

# THORACIC PARAVERTEBRAL BLOCK VERSUS PECTORAL NERVE BLOCK FOR ANALGESIA AFTER MODIFIED RADICAL MASTECTOMY

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## ABSTRACT

**Background:** Postoperative pain control is essential for early recovery, patient comfort, and reduced opioid requirement after modified radical mastectomy with immediate breast reconstruction.

**Objective:** To compare thoracic paravertebral block and pectoral nerve block in terms of postoperative pain scores, nalbuphine requirement, time to rescue analgesia, and complications after modified radical mastectomy surgery.

**Materials and Methods:** This randomized controlled trial was conducted in the Department of Anesthesia, Jinnah Hospital, Lahore from April 2022 to November 2022. A total of 54 patients undergoing modified radical mastectomy were included after informed consent and randomly allocated into two equal groups. Group A received thoracic paravertebral block, while Group B received pectoral nerve block. General anesthesia was induced using nalbuphine 0.1 mg/kg, propofol 2 mg/kg, and atracurium 0.5 mg/kg in all patients.

**Results:** At rest in the post-anesthesia care unit, the mean NRS score was  $1.44 \pm 0.51$  in the paravertebral block group and  $1.48 \pm 0.51$  in the pectoral nerve block group ( $p=0.790$ ). At 8 hours, the mean resting NRS score was significantly higher in the paravertebral block group compared with the pectoral nerve block group ( $4.15 \pm 0.60$  vs  $3.48 \pm 0.58$ ;  $p<0.001$ ). On movement in the post-anesthesia care unit, the mean NRS score was  $2.67 \pm 0.48$  in the paravertebral block group and  $2.41 \pm 0.50$  in the pectoral nerve block group ( $p=0.058$ ). At 8 hours, movement-related pain was significantly higher in the paravertebral block group than in the pectoral nerve block group ( $4.52 \pm 0.70$  vs  $3.70 \pm 0.67$ ;  $p<0.001$ ).

**Conclusion:** Pectoral nerve block provided better postoperative analgesia, lower pain scores at 8 hours, and longer duration before rescue analgesia compared with thoracic paravertebral block after modified radical mastectomy surgery. Both techniques were safe, with no observed complications.

**KEYWORDS:** Modified Radical Mastectomy, Pectoral Nerve Block, Paravertebral Block, Pain

## INTRODUCTION

Although the breast-conserving surgery has become the standard treatment for breast cancer, modified radical mastectomy (MRM) is among the procedures most commonly performed. Even though breast-conserving surgery is the most common form of breast cancer surgery, modified radical mastectomy (MRM) is also performed. Although surgical techniques and peri- and post-operative management have improved, postoperative pain after MRM continues to be a major clinical problem that can adversely impact patient recovery, respiratory function, mobilization, hospital length of stay, and the overall quality of life. The modified radical mastectomy (MRM) procedure is usually performed under general anesthesia and is associated with considerable postoperative pain. This discomfort can make the risk of chronic persistent pain go up [1]. Proper management of pain immediately after surgery is very important because it ensures comfort and expedient hospital discharge of the patient and further reduces the risk of future pain problems [2]. A lack of adequate pain management during this time is a major risk factor for chronic pain. Regional anesthesia techniques may be better for postoperative pain control [3]. There have been some studies recently that have compared TPVB to another technique known as "modified Pecs block. These studies found that the modified Pecs block provided better pain relief after certain types of breast surgeries compared to TPVB, especially for surgeries where a lot of tissue around the armpit area is removed (called radical mastectomies with axillary clearance) [4,5].

A few studies have compared thoracic paravertebral block and pectoral nerve block in breast surgery, with conflicting results about which provides superior analgesia. There have been some similar results in terms of effectiveness in relieving pain and providing longer lasting analgesia with PECS block when compared to LAST IV, and it may also offer better pain control, a longer lasting effect and reduced opioid usage after modified radical

mastectomy. Results have been inconsistent, due in part to differences in study design, anesthetic protocols, assessment of pain, and institutional practice. All of these studies perform a single injection of paravertebral block at T4 level, without the use of a catheter; however, the authors state that this may not provide adequate local anesthetic for higher levels of the spine, as the distribution of local anesthetic varies from patient to patient [6]. The rationale of this study is to compare the opioid consumption at the 30 minutes, 2 hours, 4 hours, 6 hours and 8 hours in postoperative period following thoracic paravertebral block versus pectoral nerve block after modified radical mastectomy [7,8]. Although studies have reported higher efficacy of pectoral nerve block but still few studies have reported that both blocks are equally effective for better postoperative analgesia in women undergoing breast surgery [9]. The use of regional anesthesia techniques has become more and more popular as a valuable alternative for postoperative pain management in breast surgery. These techniques offer focused and targeted pain, allow for reduced opioid use, increase patient comfort, and can optimize enhanced recovery pathways. Thoracic paravertebral block (TPVB) is a traditional gold standard regional analgesia technique for breast surgery that offers unilateral somatic and sympathetic blockade of multiple thoracic dermatomes. TPVB is a method of depositing local anesthetic near the thoracic vertebral bodies, which will also provide effective breast and chest wall analgesia. It can be technically difficult though and has potential complications of pneumothorax, hypotension, vascular puncture and inadvertent neuraxial spread [10].

### **Objective:**

To compare the efficacy in terms of post op pain and opioid (nalbuphine) consumption postoperatively after MRM and complications (pneumothorax, hypotension, spinal cord injury) between thoracic paravertebral block and pectoral nerve block after MRM surgery.

### **METHODOLOGY**

This was randomized controlled trial conducted at Department of anesthesia, Jinnah Hospital Lahore from April 2022 to November 2022. A total of 54 patients were included, with 27 patients in each group. The sample size was calculated using a 95% confidence level and 80% power of study, taking expected mean opioid consumption with Pecs II block as  $11.3 \pm 4.75$  and with thoracic paravertebral block as  $15.0 \pm 4.86$ , as reported by Siddeshwara et al. Purposive sampling technique (non-probability) was utilized. Female patients aged 30–70 years, with ASA physical status I–II, scheduled for modified radical mastectomy were included in the study. Patients with bleeding disorders, anticoagulants, BMI > 35 kg/m<sup>2</sup>, history of sensitivity to local anaesthetic, major cardiac disorders, decreased pulmonary reserve, renal dysfunction, spine or chest wall deformity and pregnant females were excluded. Enclosed opaque envelopes were used in a lottery to randomly assign patients to either group. Envelopes were opened by an independent anesthesiologist. The person collecting the perioperative and postoperative data was masked to the type of analgesic technique.

### **Data Collection Procedure**

After approval from the Institutional Ethical Review Committee, eligible patients were enrolled after obtaining informed written consent. Patients' preoperative assessment was done 1 day prior to surgery, and informed about the Numeric Rating Scale for pain assessment. Group A patients had thoracic paravertebral block and Group B patients had pectoral nerve block. The night prior to surgery and two hours before surgery, all patients received lorazepam and ranitidine as premedication. Using the 22-gauge echogenic needle, ultrasound guided blocks were performed on the operative side. For Group A, paravertebral thoracic block at T3 level was done in the sitting position. In Group B, Pecs II block was conducted in supine position when the arm was abducted. The sensory level was evaluated every five minutes from T1 to T8 dermatomes for 30 minutes by an anesthesiologist who was blinded to the group assignment. Patients that failed to have decreased sensation in the targeted segments after 30 minutes were deemed to be block failures and excluded from analyses. The general anesthesia was induced with nalbuphine, propofol and atracurium, and then maintained with oxygen, air and isoflurane. Patients were reversed at the end of surgery and transferred to the post-anesthesia care unit. NRS both at rest and on movement was used for postoperative pain assessment at 30 minutes, 2 hours, 4 hours, 6 hours and 8 hours. The need for rescue analgesia, nalbuphine use, haemodynamic parameters, postoperative nausea and vomiting and complications were noted. The key outcome measures were Numeric Rating Scale (NRS) for pain at rest and on movement assessments in the postoperative period. Secondary outcomes included the time to rescue analgesia, overall nalbuphine consumption, hemodynamic changes, postoperative nausea and vomiting, and analgesia-related complications.

### **Data Analysis**

The data were inserted and analyzed by SPSS version 23. Age, weight, height, BMI, duration of surgery, NRS score, duration of analgesia and the amount of analgesic consumed were quantitative variables and were expressed as mean  $\pm$  SD. Results for qualitative variables such as ASA status, PONV and complications were reported as frequencies and percentages. The normality of quantitative data was checked by Shapiro-Wilk test. Normally distributed quantitative variables were compared using independent sample t-test, and the non-normal data was

tested using a non-parametric alternative test. The data on complications and qualitative were compared between groups by a chi-square test. A p-value <0.05 was considered statistically significant.

## RESULTS

A total of 54 patients were included, with 27 patients in each group. The mean age was  $50.63 \pm 11.16$  years. The PVB group had a mean age of  $48.52 \pm 10.10$  years, while the PeCS group had a mean age of  $52.74 \pm 11.95$  years, with no statistically significant difference. Baseline weight, height, BMI, ASA status, and duration of surgery were also comparable between both groups.

**Table 1. Baseline characteristics of study participants**

Variable	PVB group (n=27)	PeCS group (n=27)	p-value
Age, years	$48.52 \pm 10.10$	$52.74 \pm 11.95$	0.167
Weight, kg	$67.52 \pm 8.87$	$71.96 \pm 9.66$	0.084
Height, m	$1.62 \pm 0.16$	$1.68 \pm 0.17$	0.218
BMI, kg/m <sup>2</sup>	$25.73 \pm 2.46$	$25.60 \pm 2.60$	0.851
ASA I	20 (74.1)	21 (77.8)	0.750
ASA II	7 (25.9)	6 (22.2)	
Duration of surgery, minutes	$106.89 \pm 9.78$	$106.29 \pm 9.65$	0.824

NRS pain scores at rest were similar in PACU between the PVB and PeCS groups ( $1.44 \pm 0.51$  vs  $1.48 \pm 0.51$ ;  $p=0.790$ ). However, from 30 minutes onward, the PeCS group showed significantly lower pain scores compared with the PVB group, including at 30 minutes ( $2.52 \pm 0.51$  vs  $3.00 \pm 0.96$ ;  $p=0.027$ ), 2nd hour ( $3.07 \pm 0.55$  vs  $3.63 \pm 0.63$ ;  $p=0.001$ ), 4th hour ( $3.11 \pm 0.58$  vs  $3.78 \pm 0.69$ ;  $p<0.001$ ), 6th hour ( $3.59 \pm 0.50$  vs  $3.92 \pm 0.61$ ;  $p=0.034$ ), and 8th hour ( $3.48 \pm 0.58$  vs  $4.15 \pm 0.60$ ;  $p<0.001$ ).

**Table 2. Comparison of NRS pain score at rest**

Time point	PVB group	PeCS group	p-value
PACU	$1.44 \pm 0.51$	$1.48 \pm 0.51$	0.790
30 minutes	$3.00 \pm 0.96$	$2.52 \pm 0.51$	0.027
2nd hour	$3.63 \pm 0.63$	$3.07 \pm 0.55$	0.001
4th hour	$3.78 \pm 0.69$	$3.11 \pm 0.58$	<0.001
6th hour	$3.92 \pm 0.61$	$3.59 \pm 0.50$	0.034
8th hour	$4.15 \pm 0.60$	$3.48 \pm 0.58$	<0.001

At the 2nd hour, NRS was  $3.52 \pm 0.51$  in the PeCS group compared with  $3.81 \pm 0.56$  in the PVB group ( $p=0.046$ ). This difference remained significant at the 4th hour, 6th hour, and 8th hour, with consistently lower movement-related pain scores in the PeCS group.

**Table 3. Comparison of NRS pain score on movement**

Time point	PVB group	PeCS group	p-value
PACU	$2.67 \pm 0.48$	$2.41 \pm 0.50$	0.058
30 minutes	$3.07 \pm 0.55$	$2.96 \pm 0.52$	0.448
2nd hour	$3.81 \pm 0.56$	$3.52 \pm 0.51$	0.046
4th hour	$4.07 \pm 0.47$	$3.52 \pm 0.51$	<0.001
6th hour	$4.25 \pm 0.45$	$3.59 \pm 0.50$	<0.001
8th hour	$4.52 \pm 0.70$	$3.70 \pm 0.67$	<0.001

Hemodynamic parameters remained stable in both groups. Heart rate was comparable at PACU,  $109.52 \pm 6.19$  versus  $111.18 \pm 4.51$  beats/min ( $p=0.264$ ), 30 minutes,  $105.18 \pm 6.37$  versus  $106.48 \pm 6.05$  ( $p=0.447$ ), 2nd hour,  $102.00 \pm 6.96$  versus  $103.70 \pm 8.23$  ( $p=0.415$ ), 4th hour,  $89.44 \pm 6.17$  versus  $88.59 \pm 6.26$  ( $p=0.617$ ), 6th hour,  $78.52 \pm 5.82$  versus  $81.18 \pm 6.65$  ( $p=0.123$ ), and 8th hour,  $76.18 \pm 2.65$  versus  $74.70 \pm 3.42$  ( $p=0.081$ ). Blood pressure was also comparable at all time points, including PACU  $109.48 \pm 3.10$  versus  $110.93 \pm 2.95$  mmHg ( $p=0.085$ ) and 8th hour  $121.22 \pm 5.64$  versus  $119.52 \pm 6.65$  mmHg ( $p=0.315$ ).

**Table 4. Hemodynamic parameters during follow-up**

Parameter	Time point	PVB group	PeCS group	p-value
Heart rate, beats/min	PACU	$109.52 \pm 6.19$	$111.18 \pm 4.51$	0.264
	30 minutes	$105.18 \pm 6.37$	$106.48 \pm 6.05$	0.447
	2nd hour	$102.00 \pm 6.96$	$103.70 \pm 8.23$	0.415
	4th hour	$89.44 \pm 6.17$	$88.59 \pm 6.26$	0.617
	6th hour	$78.52 \pm 5.82$	$81.18 \pm 6.65$	0.123
	8th hour	$76.18 \pm 2.65$	$74.70 \pm 3.42$	0.081
Blood pressure, mmHg	PACU	$109.48 \pm 3.10$	$110.93 \pm 2.95$	0.085
	30 minutes	$115.63 \pm 3.20$	$114.96 \pm 3.49$	0.468
	2nd hour	$118.74 \pm 4.53$	$116.92 \pm 3.93$	0.122

	4th hour	123.37 ± 3.95	122.37 ± 4.93	0.415
	6th hour	119.44 ± 4.00	117.37 ± 5.11	0.103
	8th hour	121.22 ± 5.64	119.52 ± 6.65	0.315

Time to rescue analgesia was significantly longer in the PeCS group than the PVB group, 179.44 ± 16.18 minutes versus 140.55 ± 16.02 minutes (p<0.001), showing prolonged analgesic effect with PeCS block. No complications were reported in either group, including hypotension 0 (0.0%), pneumothorax 0 (0.0%), and spinal cord injury 0 (0.0%).

**Table 5. Rescue analgesia and complications**

Variable	PVB group (n=27)	PeCS group (n=27)	p-value
Time to rescue analgesia, minutes	140.55 ± 16.02	179.44 ± 16.18	<0.001
Hypotension	0 (0.0)	0 (0.0)	—
Pneumothorax	0 (0.0)	0 (0.0)	—
Spinal cord injury	0 (0.0)	0 (0.0)	—

## DISCUSSION

Managing pain after breast surgery is crucial for patients' recovery. The importance of pain control is more about optimizing the time spent in the hospital, minimizing healthcare costs, and maximizing patient satisfaction. A number of techniques exist for pain management and these include oral analgesia, IV medications, local infiltration of anesthesia, thoracic epidural, intercostal block, pectoral block, and paravertebral block [11]. In this study, at rest, the mean NRS score on PACU was 1.44±0.51 in the PVB group and 1.48±0.51 in the PeC group (p-value=0.790). However, on the 8th hour follow-up, the mean NRS score was 4.15±0.60 in the PVB group and 3.48±0.58 in the PeC group (p-value=<0.001). The scores on PACU were also similar in the PVB and PeC groups in terms of mean values upon movement (2.67±0.48, 2.41±0.50, respectively; p-value=0.058). On the 8th hour follow-up, the mean NRS score was 4.52±0.70 in the PVB group and 3.70±0.67 in the PeC group (p-value=<0.001). Furthermore, in PVB group, the mean time required for rescue analgesia was 140.55±16.02 minutes and in PeC group, it was 179.44±16.18 minutes [12]. The PVB group had a significantly reduced rescue analgesia time compared to the PeC group (p-value=<0.001). S. Kulhari et al performed a study and results showed that the duration of analgesia was significantly longer in the IPecs II1 group than in the TPVB1 group (mean (SD): 294.5 (52.76) vs 197.51 (31.35) min, respectively; P<10.0001). In addition, the Pecs II block group had lower 24-hour consumption of Morphine [mean (SD) consumption 3.901 (0.79) vs 15.301 (0.98) mg, respectively; P<0.0001] [13].

Sherif Samir Wahba's study aimed to compare the differences in the consumption of morphine and the effectiveness of the analgesics, after the modified radical mastectomy (MRM), between the two techniques. Morphine consumption in the two groups at 24 hours was significantly different, with lower consumption in the Pecs group [21 (20–25) mg] than the PVB group [28 (22–31) mg] (p = 0.002). Patients in the Pecs group also experienced a longer time until the first request for morphine [1751 (155–220) min] compared to the PVB1 group [137.5 (115–165) min] (p < 0.001). Furthermore, the Numerical Rating Score (NRS) at rest was reduced in the Pecs group at 1 hour, 6 hours and 12 hours (p<0.001), but in the PVB group at 18 hours and 24 hours (p=0.0081, p<0.001 respectively) [14-16].

## Limitations of the study

Here are given the few of the study limitations

- The sample size of this study was small so the results of this study could not be generalized to whole population.
- The data was collected from single center setting, so there are chances of bias approach, so it is suggested that in future studies data must be taken from multicenter setting to control the bias
- There are many other parameters which can also be taken under consideration but due to time and financial constraint could not be entertained.

## CONCLUSION

On the basis of this study we may conclude that pectoral nerve block group patients showed significantly better control on pain and showed longer duration of rescue for analgesia as compared to paravertebral block group patients after MRM surgery, however no complication was observed in any group.

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