group M (n=30)**	**P=value**
Age in years (Mean ± S.D.)	39.9±6.2	39.7±6.2	39.8±6.2	0.471^{ns}
Height in cm (Mean ± S.D.)	158.2±11.5	161.95±9.8	160.5±9.5	0.704^{ns}
Weight in kg (Mean ± S.D.)	59.68±7.2	56.9±6.3	61.5±6.1	0.958^{ns}
BMI (kg/m^2)	23.8±2.5	24.9±2.8	24.5±2.7	0.094^{ns}
ASA status				
ASA II	19(63.3%)	18(60%)	19(63.3%)	0.825^{ns}
ASA III	11(36.6%)	12(40%)	11(36.6%)	

Table I shows the parameters of demographic variables of the study groups (n=90). Total of 90 patients fulfilling inclusion/exclusion criteria were studied. Mean age was found to 39.9±6.2 years in group F, 39.7±6.2 years in group D and 39.8±6.2 years in group M. The mean height was found 158.2±11.5 cm in group F, 161.95±9.8 cm in group D and 160.5±9.5 cm in group M. The mean weight was found 59.68±7.2 kg in group F, 56.9±6.3 kg in group D and 61.5±6.1 kg in group M. The mean BMI was found 23.8±2.5 kg/m^2 in group F, 24.9±2.8 kg/m^2 in group D and 24.5±2.7 kg/m^2 in group M. All patients were with ASA physical status II and III. Group F, 19(63.3%) were ASA II and 11(36.6%) were ASA III. Group D, 18(60%) were ASA II and 12(40%) were ASA III. Group M, 19(63.3%) were ASA II and 11(36.6%) were ASA.

Table II: Onset of sensory block between groups(n=90)

Time (min)	**Number of patients**			**P value**
	Group F (n=30)	**Group D (n=30)**	**Group M (n=30)**	
≤5	2(6.7%)	0	0	
6-10	23(76.7%)	19(63.3%)	21(70.0%)	

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

>10	5(16.7%)	11(36.7%)	9(30.0%)	
Mean ± S.D.	8.17 ± 1.14 min	9.02 ± 1.68 min	8.93 ± 1.52 min	0.816

Table II shows time to onset of sensory block. Onset of sensory block was rapid in Group F (8.17 ± 1.14 min) than Group D (9.02 ± 1.68 min) and Group M (8.93 ± 1.52 min). On comparison of the required time to the onset of sensory block between groups was 6-10 minute in 23(76.7%) patients of Group-F versus 19(63.3%) in Group-D and 21(70.0%) in Group-M patients. The result was non-significant (p value > 0.05).

Figure 1: Trends of heart rate (HR) between the groups (n=90)

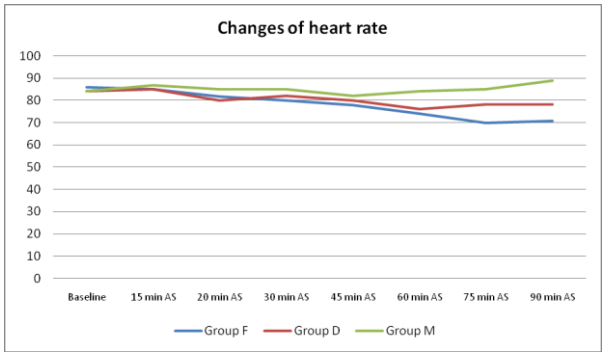

Figure 1 shows the heart rate (HR) in the studied groups. No significant variation was found in case of mean heart rate (HR) throughout the perioperative period. Only Group- F shows gradually declining the heart rate compared to Group-D & M, but difference was non-significant. Compared with group D, group M patients shows non- significant increased heart rate at 30 minutes onwards. Baseline heart rate was 86, 84, 84 beat/min in Group-F, D, M respectively. At 20 min heart rate was 82, 80, 85 beat/min in Group-F, D, M respectively. At 45 min heart rate was 78, 80, 82 beat/min in Group-F, D, M respectively. At 60 min heart rate was 74, 76, 84 beat/min in Group- F, D, M respectively. At 75 min heart rate was 70, 78, 85 beat/min in Group-F, D, M respectively. At 90 min heart rate was 71, 78, 89 beat/min in Group-F, D, M respectively. So, at the end of follow up we found that, heart rate almost stabilized in D group.

Figure 2: Trends of systolic blood pressure (SBP) between groups (n=90)

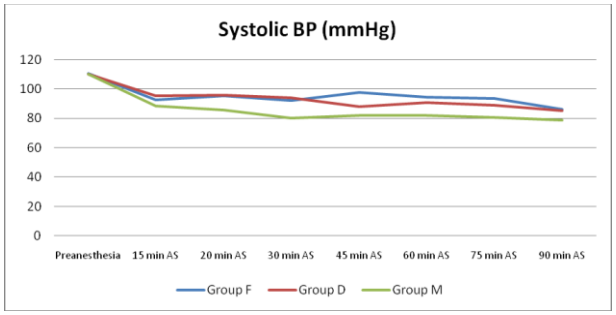

Figure 2 shows that Systolic Blood pressure (SBP) had well maintained during the perioperative period in three groups. In magnesium sulfate group (Group-M) 4(13.3%) patients had suffered hypotension during perioperative period. Graph shows systolic blood pressure during follow up it was observed that at preanesthesia, mean systolic BP was found 110.6±6.3, 110.3±6.4, 109.9±6.2 in group F, D, M respectively. At 15 minutes after, mean systolic blood pressure was 92.5±5.1, 95.4±5.6, 88.4±5.3 in group F, D, M respectively. At 20 minutes after, mean systolic blood pressure was 95.3±5.3, 95.8±5.7, 85.5±5.5 in group F, D, M respectively. At 30 minutes after, mean systolic blood pressure was 92.4±5.2, 94.2±5.4, 80.3±5.4 in group F, D, M respectively. At 60 minutes after, mean systolic blood pressure was 94.6±6.8, 90.8±6.2, 81.9±6.4 in group F, D, M respectively. At 75 minutes after, mean systolic blood pressure was 93.6±6.1, 89.3±6.5, 80.5±6.3 in group F, D, M respectively. At 90 minutes after, mean systolic blood pressure was 86.3±5.9, 85.4±5.8, 78.8±6.1 in group F, D, M respectively. Systolic blood pressure changes were non-significant in between groups.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

Table III: Assessment of pain intensity by VAS score between groups (n=90)

VAS score at different follow up time	Number of patients			P value
	Group F (n=30)	Group D (n=30)	Group M (n=30)	
2 hr After surgery				
0-2	4 (13.3)	0	0	
3-6	16 (53.3)	12 (40.0)	9 (30.0)	
7-10	10 (33.4)	18 (60.0)	21 (70.0)	
Mean±SD	5.7±0.47	6.1±0.45	6.8±0.48	0.068
6 hr after surgery				
0-2	11 (36.7)	5 (16.7)	2 (6.7)	
3-6	12 (40.0)	14 (46.7)	13 (43.3)	
7-10	7 (23.3)	11 (36.7)	15 (50.0)	
Mean±SD	5.4±0.3	6.8±0.3	7.7±0.3	0.001
12 hr after surgery				
0-2	22 (73.3)	17 (56.7)	13 (43.3)	
3-6	8 (26.7)	9 (30.0)	10 (33.4)	
7-10	0	4 (13.3)	7 (23.3)	
Mean±SD	3.0±0.27	4.2±0.32	5.2±0.35	0.001
24 hr after surgery				
0-2	24 (80.0)	20 (66.7)	14 (46.7)	
3-6	4 (13.3)	7 (23.3)	10 (33.4)	
7-10	2 (6.7)	3 (10.0)	6 (20.0)	
Mean ± SD	1.9±0.21	3.1±0.26	4.3±0.29	0.001

Patients in the Group-D & M had higher VAS than Group-F during the second hours after surgery. Pain score gradually declined in all three groups, but significantly lower in Group-F compared to others. VAS score 7-10 or severe pain were 7 (23.3) in Group-F, 11 (36.7) in Group-D, and 15 (50.0) patients in Group-M 6 hr after surgery. 12 hr after surgery revealed that 22 (73.3) in Group-F, 17 (56.7) in Group-D, and 13 (43.3) patients in Group-M had VAS score 0-2 or mild pain. 24 hr after surgery revealed that 24 (80.0) in Group-F, 20 (66.7) in Group-D, and 14 (46.7) patients in Group-M had VAS score 0-2 or mild pain. With progression of time, VAS score was significantly lower in fentanyl group compared to others. 2 hours after surgery mean VAS pain score was 5.7±0.47,

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

6.1±0.45 and 6.8±0.48 in group F, D & M respectively. The difference was statistically significant. Six hours after the surgery, mean VAS pain score was 5.4±0.3, 6.8±0.3 and 7.7±0.3 in group F, D & M respectively. Twelve hours after the surgery, mean score was 3.0±0.27, 4.2±0.32 and 5.2±0.35 in group F, D & M respectively. At the 24th hour, almost maximum patients had no pain. So overall finding suggested that, three drugs are effective in control of postoperative pain in first 24 hours, however Fentanyl group performed better pain control compared to others and efficacy was fentanyl > dexamethasone> Magnesium sulfate (Table III).

Table IV: Analgesic requirement amongst the study population (n=90)

Rescue Analgesic requirement	**Number of patients**			**P value**
	Group F (n=30)	**Group D (n=30)**	**Group M (n=30)**	
No. of rescue analgesic (frequency)	4(13.3)	7(23.3)	8(26.7)	0.072
Time of 1st demand of analgesic (min)	196.5±16.2	105.7±16.9	98.7±15.5	0.001
Dose of Opioid consumption (Inj. Pethidine) in mg/24 hr	286.5±28.7	458.2±34.7	485.5±35.8	0.017

Table IV shows the time of rescue analgesic requirement in postoperative period of the study patients. It was observed that mean time of analgesic requirement was earlier in group M (98.7±15.5 min) and Group-D (105.7±16.9 min) than group F (196.5±16.2 min). Total required dose of Opioid (Inj. Pethidine) in mg/24 hr were 286.5±28.7 mg in Group-F, 458.2±34.7 mg in Group-D and 485.5±35.8 mg in Group-M. The difference was statistically significant ($p< 0.05$) between three groups.

Figure 3: Mean duration (min) of block (n=90)

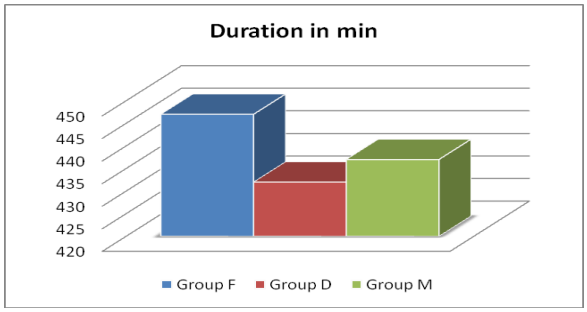

Figure 3 shows the duration of blockade, defined as the time between onset of sensory block and return of dull pain but VAS<4. Block lasted longer in the Group-F patients (447.5 min) as compared to the other groups (432.6 min in Group-D and 437.8 min Group-M). But the difference was statistically non-significant ($p>0.05$).

Table V: Evaluation of adverse events between groups (n=90)

Complication	**Number of Patient**		
	Group F (n=30)	**Group D (n=30)**	**Group M (n=30)**
Hypersensitivity or rash	0	0	0
Hypotension	0	0	4 (13.3%)
Nausea, vomiting	5 (16.7%)	0	0
Cardiovascular collapse	0	0	0

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

Myoclonus pneumothorax	0 0	0 0	0 0

Fentanyl produced a remarkably low postoperative VAS score, but high incidence of nausea and vomiting postoperatively compared with others. Hypotension developed in 4 (13.3%) patients of Group-M. Difference was statistically non-significant (Table V).

Discussion

This Randomized control trial was carried out in the Department of Anesthesia, Analgesia and Intensive Care Medicine, BSMMU, to assess and compare the effectiveness of different adjuvants fentanyl, dexamethasone and magnesium sulfate to bupivacaine in thoracic paravertebral block for prolongation of postoperative analgesia after unilateral breast cancer surgeries under general anesthesia. Women of age 25-60 years undergone unilateral breast cancer surgery in hospital within study period were selected after fulfillment of eligible criteria. Total number of ninety (90) patients was recruited and allocated into three groups, 30 in each group.

In this study, majority of the patients i.e. 74 (82.2%) were between 45-60 years, 17.8% (n=16) were between 25-44 years. Mean age was found to 39.8±6.2 years. The difference was statistically non-significant (p>0.05) between three groups. All patients were with ASA physical status II and III. In Group F, 19(63.3%) were ASA II and 11(36.6%) were ASA III. Group D, 18(60%) were ASA II and 12(40%) were ASA III.

Group M, 19(63.3%) were ASA II and 11(36.6%) were ASA III. The mean weight was found 59.68±7.2 kg in group F, 56.9±6.3 kg in group D and 61.5±6.1 kg in group M. The mean height was found 158.2±11.5 cm in group F, 161.95±9.8 cm in group D and 160.5±9.5 cm in group M. The demographic profile difference was not statistically significant. Findings are consistent with results of the other studies. Previous study reported that socio-demographic profile was similar among the both groups [6].

In this study it was observed that onset of sensory block was faster in Group F who received fentanyl (8.17 ± 1.14 min) than Group D (9.02 ± 1.68 min) and Group M (8.93 ± 1.52 min) who received dexamethasone and magnesium sulfate respectively. The result was statistically non-significant (p value > 0.05).

Sayed M. et al., conducted a comparative study between fentanyl and dexamethasone as adjuvant to bupivacaine and observed, onset of sensory block was earlier in fentanyl group than dexamethasone [18]. A comparative study between fentanyl and magnesium sulfate as adjuvant to bupivacaine in supraclavicular brachial plexus block was conducted by Emdad H. et al., and showed onset of block was faster in patients who received fentanyl [19]. Khezri M. et al., also demonstrated delayed onset of analgesia with addition of magnesium. This may be due to difference in pH and baricity of the solution containing magnesium that contributed to the delayed onset [20].

In this study no significant variation was found in case of mean heart rate (HR) throughout the perioperative period. Only Group-F who received fentanyl showed gradually declining the heart rate compared to Group-D & M, but difference was statistically non-significant. Declining heart rate in fentanyl group may be due to suppressed stress response mediated by fentanyl. The local anesthetic action of fentanyl is potentiated by analgesia mediated by an opioid receptor that leads to fentanyl uptake to the systemic circulation [21]. Systolic Blood pressure (SBP), diastolic blood pressure (DBP) and SpO_2 had well maintained during the perioperative period in three groups.

In this study patients in the Group-D & M had higher VAS than Group-F during the second hours after surgery. Pain gradually declined in all three groups, but it was more significantly in Group-F. Difference was statistically significant. Six hours after the surgery, mean VAS score were 5.4±0.3, 6.8±0.3 and 7.7±0.3 in group F, D and M

respectively. Twelve hours after the surgery, mean VAS was improving further as reflected by the mean score were 3.0±0.27, 4.2±0.32 and 5.2±0.35 in group F, D & M respectively. At the 24th hour, almost maximum patients had no pain. So overall finding suggested that, all the three drugs are effective in control of postoperative pain, but fentanyl was better compared to dexamethasone and magnesium sulfate). Fentanyl produced a remarkably low postoperative VAS score compared to others.

Previous study regarding fentanyl versus dexamethasone or both as adjuvants to bupivacaine in an ultrasound-guided paravertebral block in patients undergoing modified radical mastectomy showed that mean VAS score was lower in fentanyl group than dexamethasone group [22]. Another study reported that mean VAS score was higher in group who received magnesium sulfate compared to dexamethasone group and VAS score was significantly decreased after receiving rescue analgesic in both the groups [6].

In this study, mean duration of block was higher in fentanyl group (447.5 min) compared to dexamethasone (432.6 min) and magnesium sulfate group (437.8 min) but the difference was not statistically significant. Comparative study between fentanyl and magnesium sulphate as adjuvants to bupivacaine showed that there was significant increase in duration of analgesia in fentanyl group as compared to magnesium sulfate group [23].

In this study it was observed that, hypotension developed in 4 (13.3%) patients of Group-M who received magnesium sulfate. In group F who received fentanyl. 5 (16.7%) patients developed nausea and vomiting. Difference was statistically non- significant.

In magnesium sulfate group 12% patients had suffered hypotension during perioperative period [6]. There was no significant adverse effect in a study, fentanyl versus dexamethasone or both as adjuvants to bupivacaine in an ultrasound-guided paravertebral block in patients undergoing modified radical mastectomy [22].

So, overall findings concluded that fentanyl is more effective than dexamethasone and magnesium sulfate as adjuvant to bupivacaine. Possible explanation is pharmacodynamic variability and analgesic properties of different drugs. Theories have shown that on nociceptive C-fibers, dexamethasone increases the activity of inhibitory potassium channels, thus decreasing their activity. But it has no effect on central pain modulation. On the other hand, Fentanyl is extremely selective μ receptor agonist that has effect on both central and peripheral pain receptor. So, it prolonged the duration of analgesic action by directly binding with opioid binding site on the dorsal nerve roots or by diffusing into surrounding tissues [24, 25].

From the results of this study, it was found that fentanyl is better than other drugs, e.g., dexamethasone, magnesium sulfate as adjuvant to bupivacaine in thoracic paravertebral block for postoperative analgesia after breast cancer surgeries, improved postoperative pain scores and reduced postoperative analgesic requirements with minimal side effects.

Limitations of the study

The present study had certain limitations that should be acknowledged. First, the relatively small sample size may limit the generalizability of the findings to a larger population. In addition, the possibility of personal bias cannot be completely excluded, which may have influenced the interpretation of results. Furthermore, the satisfaction of both the surgeon and the patient, which could provide valuable insights into the overall effectiveness of the management approaches, was not evaluated. These limitations highlight the need for larger, more comprehensive studies with broader outcome measures in the future.

Recommendations

Regional block may be used more as it efficiently controls pain, maintain better hemodynamic stability.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(6), 287-297 | ISSN:2251-6727

Conclusion

In this study fentanyl, dexamethasone and magnesium sulfate were effective adjuvants to bupivacaine for managing post-operative pain in thoracic paravertebral block for unilateral breast cancer surgery.

Financial support and sponsorship

No funding sources.

Conflicts of interest

There are no conflicts of interest.

References

1. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. CA: a cancer journal for clinicians. 2022 Jan 1;72(1).
2. Forazy MA. Incidence of breast cancer in Bangladesh. Health Care. 2015 Oct;3(3):53-4.
3. El Mourad MB, Amer AF. Effects of adding dexamethasone or ketamine to bupivacaine for ultrasound-guided thoracic paravertebral block in patients undergoing modified radical mastectomy: A prospective randomized controlled study. Indian journal of anaesthesia. 2018 Apr 1;62(4):285-91.
4. Memtsoudis SG, Fiasconaro M, Soffin EM, Liu J, Wilson LA, Poeran J, Bekeris J, Kehlet H. Enhanced recovery after surgery components and perioperative outcomes: a nationwide observational study. British journal of anaesthesia. 2020 May 1;124(5):638-47.
5. Ramaswamy S, Langford RM. Antinociceptive and immunosuppressive effect of opioids in an acute postoperative setting: an evidence-based review. BJA Education. 2017 Mar 1;17(3):105-10.
6. Mahabubuzzaman M, Kabir MH, Islam MS, Bhowmick LK, Sheikh MZ, Kumar D. The Analgesic Effect of Dexamethasone and Magnesium Sulphate (MgSO4) as an adjuvant to 0.25% Bupivacaine in ultrasound guided Pectoral Nerve Block (PEC Block) for unilateral Modified Radical Mastectomy: A Comparative Study. Community Based Medical Journal. 2022 Jun 16;11(1):4-13.
7. Jørgen, B., Dahl and Steen Møiniche., Pre-emptive analgesia. *British Medical Bulletin*, 2005; 71(1), 13–27.
8. Pani N, Sahu P, Swain D, Biswal C, Pradhan A, Routray SS. Effects of fentanyl and dexmedetomidine as adjuvants to bupivacaine in paravertebral block for postoperative analgesia in patients undergoing modified radical mastectomy: A prospective randomised double-blind study. Indian Journal of Anaesthesia. 2022 Jan 1;66(Suppl 4):S193-9.
9. Rao F, Wang Z, Chen X, Liu L, Qian B, Guo Y. Ultrasound-guided thoracic paravertebral block enhances the quality of recovery after modified radical mastectomy: a randomized controlled trial. Journal of Pain Research. 2021 Aug 20:2563-70.
10. Calì Cassi L, Biffoli F, Francesconi D, Petrella G, Buonomo O. Anesthesia and analgesia in breast surgery: the benefits of peripheral nerve block. European Review for Medical and Pharmacological Sciences. 2017;21(6):1341-5.
11. Niesen AD, Jacob AK, Law LA, Sviggum HP, Johnson RL. Complication rate of ultrasound-guided paravertebral block for breast surgery. Regional Anesthesia & Pain Medicine. 2020 Oct 1;45(10):813-7.
12. Myles PS, Boney O, Botti M, Cyna AM, Gan TJ, Jensen MP, Kehlet H, Kurz A, De Oliveira Jr GS, Peyton P, Sessler DI. Systematic review and consensus definitions for the Standardised Endpoints in Perioperative Medicine (StEP) initiative: patient comfort. British journal of anaesthesia. 2018 Apr 1;120(4):705-11.
13. Mahmoud H, Abbas F, Youssef MG, Abdelgaber G. Comparison between levobupivacaine alone and levobupivacaine with fentanyl in extending the duration and postoperative analgesia of supraclavicular brachial plexus block for elective upper limb orthopedic surgeries. The Egyptian Journal of Hospital Medicine. 2020 Oct 1;81(2):1531-7.
14. Terkawi AS, Tsang S, Sessler DI, Terkawi RS, Nunemaker MS, Durieux ME, Shilling A. Improving analgesic efficacy and safety of

thoracic paravertebral block for breast surgery: a mixed-effects meta-analysis. Pain physician. 2015;18(5):E757.
15. Mahar S, Malhotra M. Dexamethasone-induced withdrawal seizure. Journal of Pharmacology and Pharmacotherapeutics. 2015 Jun;6(2):103-4.
16. Ammar AS, Mahmoud KM. Does the addition of magnesium to bupivacaine improve postoperative analgesia of ultrasound-guided thoracic paravertebral block in patients undergoing thoracic surgery?. Journal of anesthesia. 2014 Feb;28(1):58-63.
17. Abo Seif, E.K., Kamel, W.Y. and Hilal, A.M. The effect of adding magnesium to bupivacaine as an adjuvant in continuous pectoralis nerve II (PECs) block in simple mastectomy. Glob J Anes & Pain Med, 2020; 2 (5), 197–201.
18. Badawy Sayed M, Mostafa Abd El-Hameed S, Mohammed Yousef Ahmed E. Comparative study between dexamethasone and fentanyl as an adjuvant to bupivacaine in ultrasound guided supraclavicular brachial plexus block in upper limb surgeries. Al-Azhar Medical Journal. 2019 Oct 1;48(4):501-12.
19. Emdad, H., Panna, L.S., Tushar, S., et al., 2021.Mgso4 versus Fentanyl as adjuvant with bupivacaine in supraclavicular brachial plexus block. A comparative study. Medico research chronicles, 2021;8(6).
20. Khezri MB, Yaghobi S, Hajikhani M, Asefzadeh S. Comparison of postoperative analgesic effect of intrathecal magnesium and fentanyl added to bupivacaine in patients undergoing lower limb orthopedic surgery. Acta Anaesthesiologica Taiwanica. 2012 Mar 1;50(1):19-24.
21. Kore SS, Ubhe SB, Fasil F. Comparison between dexamethasone and fentanyl as an adjuvant to bupivacaine and lignocaine in supraclavicular brachial plexus block for upper limb surgery. Journal of Pharmacology and Pharmacotherapeutics. 2022 Mar;13(1):59-65.
22. Abdel-Wahab AH, Gegres AK, Hamed R, Abdellatif MM. Fentanyl versus dexamethasone or both as adjuvants to bupivacaine in an ultrasound-guided paravertebral block in patients undergoing modified radical mastectomy: a randomized double-blind clinical study. Minerva Anestesiologica. 2021 Sep 16;88(3):129-36.
23. Katiyar S, Dwivedi C, Tipu S, Jain RK. Comparison of different doses of magnesium sulphate and fentanyl as adjuvants to bupivacaine for infraumbilical surgeries under subarachnoid block. Indian Journal of Anaesthesia. 2015 Aug 1;59(8):471-5.
24. Rashwan DA, Mohammed AR, Rashwan SA, Abd El Basset AS, Nafady HA. Efficacy of serratus anterior plane block using bupivacaine/magnesium sulfate versus bupivacaine/nalbuphine for mastectomy: a randomized, double-blinded comparative study. Anesthesiology and Pain Medicine. 2020 Jun 22;10(3):e103141.
25. Grape S, Jaunin E, El-Boghdadly K, Chan V, Albrecht E. Analgesic efficacy of PECS and serratus plane blocks after breast surgery: a systematic review, meta-analysis and trial sequential analysis. Journal of clinical anesthesia. 2020 Aug 1;63:109744.