ANAESTHESIA, PAIN & INTENSIVE CARE
www.apicareonline.com

ORIGINAL ARTICLE

Ultrasound guided paravertebral block vs. modified PECS block for modified radical mastectomy

Rahul Joshi[1], Manish Kumar Singh[2], Shameek Bhattacharjee[3], Raj Tobin[4], Depinder Kaur[5], Shiv Kumar Singh[5]

[1]Senior resident;
[2]Assistant Professor;
[5]Associate Professor
Department of Anesthesiology, Shaheed Hasan Khan Mewati Government Medical College (SHKM GMC), Nalhar Mewat, Haryana (India)
[3]Senior consultant;
[4]Director Anesthesia Max Super Speciality Hospital, Saket, New Delhi, (India)
Correspondence:
Dr. Manish Kumar Singh
Assistant Professor Department of Anesthesiology SHKM GMC, Mewat, Haryana, (India);
E-mail: drmanishgsb@gmail.com
Phone: +918130862829
Received: January 5, 2019,
Reviewed: April 4, 5, 2019,
Revised: April 24, 29, 2019,
Accepted: April 30, 2019

ABSTRACT

Aim & objectives: To compare safety and efficacy of ultrasound guided modified pectoral nerve block (PECS block) and paravertebral (PVB) block in patients undergoing modified radical mastectomy.

Methodology: In this prospective, randomized, single blind study, sixty ASA class I-II patients posted for modified radical mastectomy were randomly allocated one of the two groups; Group 1 and Group 2 each with thirty patients. Both the groups received ultrasound guided blocks. Patients of Group 1 received PVB and Group 2 received PECS block.

Results: Both the groups were comparable with respect to initial characteristics like age, weight, height, BMI, ASA class. Intraoperatively both the blocks were comparable in consumption of fentanyl use. Postoperatively PVB group received more tramadol (rescue analgesic) in comparison to Modifies PECS block group. Postoperatively PVB group received more ondansetron compare to Modified PECS block in initial 12 h. At 24 h postoperatively both the groups were comparable in total tramadol and ondansetron used. Both the blocks were comparable in terms of VAS score at rest and VAS score during physiotherapy at 24 h. Episodes of hypotension were more with PVB as it also causes sympathetic block.

Conclusion Ultrasound guidance has brought a revolution in the field of nerve blocks because it is now possible to directly visualise the muscular planes, the advancing needle and the spread of local anesthetic solution during injection in real time. With our experience we suggest Modified PECS block better alternative in breast surgeries. Larger RCTs are required to establish the fact.

Key words: Modified radical mastectomy; Ultrasound guided; Nerve block; Modified PECS block; Paravertebral block

Citation: Joshi R, Singh MK, Bhattacharjee S, Tobin R, Kaur D, Singh SK. Ultrasound guided paravertebral block vs. modified PECS block for modified radical mastectomy. Anaesth. pain & intensive care 2019;23(2):172-177

INTRODUCTION

According to the World Health Organisation, breast cancer is the most common cancer in women worldwide and is increasing, particularly, in developing countries where the majority of cases are diagnosed in late stages and most of these women require breast surgery to remove the primary tumors.[1]

About 40% of the patients undergoing surgery for breast cancer experience clinically significant acute postoperative pain, indicating postoperative pain treatment is not sufficient. Furthermore, acute postoperative pain is an important risk factor for the development of chronic postoperative pain in women after breast surgery. Chronic postoperative pain occurs in up to 50% of patients after breast surgery. Insufficiently controlled postoperative pain may delay recovery, lead to a prolonged hospital stay, extend medical costs, and cause persistent chronic

pain.[2]

Several forms of regional techniques, like local anesthetic (LA) infiltration, intercostal nerve block, epidural block and paravertebral block (PVB), have been used for the management of pain after breast surgery. The epidural and thoracic PVBs have established themselves as the preferred choices. Paravertebral scores over epidural in its being unilateral and obviates several of the risks with epidural like hypotension, high block.[3,4,5]

While thoracic PVB has rightly enjoyed a edge over epidural, and other regional techniques in patients undergoing breast surgeries, the conventional landmark guided technique is not without its concerns. Incidence of inadvertent spread of LA to epidural space, pneumothorax, intravascular injection, have been reported. Ultrasound guidance (USG) with visualization of the anatomy, the progress of the needle tip, and spread of the LA, has greatly helped in increasing the safety and success rate with thoracic PVBs. Of course, other regional techniques have also benefitted.[6]

Ultrasound has also opened up new possibilities in regional anesthesia / analgesia practice. Pectoral nerve blocks came into clinical practice only after the introduction of ultrasound to Anesthesia. Initial PECS block, or PECS I block, was used for superficial breast surgeries including insertion of breast expanders and sub pectoral prosthesis. PECS II block or modified PECS block is an extension of PECS I block, recently described by Blanco, and provides analgesia over a wider area facilitating axillary clearance.[7]

Now use of PECS block for management of postoperative pain after modified radical mastectomy (MRM) is increasing. So in this study we compared USG guided Thoracic PVB with USG PECS block.

METHODOLOGY

This prospective, randomized, single blind study was carried out in Department of Anesthesia, SHKM Government Medical College, for one calendar year comprising of 12 months.

Informed and written consent was taken in all cases. Inclusion criteria was women > 18 y of age, ASA grade 1 and 2 undergoing MRM. Pregnant patients, those with a known bleeding disorder, or any infection at the site of injection, gross obesity (body mass index > 35 kg/m^2), allergy to LAs to be used and patient refusal were the exclusion criteria.

Patients were randomly allocated by computer generated random numbers into two groups. Group 1 received a single ipsilateral USG thoracic PVB at T4 level with 0.3 ml/kg of 0.375% levobupivacaine (upto 20 ml). Group 2 patients received USG PECS block with 0.5 ml/kg of 0.375% levobupivacaine (upto 30 ml) divided (2 parts between pectoralis minor and serratus anterior and 1 part between pectoralis major and pectoralis minor).

This being a single blinded study the procedure group assignment will not be known to the study subjects.

Primary outcome was measured by opioid sparing in the perioperative period with the help of fentanyl consumption in intraoperative period and Tramadol requirement in postoperative period.

Secondary outcomes measures were; pain relief in the postoperative period (VAS scores), ease of physiotherapy in the postoperative period (VAS scores during adduction and abduction of arms), incidence of any complications (pleural puncture, epidural spread of LA, hypotension, block failure, adverse drug reaction, vascular puncture, Horner's syndrome etc.)

Time to first rescue analgesia (tramadol 1 mg/kg) in postoperative period and total dose of tramadol required in first 24 h in postoperative period were noted.

General anesthesia (GA) was given with muscle relaxant, sevoflurane and inj fentanyl 2 μg/kg iv in both the groups. Airway was secured with LMA. Blocks were given after induction of GA by the same consultant anesthesiologist. Authors involved in data collection were blinded to the block. Intraoperatively, heart rate and mean arterial blood pressure were maintained within ±30% of preoperative baseline. Boluses of injection fentanyl 0.5 to 1 μg / kg intravenously were given if the heart rate or the mean arterial pressure increased more than 30% of the preoperative baseline, indicating inadequate analgesia.

Patients having VAS score ≥3 were given 100 mg of tramadol in 100 ml normal saline by slow iv infusion as rescue analgesia.

Patients in Group 1 were placed in a lateral decubitus position with the side to be blocked up. After the aseptic preparation of the skin and the probe, USG PVB was performed by out of plane approach, with the probe in the longitudinal plane. After negative aspiration test for blood, the calculated amount of levobupivacaine was injected slowly.

Patients in Group 2 were placed in a supine position with the side to be blocked marked and exposed. After aseptic preparation of the skin and the probe, pectoral nerve block was given. A high frequency linear probe was placed obliquely caudal to the coracoid process of the scapula to locate the axillary

vessels under the pectoralis major and the subclavius muscle. After identification of the first rib, the probe was moved distally towards the axilla until the third rib encountered.

With an in-plane medial-to-lateral approach, half of the calculated amount of LA was injected into the interfascial plane between pectoralis minor and serratus anterior, and the remaining half was injected into the interfascial plane between the two pectoralis muscles.

Pulse rate, systolic (SBP), diastolic (DBP) and mean arterial pressures (MAP), and SpO_2, were recorded before administration of block, and after induction of anesthesia, post induction at 5, 10 min, at skin incision, post skin incision initially at 5 min interval for first 15 min, then every 15 min

After emerging from anesthesia, the patient was transferred to post-anesthesia care unit (PACU) for observation. Vital ignss and pain scores were noted at the end of surgery that is at 0 h, 1 h, 6 h, 12 h and 24 h following reversal from GA. Time for first rescue analgesia was noted. Total tramadol injected was noted. Incidence of nausea or vomiting was noted in the first 24 h. Inj ondansetron 4 mg was administered for nausea and vomiting. In cases of severe episodes, inj dexamethasone 8 mg was added. Total consumption of tramadol, ondansetron and dexamethasone were recorded for the first 24 h.

Ease of limb physiotherapy using VAS scores during adduction and abduction of arms were assessed at 24 h. The patients were enquired at the end of 24 h that whether pain had disturbed their sleep during night and about any other complaints relevant to the study.

Statistical analysis:

For statistical analysis SPSS-20 software (IBM) was used. Total consumption of tramadol in two groups was analyzed by non-parametric method (Mann Whitney u test). The analysis of VAS scores was done at different points by area under curve, and significance was checked by Student's t test. Ease of physiotherapy was assessed and analyzed by either Student's t test or Mann Whitney u test depending upon the distribution of data. Incidence of PONV and other complications was compared by chi square test. For all statistical tests, a $p < 0.05$ was taken to indicate a significant difference.

RESULTS

Demographic profile and baseline hemodynamic parameters were equivalent in both groups, with no statistically significant differences as shown in Table 1.

Postoperatively at 6 h and 12 h tramadol requirements were higher in Group1compare to Group 2. In Group

Table 1: Demographic profile and baseline hemodynamic parameters of two groups (Mean ± SD)

Parameter	Group 1 (PVB)	Group 2 (PECS)	p value
Age	53.30 ± 12.66	54.00 ± 9.98	0.813
Weight (Kg)	65.75 ± 13.96	70.30 ±12.60	0.206
Height (cm)	153.91 ± 6.56	153.18 ± 4.58	0.622
BMI	27.86 ± 6.00	29.97 ± 5.86	0.174
HR (per min)	79.87 ± 8.35	77.10 ± 9.29	0.230
SBP (mmHg)	124.70 ± 8.83	122.17 ± 11.99	0.355
DBP (mmHg)	71.23 ± 6.77	68.70 ± 6.69	0.150

p < .05 statistically significant

Table 2: Ease of physiotherapy; tramadol and ondansetron requirement (Mean ± SD)

Parameter	Group 1 (PVB) (n=30)	Group 2 (PECS) (n=30)	p-value
Total intraop fentanyl dose (μg)	132.33 ± 28.37	147.50 ± 30.87	0.052
Postop tramadol requirement (mg)	80.00 ± 25.82	87.50 ± 23.15	0.531
Postop ondansetron requirement 9mg)	4.00 ± 0.00	4.00 ± 0.00	-
Ease of physiotherapy [VAS score]	2.27 ± 0.58	2.10 ± 0.55	0.259

p < 0.05 - statistically significant

Table 3 VAS scores at different time intervals

VAS	Group 1 (n=30)	Group 2 (n=30)	p-value
	Mean ± SD	Mean ± SD	
Postop 0 h	0.00 ± 0.00	0.00 ± 0.00	-
Postop 1 h	0.13 ± 0.51	0.00 ± 0.00	0.155
Postop 6 h	1.97 ± 0.77	0.80 ± 0.48	<0.001
Postop 12 h	2.57 ± 0.77	1.43 ± 0.73	<0.001
Postop 24 h	1.40 ± 0.50	1.47 ± 0.51	0.610

P< 0.05 – statistically significant.

1at 6 h 7 (23.3%) patients needed tramadol, compared to 0(0%) in Group 2 (p = 0.011) and at 12 h the figures were clinically significant, e.g., 12 (40.0%) vs. 4 (13.3%) in Group 1 and 2 consecutively (p = 0.039).

Postoperatively at 24 h ease of physiotherapy (assessed by VAS score), intraoperative and postoperative tramadol requirement and ondansetron requirement was comparable and was statistically insignificant (Table 2).

VAS scores of patients in Group 1 (PVB) were comparably higher than Group 2 (PECS) at 6 h and 12 h. p value at 6 h and 12 h were <0.001. as we can see in the graph at 24 h both the blocks are reaching at comparable level in VAS score (P = 0.610) as shown in Table 3.

DISCUSSION

Different treatment modalities have been used for postoperative pain relief in breast surgery including parenteral and regional routes. Parenteral use of NSAID's and opioids with patient control analgesia (PCA) pump is the most preferred route. Out of the regional analgesia techniques would local infiltration and nerve blocks e.g., thoracic epidural, intercostal block, PVB and PECS block are commonly employed.[3,4,5]

PCA with opioids remains the most common technique for management of postoperative pain, but its efficacy is suboptimal and side effects are frequent. Postoperative nausea / vomiting is one of the common side effects.

Thoracic epidural with LA, opioids, or both have been used in breast surgery cases and was once considered as gold standard for providing analgesia in such cases. Epidural blockade has been shown to reduce the intraoperative surgical stress response and has possible advantages for cardiovascular, respiratory, coagulation, gastrointestinal, metabolic and immune function. However, thoracic epidurals can cause hypotension, neurological injury and are contra-indicated in the presence of coagulopathy or local sepsis.[6,7]

Thoracic PVB is the technique of injecting LA adjacent to the thoracic vertebra close to where the spinal nerves emerge from the intervertebral foramina. Clinical advantage of this block is that a single injection produces multidermatomal ipsilateral nerve block, It also maintains hemodynamic stability and reduces opioid requirements and there is low incidence of complications, preserves bladder sensation and lower limb motor power. Extradural anesthesia selectively blocks cardiac sympathetic fibers, and this offers potential patient benefits: attenuation of the surgical stress response, improvement of myocardial oxygen balance, and stabilization of intraoperative hemodynamics.

PVB provides better postoperative analgesia in addition to GA or alone. A recent meta-analysis reported that PVB provides similar pain relief compared with thoracic epidural analgesia after thoracotomy but with fewer side effects, technical problems and failed blocks.[8,9] Continuous PVB with the help of catheter has better analgesia compared to single shot block and this can be considered as a choice for postoperative pain relief in breast surgery. But 'early recovery after surgery' (ERAS) concept has limited the use of continuous PVB. We used single bolus PVB as patients were discharged after 24 h of surgery.

A lot of studies have come up about Thoracic PVB regarding postoperative pain management in breast surgeries. But this block may not be suitable in all breast surgeries. PVB block provides ipsilateral dermatomes and sympathetic blockade but does not block medial and lateral pectoral nerves and as well as long thoracic nerve and thoracodorsal nerves. Therefore, during breast surgeries involving axillary dissection, lack of adequate analgesia is definitely coexisting.[10-14]

Use of ultrasound guidance and/or nerve stimulation may reduce complication rates although there is no firm evidence to support this notion.[15] With addition of ultrasound and understanding of neural supply of anterior chest wall and breast, a novel interfascial plane block was introduced by R. Blanco in 2011 and modified it also to cover axillary clearance in breast surgery. Modified PECS block covers medial and lateral pectoral nerves and also covers the long thoracic nerve and thoracodorsal nerve. This technique is routinely used now a day in our institution for breast surgeries. So our aim was to compare PVB and pectoralis block in terms of intraoperative pain relief and postoperative pain relief. And also compare complications like PONV and other peculiar complications associated with particular block.[7]

MAP was comparable intraoperatively and changes between the two groups were not statistically significant.. The other intraoperative variables like minimum alveolar concentration of sevoflurane, the end tidal CO^2 and the oxygen saturation were comparable between the two groups during surgery.

PECS block spare the sympathetic chain and hence hemodynamics are not affected. Intraoperative fentanyl consumption was comparable in both the groups so intraoperative analgesia was good with both the blocks.

A similar study done by Wahba SS and Kamal SM found that intraoperative fentanyl consumption was significantly lower in PECS group compared

with PVB group. The higher concentration of levobupivacaine (0.375%) that we used in our study might have helped better spread of the drug in the paravertebral space. Moreover, we used ultrasound guidance for both PVB and PECS block unlike the above study which used ultrasound only for PECS block. Real-time visualization might have improved accuracy of PVB.[16]

Postoperative pain assessment was done by using VAS scores. At 12 h 12 patient needed tramadol in Group 1 (PVB) and 4 patients needed tramadol in Group 2 (PECS). This difference is clinically significant. Similar results were observed by Sherif Wahba et al. where numerical rating scale (NRS) score at rest was lower in PECS group compared with PVB Group ($p < 0.001$).[16]

In MRM surgeries, axillary dissection is done and it has been reported that in the presence of axillary dissection PVB is inadequate. This could explain the superior results with Modified PECS block. Another study done by Sopena-Zubiria and colleagues also found out that postoperative pain scores were significantly reduced when pectoral nerve block was added to PVB, however in this study patients had undergone minor breast surgeries; subpectoral implants.[17,18]

In our study, at 24 h both VAS score and tramadol requirement were comparable in both the Groups. Rather dynamic VAS scores of patients with PVB were better than with PECS block. Though it did not reach statistical significance. This was in variance with the study by Wahba et al. where at 18 h and 24 h numerical rating score (NRS) was lower in PVB Group compared with Pecs Group ($p= 0.008$ and <0.001 respectively). During movement, NRS at 18 and 24 h was significantly lower in PVB Group ($p< 0.001$). Possible explanation for the longer duration of analgesia in the PECS group could be the higher concentration (0.375%) of levobupivacaine used in our study instead of 0.25% levobupivacaine which was used in the other study, as we know that more concentration of LA causes more duration of analgesia. Our assessment is of course limited by the small number of published studies on PECS block.

In our study ondansetron requirement was higher in the PVB group both at 6 and 12 h compared to pecs block group. but this includes the ondansetron 4 mg that we had given before each dose of tramadol as part of standard of patient care. Only two additional ondansetron doses were necessary in two patients of PVB group.

None of the complications related to both the blocks were observed during our study apparently because of ultrasound assistance. This suggests that both the block were safe when these blocks were performed under ultrasound guidance. One patient had come with postoperative bleeding after 6 h due to accidental vessel clip detachment which was re-explored and patient was removed from study.

Postoperative VAS score was found to be higher in PVB group and it was statistically significant at 6 h and 12 h suggesting better postoperative analgesia in pectoral nerve block group during first 12 h. We did not encounter any assumed complication of pectoral nerve block and PVB given by ultrasound guidance. This definitely reflects enhanced safety profile due to use of ultrasound.

Modified PECS block is technically easy and safe to perform. In addition, it does not require change of position during giving block after induction, Thereby, saving on time and manpower. Undoubtedly modified PEC block has established a place for itself in such a short time since its introduction in 2011.

CONCLUSION

Modified PECS and paravertebral blocks, both are good in management of postoperative pain in breast surgeries. In our study, Modified PECS block has stood up as an effective alternative choice for MRM surgeries with its ease of performing the block. We found better analgesia in the initial 12 h postoperatively in modified PECS block group. The blocks were comparable in terms of VAS score at rest and during physiotherapy at 24 h postoperatively for analgesia. Therefore, we can suggest that modified PECS block is a better alternative in breast surgeries for postoperative analgesia. Although larger RCTs are required to establish the fact.

Conflict of interest: None declared by the authors.

Authors' contribution:

RJ + SB: Concept, conduction of the study work

MS: Concept, statistical analysis and manuscript editing

RT: literature search

DK + SS: manuscript editing

REFERENCES

1. McGuire S. World cancer report 2014. Geneva: WHO Press; 2015.
2. Tyczynski JE, Bray F, Parkin DM. ENCR cancer fact sheets. Alcohol; 2001.
3. Schnabel A, Reichl SU, Kranke P, Pogatzki-Zahn EM, Zahn PK. Efficacy and safety of paravertebral blocks in breast surgery: a meta-analysis of randomized controlled trials. Br J Anaesth. 201;105(6):842-52. [PubMed] DOI: 10.1093/bja/aeq265
4. Pennefather SH, Quarterman CP, Klinger RY, Kanellakos GW. Pain management after thoracic surgery. Principles and practice of anesthesia for thoracic surgery. Springer; 2019. p. 981-1027.
5. Batra RK, Krishnan K, Agarwal A. Paravertebral block. J Anaesthesiol Clin Pharmacol. 2011 Jan;27(1):5-11. [PubMed]
6. Chang SH, Mehta V, Langford RM. Acute and chronic pain following breast surgery. Acute Pain. 2009;11(1):1-4.
7. Blanco R. The 'pecs block': a novel technique for providing analgesia after breast surgery. Anaesthesia. 2011;66(9):847-8. [PubMed] DOI: 10.1111/j.1365-2044.2011.06838.x
8. Terkawi AS, Tsang S, Sessler DI, Terkawi RS, Nunemaker MS, Durieux ME, et al. Improving analgesic efficacy and safety of thoracic paravertebral block for breast surgery: a mixed-effects meta-analysis. Pain Phys. 2015 Sep;18:E757-80. [PubMed]
9. Bhargava S, Tamaskar A, Chakravarty N, Shende S, Shidhaye RV. Comparative study of thoracic epidural fentanyl with sufentanil for postoperative pain relief in thoracic surgery. Anaesth Pain Intensive Care. 2014;18(3):260-4. [Free full text]
10. Hura G, Knapik P, Misiolek H, Krakus A, Karpe J. Sensory blockade after thoracic paravertebral injection of ropivacaine or bupivacaine. Eur J Anaesthesiol. 2006 Aug;23(8):658-64. [PubMed] DOI: 10.1017/S0265021506000561
11. Najarian MM, Johnson JM, Landercasper J, Havlik P, Lambert PJ, McCarthy D. Paravertebral block: an alternative to general anesthesia in breast cancer surgery. The Am Surg. 2003 Mar 1;69(3):213-8. [PubMed]
12. Eason MJ, Wyatt R. Paravertebral thoracic block—a reappraisal. Anaesthesia. 1979 Jul;34(7):638-42. [PubMed]
13. Pusch F, Freitag H, Weinstabl C, Obwegeser R, Huber E, Wildling E. Single-injection paravertebral block compared to general anaesthesia in breast surgery. Acta Anaesthesiol Scand. 1999 Aug;43(7):770-4. [PubMed]
14. Tamura T, Mori S, Mori A, Ando M, Yokota S, Shibata Y, Nishiwaki K. A randomized controlled trial comparing paravertebral block via the surgical field with thoracic epidural block using ropivacaine for post-thoracotomy pain relief. J Anesth. 2017 Apr 1;31(2):263-70. [PubMed] DOI: 10.1007/s00540-017-2307-5
15. Lönnqvist PA, MacKenzie J, Soni AK, Conacher ID. Paravertebral blockade: failure rate and complications. Anaesthesia. 1995 Sep;50(9):813-5. [PubMed]
16. Wahba SS, Kamal SM. Thoracic paravertebral block versus pectoral nerve block for analgesia after breast surgery. Egy J Anaesth. 2014 Apr 1;30(2):129-35. DOI: 10.1016/j.egja.2013.10.006
17. Sopena-Zubiria LA, Fernández-Meré LA, Valdés CA, Muñoz FG, Sánchez JA, Ibáñez CE. Thoracic paravertebral block compared to thoracic paravertebral block plus pectoral nerve block in reconstructive breast surgery. Rev Esp Anestesiol Reanim. 2012 Jan;59(1):12-7. [PubMed] DOI: 10.1016/j.redar.2011.10.001
18. Kulhari S, Bharti N, Bala I, Arora S, Singh G. Efficacy of pectoral nerve block versus thoracic paravertebral block for postoperative analgesia after radical mastectomy: a randomized controlled trial. Br J Anaesth. 2016 Aug 19;117(3):382-6. [PubMed] DOI: 10.1093/bja/aew223

★★★★★