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Original Research Article

Comparative study between ultrasound guided modified pectoral nerve block versus erector spinae block in breast surgeries-prospective randomised comparative study

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ABSTRACT

Background: Breast cancer is the most common cancer in women, comprising approximately 25% of all cases. Failure to provide effective pain control is associated with poor quality of recovery & chronic postsurgical pain after breast surgery. According to a recently published PROSPECT guideline, pectoral nerve (PECS) blocks seem to be an effective alternative to PVB for postsurgical pain management in breast surgery. In order to relieve post-operative pain in patients undergoing MRM, in this study we compared the efficacy of modified pectoral nerve block versus erector spinae plane block for breast cancer surgeries.
Methods: A comparative study was conducted among 80 female patients of age 25-65 years scheduled for modified radical mastectomy surgery with ASA class I and II after obtaining approval from ethical committee. Written informed consent was obtained and research process were explained to the patients. They were randomly allocated into two groups of 40 each. Group 1: was assigned to receive 0.2% Ropivacaine 25ml for Erector spinae block and Group 2: Was assigned to receive 0.2% ropivacaine 25 ml for modified pectoral nerve block, p value <0.05 was considered statistically significant.
Results: In patients receiving modified pectoral nerve block (PEC 2) there was considerably lesser opioid consumption, Ionger duration of analgesia and lesser postoperative pain score as compared to patients receiving erector spinae block (ESP) for modified radical mastectomy surgeries.
Conclusions: Modified Pectoral nerve block is a potential analgesic technique in breast surgeries since it has less perioperative opioid consumption, proIonged duration of anaIgesia, Iesser postoperative pain score when compared to Erector Spinae block.

Keywords: Ropivacaine, Modified pectoral nerve block, Erector spinae block, Modified radical mastectomy

INTRODUCTION

Breast cancer being the most common cancer in women, affects one in nine females during their lifetime.[1] Management is multidisciplinary and usually involves a combination of surgery, radiotherapy and chemotherapy. For majority of breast cancer cases, surgery is the primary and most effective therapeutic intervention.[2] Indeed, the risks of chronic postsurgical pain and long-term opioid dependence after breast cancer surgery are 29% and 11% respectively. This has fuelled an interest in regional anaesthesia for breast surgeries. Thoracic paravertebral,

thoracic epidural, intercostal nerve blocks have been used for anesthesia during modified radical mastectomy, but their applications are limited by the complicated nature of the procedures.[3] Many trials have been published and some meta-analyses revealed a high analgesic efficacy following PECS II blocks compared with no block or PVB.[4] The Pecs II like the Pecs I, targets the interfacial plane between the pectoralis major and minor muscles and it also targets the interfacial plane between the pectoralis minor and serratus anterior muscle, aiming to block intercostal nerves 3 to 6, intercostobrachial, and long thoracic nerves, all of which are required for axillary node dissection.[5]

The ESP block is easy to perform with a well- defined sonographic end-point: an injection between the bony transverse process and erector spinae muscle. It hasbeen shown to spread to the epidural and neural foraminal spaces, intercostal spaces with widespread cranio-caudal distribution along the paraspinal muscles allowing indirect access to the paravertebral space. And it not only covers the anterior and lateral chest wall, but also the posterior chest wall. Erector spinae blockade being more superficial, has a less risk of pneumothorax than paravertebral block and also lesser risk of neuraxial damage or haemodynamic instability dueto sympathetic blockade than intrathecal or epidural block.[6] Several studies have demonstrated the efficacy of modified PECS block & ESP block for breast surgeries with varying results. In this study, PECS and Erector spinae Block were compared using ultrasound guidance for postoperative morphine consumption inBreast surgeries.

Aim and objectives

This study aims to compare the analgesic efficacy of Pectoral nerve block versus Erector Spinae block in patients undergoing breast surgeries in terms of postoperative opioid consumption, duration of analgesia, postoperative pain scores and side effects.

METHODS

This comparative study was conducted over a period of 1 year from November 2021 to October 2022 among 80 female patients aged between 25 to 65 years, ASA class I and II posted for modified radical mastectomy surgeries in Government general hospital, Rangaraya medical college, Kakinada. After obtaining institutional ethics committee approvaland informed written consent from the patients, this study population is allocated into two groups of 40 each. Group 1: Was assigned to receive 0.2% Ropivacaine 25mI for Erector spinae block. Group 2: Was assigned to receive 0.2% Ropivacaine for modified pectoral nerve block 15mI between pectoralis minor and serratus anterior and 10mI between pectoralis major and minor.

Inclusion criteria

Inclusion criteria for current study were; female patients of aged 25 to 65 years scheduled for elective unilateral modified radical mastectomy under general anaesthesia were enrolled in this study, patients belonging to ASA status 1and 2.

Exclusion criteria

Exclusion criteria for current study were; patients not willing to participate in the study. patients with ASA 3 and 4 status, diabetes mellitus, hypertension, cardiac, renal, pulmonary and liver diseases and patients with; Bilateral surgery, Chronic neurological disease, Bleeding disorder or receiving anticoagulants, BMI >40kg/m2, hypersensitivity to the test drugs and substance abuse, chronic drug addict.

Procedure

All patients were thoroughly evaluated preoperatively and optimized before the surgical procedure. Demographic data (age, weight, ASA status and duration of surgery) and basal vital parameters like heart rate, non invasive blood pressure, BO2 saturation, ECG, respiratory rate were recorded before starting thecase. The blocks were performed under aseptic precautions 30 minutes before surgery with a 25 gauge spinal needle using the ultrasound machine and linear array probe.

Erector spinae block was performed in Group 1 patients in the sitting position. After infiltrating local anaesthetic, the needle was inserted in a cephalocaudad direction to contact the transverse process of T4 and 25mlof 0.2% ropivacaine was injected. The correct placement was identified by linear fluid spread that lifted the erector spinae muscle from the underlying transverse processes.

Modified Pectoral nerve block was performed in Group 2 patients on the side of surgery with the patient in the supine position and the arm abducted at 90 degree. Infraclavicular region was scanned to locate the axillary artery and vein. At the level of third rib two ml of 2% lignocaine was used for skin infiltration. The needle was advanced in an oblique manner until its tip was visualised between the pectoralis minor and serratus anterior muscle and 15 ml of 0.2% Ropivacaine was deposited. The needle was withdrawn till the tip was located between the pectoralis major and minor and 10 ml of 0.2% Ropivacaine was injected there. After performing the block all patients were monitored for 30 minutes for heart rate, blood pressure, SPO2 and for the level of sensory block with pin-prick sensation from T1 to T8. If sensory block was not attained until 30 minutes of administration of GA it was considered as a block failure. Any bIock-related complications such as hypotension, vascuIar puncture, pneumothorax, seizures etc., were recorded.

General anaesthesia was administered thereafter with standard GA regimen in both the groups comprising of glycopyrrolate, midazolam, fentanyl, propofol, vecuronium & reversal of all cases was done with neostigmine and glycopyrrolate as per the standard dosage. surgical procedure was commenced then. After

administering GA, in both the groups pain scores were assessed intraoperatively and postoperatively using numerical rating scale during the following time periods i.e., 30 mins, 1 hr, 2, 4, 6, 8, 12, 16, 24hr. First rescue analgesia was given with Injection Morphine sulfate 0.1mg/kg IV when numerical rating scale score is equal to or more than 4.If patient requires second dose of rescue analgesia only half of the original dose of morphine is given taking into consideration the adverse effect of morphine. Total morphine consumption in 24 hours was calculated. Numerical rating scale score used for assessing pain is depicted in the (Figure 1).

Statistics

Sample size was taken considering the data based on the previous study done by Amutha et al. The alpha error was taken as 0.05% and beta error was taken as 0.90, margin of error as 5% and mean rescue dose requirement difference between 2 groups was considered to be 2.5-5mg.So sample size was taken as 40 per group in order to account for errors. Age, weight, duration of surgery was analysed with t-test and ASA status with chi- square test. Hemodynamic parameters like HR. Mean arterial pressure, SPO2 were recorded and compared in both the groups with t-test. Mean duration of analgesia, oipioid consumption and Numerical rating scale scores were analysed with t-test. Adverse effects in both the groups were analysed with chi square test. Data was represented as absolute numbers, percentages, mean and standard deviation, p value less than 0.05 is considered significant.

RESULTS

A total of 80 patients were enrolled for the study of 40 patients in each group. All patients completed the study. None of them had failed block. Results of the study were: In respect to demographic data; in both the groups Age, weight and duration of surgery were compared using t test and was found to have statistical insignificance since p value is <0.05 (Table 1).

Table 1: Demographic data comparison between the group.

Variables	Group ESP		Group PECS		T test	P value
	Mean	SD	Mean	SD		
Age	48.53	6.42	50.23	7.46	1.09	0.278
Weight	56.11	7.46	57.16	6.23	0.68	0.49
Duration of surgery (min)	89.1	7.59	90.2	9.45	1.61	0.109

Table 2: Comparison of ASA status between two groups.

ASA status	Group ESP, N (%)	Group PECS, N (%)	Chi-Square	P value
Grade 1	18 (45)	14 (35)	0.8333	0.361
Grade 2	22 (55)	26 (65)		

Table 3: Comparison of opioid consumption between two groups.

Total morphine consumed (mg)	Group ESP	Group PECS	T test	P value
Mean	7.5	4.6	3.53	0.0007
SD	2.1	1.23		

Table 4: Comparison of mean duration of analgesia between the groups.

Duration of analgesia (min)	Group ESP	Group PECS	T test	P value
Mean	291.6	416.4	3.99	<0.001
SD	1.43	2.97		

Regarding ASA status, patients belonging to ASA grades 1 and 2 were taken for the study. Their distribution is analyzed using a chi-square test for two proportions of different samples, and the p value was calculated to be 0.36, which is statistically insignificant and was represented in (Table 2). It was observed that morphine consumption was significantly high in patients of ESP group compared to PECS group, and this mean consumption of morphine between the groups was statistically significant since p value is found to be 0.0007 (Table 3). Mean duration of analgesia was higher in group PECS i.e., 416.4 minutes compared to ESP Group 291.6 minutes and this mean duration difference between the groups was found to be statistically significant since p value was found to be <0.001 (Table 4). Regarding pain scores, mean numerical rating scale was statistically highly significant between both the groups since p value <0.01. For Patients belonging to ESP group;NRS Score was moderate but in PECS group

it was mild in most of the time points represented in (Table 5).

Table 5: Comparison of mean numerical rating scale between the groups.

Numerical rating scale score	Group ES	Group PN	T test	P value
30 minutes	3.4+0.8	1.90+0.2	7.66	<0.01
1 hour	3.6+0.9	2.20+0.5	9.82	<0.01
2 hours	3.9+0.7	2.80+0.4	14.9	<0.01
4 hours	4.7+0.8	3.40+0.3	14.8	<0.01
6 hours	4.9+0.9	4.10+0.2	13.71	<0.01
12 hours	4.1+0.9	3.10+0.3	16	<0.01
16 hours	4.2+0.7	2.40+0.4	14.9	<0.01
24 hours	3.8+0.5	2.50+0.4	7.06	<0.01

Table 6: Distribution of adverse effects between the groups.

Side effects	Group ESP	Group PECS	Chi-square	P value
Vomiting				
Yes	4 (10)	1 (2.5)	1.92	0.16
No	36 (90)	39 (97.5)		
Nausea				
Yes	2 (5)	0 (0)	0.34	0.55
No	38 (95)	40 (100)		

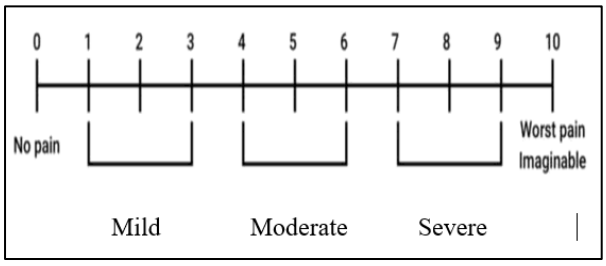

Figure 1: Numerical rating scale score.

Comparison of haemodynamic status it was found that at the baseline mean heart rate was comparable between the groups, but after 5 minutes of induction heart rate was lower in PECS group compared to ESP group, but statistically insignificant (Figure 2). Mean arterial pressure was found to be comparable between the groups at baseline, but at 5 minutes after induction and later on it was observed that MAP was lower and steady in patients belonging to PECS Group compared to ESP group, clinically but statistically insignificant (Figure 3). Regarding adverse effects, it was found that 10 % of patients experienced vomiting in group ESP and 2.5 % of patients in group PECS and this difference in the proportion between the groups was not statistically significant. Other symptom like nausea has been observed in the ESP group patients of 5% but not in PECS group and it was also not statistically significant (Table 6).

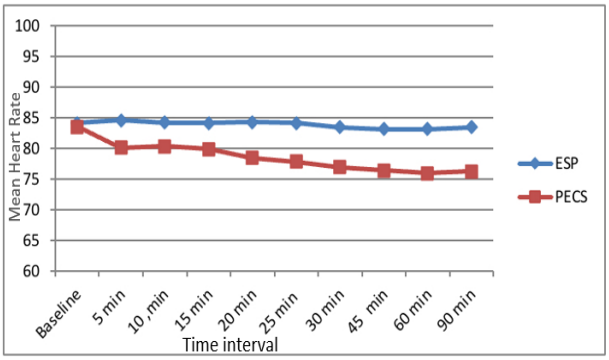

Figure 2: Mean heart rate comparison between the groups.

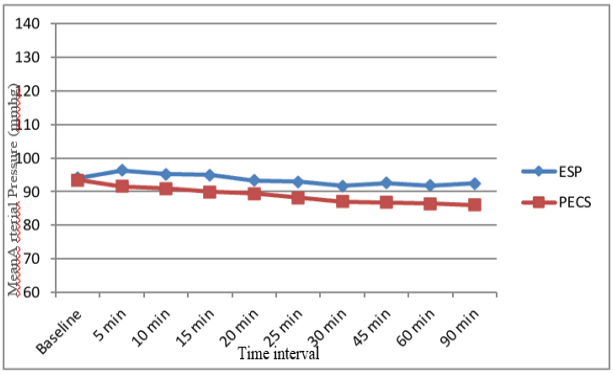

Figure 3: Mean arterial pressure comparison between the groups.

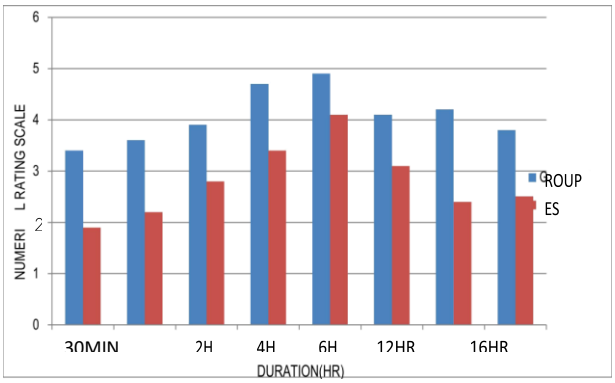

Figure 4: Comparison of mean numerical rating scale between the groups.

DISCUSSION

The modified pectoralis nerve block is a relatively newer block technique which involves deposition of the local anaesthetic solution in the inter-fascial planes between the pectoralis major, minor and serratus anterior muscle. They provide regional anaesthesia both to the chest wall and axillary areas as it blocks the lateral and medial pectoral nerves, intercostobrachial nerve, thoracic intercostal nerves and long thoracic nerves. The median and lateral pectoral nerves are implicated in post mastectomy surgical pain as

they carry nociceptive and proprioceptive fibres. Also, the motor nerves supplying the chest wall carry post ganglionic fibres from cervical and thoracic ganglion and hence, long thoracic and thoracodorsal nerves also contribute to post mastectomypain. It was first described by Blanco et al in 50 patients undergoing MRM and they reported good analgesia up to first 8 hours postoperatively.[7] These findings are consistent to our study where the patients in the PECS group had lower pain scores postoperatively compared to ESP group. Erector spinae plane block is an ultrasound guided novel interfascial plane block where local anesthetic is injected to the plane between thoracic transverse process and erector spinae muscle and can be utilized to reduce postoperative pain effectively in various surgical procedures such as breast, thoracic, abdominal and lumbar surgery. The mechanism of ESPB was thought to be similar to paravertebral block, which achieve a multi-dermatomal sensory block of the posterior, lateral, and anterior thoracic wall. Ultrasound-guided ESP block was studied by Zhang et al and they concluded that ESP Block is an effective approach for reducing morphine consumption and pain intensity within the first 24 h after breast cancer surgery, compared with GA alone.[8] Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is a pure S(-) enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles. A Study by Kuthiala et al regarding ropivacaine pharmacology concluded that clinically adequate doses of Ropivacaine appear to be associated with a lower incidence or grade of motor block than bupivacaine. Thus, Ropivacaine with its efficacy, lower propensity for motor block, reduced potential for CNS toxicity and cardiotoxicity, appear to be an important option for regional anaesthesia and management of postoperative pain.[9,10] There have been very few studies comparing the efficacy of Erector spinae with modified Pectoral nerve block in breast surgery and there are no significant differences between the procedures. Thus in this study, we have compared modified Pectoral nerve block and Erector spinae Block utilising ultrasound guidance for postoperative pain relief in Breast surgeries. Study includes total 80 patients with each group of 40 patients. Ropivacaine with concentration of 0.2% was used in the study with PECS group receiving 25 ml and Erector spinae group receiving 25 ml. Postoperative opioid consumption, Duration of analgesia (time from onset of blockade to time to first rescue analgesia), postoperative pain scores and incidence of post operative side effects if any were studied in the current study. This study demonstrated that mean duration of analgesia was more in group PECS (6.9 hours) compared to Group ESP (4.8 hours) and this difference was statistically significant since p value <0.001. Similar study conducted by Sinha et al observed that mean duration of analgesia was 7.26 hour in PECS group compared to ESP group which was 5.87 hour and this difference is also statistically significant.[11] Similar finding was seen in Blanco R Fajardo M study which used PEC 2 block in 50 patients undergoing MRM. All these patients reported good analgesia upto 8 hours. Regarding opioid consumption there was significant consumption of morphine by the patients from group ESP (7.5 mg) compared to group PECS (4.6 mg) and this mean consumption of morphine between the groups was statistically significant since p value is 0.0007.

Similar study conducted by Rani et al comparing modified pectoral nerve block versus erector spinae block in MRM surgeries also observed that opioid consumption post operatively was lower in group PECS (3.12 mg) compared to group ESP (17.96 mg) which was statistically significant.[11] A study by Wahba et al comparing thoracic paravertebral block versus pectoral block in patients undergoing MRM in terms of morphine requirement and duration of postoperative analgesia showed that the patients receiving PECS block had better pain relief and less requirement of opioids than thoracic paravertebral block.[12] Numerical rating scale (NRS) was used for post operative pain assessment in the study and it was observed that pain score was lesser in PECS group compared to ESP group which is statistically significant (p value< 0.01). A study by Baker et al titled Erector spinae block versus PECS Block in breast surgeries concluded that lesser pain intensity and low NRS Score was seen in PECS block patients for 6 hours postoperatively; then the two techniques showed a comparable pain severity scores upto 24 hours after the surgery.[13] Gad et al conducted a study among 50 female patients comparing the US guided Erector spinae block and modified pectoral nerve block in MRM surgeries. Their results showed that VAS score has no significant difference between the two studied groups ESP and PECS at the postoperative 0 hrs; however, ESP group recorded significantly higher values at all other time points compared with PEC 2 group which supports our study.[14] A study by Bhavani et al showed significant difference between ESP and PECS II group in NRS score at 30th min, first and second hour. But Postoperative paracetamol consumption was higher in PECS group than ESP group which contradicts our study where postoperative analgesic requirement in our study is less in PECS than ESP.[15] In this study post operative vomiting and nausea was seen among 10% and 5% patients respectively in ESP group and 2.5% patients in PECS Group had vomiting and this difference in the proportion of adverse effects was statistically not significant. In a study by Rani et al nausea was observed among 3 patients in group ESP and 2 patients in PECS group and also found that it was statistically not significant (p value=0.64).[11]

CONCLUSION

Both modified pectoral nerve block and erector spinae block under ultrasound guidance were effective in producing perioperative analgesia in breast surgeries. But modified pectoral nerve block produced prolonged duration of postoperative analgesia, lesser perioperative opioid consumption and lesser postoperative pain scores when compared to erector spinae block.

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