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Original Research Article

Effects of adding dexmedetomidine to ropivacaine for paravertebral block in breast cancer surgery

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Abstract

Background: Effective pain control after surgery is an important part of taking care of someone who has had surgery. A paravertebral block (PVB) is becoming more popular for breast surgery and is thought to be the best method for anaesthesia and pain relief after surgery. Several local and regional anaesthetic techniques were looked at to see if they could reduce post-surgery pain after breast surgery. The thoracic PVB technique looks promising because it reduces post-surgery pain, reduces opioid use, reduces side effects like drowsiness and the risk of breathing problems, and saves money. The goal of this study was to find out how well dexmedetomidine works with ropivacaine as a paravertebral block in breast cancer surgery.

Material and Methods: Randomly, 100 women having breast surgery were split into two groups, Group PR and Group PRD. For thoracic paravertebral block, Group PR got 0.5% ropivacaine (0.3 ml/kg) with 1 ml normal saline, while Group PRD got the same amount of ropivacaine with 1 mcg/ml of dexmedetomidine. The groups were watched to see how well the block worked, how the hemodynamic parameters changed at different times, when the sensory block started, how long it lasted and if there were any complications during or after the surgery.

Results: When added to ropivacaine in TPVB as an adjuvant, dexmedetomidine gives good pain relief during and after surgery and reduces the need for painkillers after surgery. There were no problems with the technique or the way the blood flowed and there were no bad effects from the dexmedetomidine.

Conclusion: TPVB with ropivacaine and dexmedetomidine as an add-on can be a better choice for good pain relief and stable blood flow during breast surgery without complications or side effects.

Keywords: Thoracic paravertebral block, dexmedetomidine, ropivacaine

Introduction

Effective pain control after surgery is an important part of care. It helps keep the patient comfortable, gets them up and moving faster, reduces the risk of deep vein thrombosis, speeds up recovery, and makes it less likely that neuropathic pain will develop. It also lowers the cost of care. A good painkiller can lessen the bad effects of surgery [1, 2]. Postoperative

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pain can be treated with different drugs (opioids vs. non-opioids), routes (oral, intravenous, neuraxial, regional), and ways (patient-controlled vs. "as needed"). Traditionally, opioids have been the mainstay, but there is more and more evidence to support a multimodal approach, which aims to reduce opioid side effects (like nausea and constipation) and improve pain scores [3, 4].

Breast cancer (BC) is one of the most common types of cancer in women. In the USA in 2019, there will be 268,600 new cases and 41,760 deaths from BC [1]. Surgery is the main way to treat management of patients with cancer of the breast, which leads to a 40% compared to women who didn't have surgery; they had a higher risk of dying. But it is known that patients go through several. There can be problems after surgery for breast cancer, like postoperative pain, postoperative nausea and vomiting (PONV), pneumothorax, bradycardia, respiratory depression and so on. These problems not only have a big effect on the quality of life of patients, but they also raise the cost of care at the hospital. So, it is urgently need to find effective ways to stop these complications [4].

Breast cancer is the most common type of cancer and it causes nausea, vomiting, pain after surgery, and pain that lasts for a long time. So, after surgery for breast cancer, there needs to be effective pain management [5].

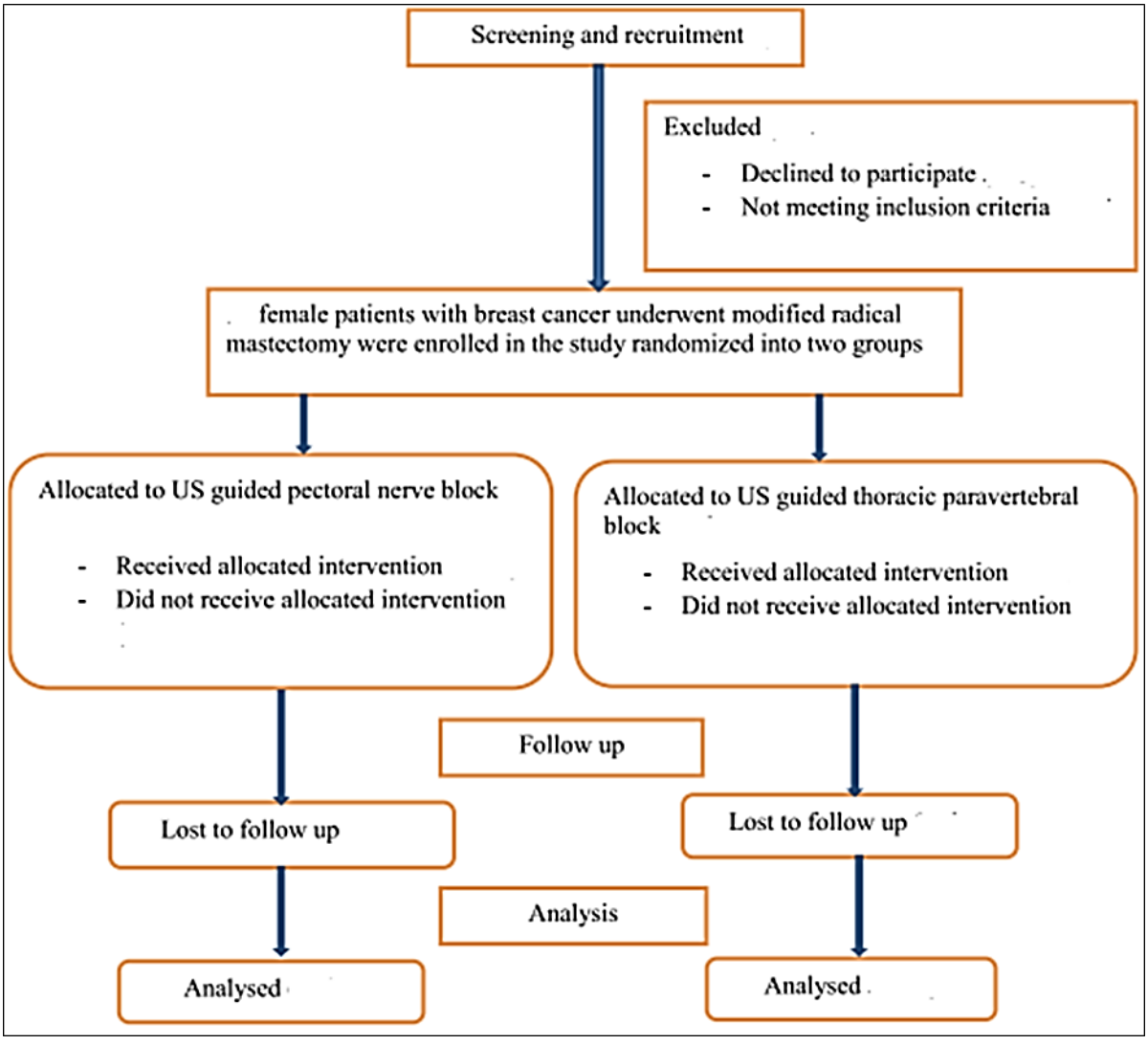

Fig 1: Consort diagram showing selection and randomization of patients

Thoracic paravertebral block (PVB) is used to relieve pain after thoracotomy and mastectomy. It seems to be a good idea because it reduces post-surgery pain, makes people

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less sleepy and less likely to have trouble breathing, saves money and lowers the risk of chronic post-surgery pain. It also improves subcutaneous oxygenation at the wound site, which could lower the risk of infection and help the wound heal [6]. A paravertebral block (PVB) is becoming more popular for breast surgery and is considered the method of choice for anaesthesia and pain relief after surgery. There are two common variations: a single site injection, in which a larger amount of medicine is injected into one paravertebral space, and a multiple site injection, in which 3-4 cm3 of medicine is injected into multiple levels. The single site technique gives anaesthesia to only one side of 4-5 dermatomes, which may not be enough to cover all relevant dermatomes [7]. We have thought about a thoracic paravertebral block at the T1, T3 and T5 levels on the same side as the surgery.

Dexmedetomidine is a highly selective alpha-2 adrenoreceptor agonist that has been shown to both calm and relieve pain. Even though it's only approved for intravenous (IV) sedation, it's been used a lot for non-approved uses, like neuraxial and peripheral nerve blocks, with good results [8]. When dexmedetomidine was added to LA for epidural analgesia, caudal block, subarachnoid block, PVB, brachial plexus block, ulnar nerve block, and greater palatine nerve block, the analgesia lasted much longer [9]. But there was only one study in English that looked at how adding dexmedetomidine to LA in PVB for breast surgery affected the patients [10]. So, the goal of this study was to see if PVB with ropivacaine and dexmedetomidine could improve pain relief and reduce the need for morphine after surgery compared to PVB with ropivacaine or no PVB in patients having major breast cancer surgery, such as modified radical mastectomy (MRM) and breast conservation surgery with axillary lymph node dissection [11].

The goals of our study were to compare the effectiveness of thoracic paravertebral block in breast surgeries, to look at hemodynamic parameters at different time levels, to find out when the sensory block started, to compare the duration of analgesic effect of thoracic paravertebral block with local anaesthetic agents like injections of ropivacaine and ropivacaine with dexmedetomidine, to find out when the first painkiller was needed [12, 13].

Material and Methods

After getting permission from the Institutional Ethics Committee-Human, 100 women between the ages of 18 and 60 with ASA I, II or III who were going to have breast cancer surgery between June 2020 and June 2022 were signed up for this prospective, randomized, double-blind control study at Medical College. All of the patients gave written permission to get anaesthesia and be in the study before they were given anaesthesia or joined the study. Two groups of 50 patients each were made out of the 100 patients. Patients in Group PR got Inj. Ropivacaine 0.5% (0.3ml/kg) with 1 ml of normal saline, while those in Group PRD got Inj. Ropivacaine 0.5% (0.3ml/kg) with 1 mcg/kg of Dexmedetomidine. The patients and their caretakers were told in clear language about the benefits and possible side effects of the method used. All of the patients had a thorough checkup before anaesthesia. This included getting a history, a general exam, a systemic exam, and a local neurological exam. All of the patients had their regular tests done. During the pre-operative visit, all patients were taught how to use a number scale to rate their pain. Patients with known allergies to local anaesthetics and dexmedetomidine were also left out [14-16].

The procedure was explained the day before the surgery and the patient was told not to eat or drink after 10 pm. On the day of surgery, the IV line was set up and Injection Dextrose Normal Saline (DNS) was started. Standard monitors like Electro Cardio Gram (ECG) leads, Non-Invasive Blood Pressure (NIBP) cuff and pulse oximeter were used and baseline parameters like Pulse Rate (PR), Systolic, Diastolic and Mean Blood Pressure (SBP, DBP, and MBP, respectively), SpO_2 and pain score were recorded. Premedication was given in the form of an IV injection of Glycopyrrolate (0.2 mg), an IV injection of Fentanyl (1 mcg/kg),

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an IV injection of Ranitidine (50 mg) and an IV injection of Ondansetron (0.02ml/kg) [17-19].
A resident doctor who was not directly or indirectly involved in the study filled syringes that looked the same with a local anaesthetic mixture. Patients were put into two groups at random using a computer-generated random number and sealed, opaque envelopes to hide the groups. The anesthesiologist who gave the block and checked the parameters didn't know what drugs were given in TPVB. Before giving general anaesthesia, a loss of resistance technique was used to give a thoracic paravertebral block at the T1, T3 and T5 levels. The medicine and dose were given based on the group's PR and PRD. Under aseptic precautions, TPVB is given on the side of operation at the T1, T3 and T5 levels [20]. The patient was told to sit with their head and neck bent forward. Find the spinous process of the T1, T3 and T5 vertebrae, and mark a point 2.5 cm to the side of it. After LA was injected into the skin and subcutaneous tissue, the 18G Tuohy needle was moved in a perpendicular direction for 4-5 cm until it hit the transverse process. The needle was then moved 5-10 mm past the transverse process in a cephalad direction until the LOR was seen. After the blood/CSF aspiration test came back negative, 3 ml of 1.5% lignocaine with adrenaline was injected as a test dose. Five minutes later, a local anaesthetic drug will be given, along with adjuvants based on the groups above. Sensory block was checked on both sides every 5 minutes with a pinprick to see how bad it was and if paresthesia developed on the other side [21, 22]. If there was no paresthesia in any of the desired dermatomes, the block was thought to have failed. After giving a block, preoxygenation with 100% oxygen for 3 minutes, induction with Sodium thiopentone 3-5 mg/kg, and tracheal intubation helped by intravenous injection of Succinylcholine 1.5-2 mg/kg. Controlled ventilation with isoflurane and 30: 60 O_2: N_2O kept the person under anaesthesia. Vecuronium was used to stop nerves and muscles from working. During the procedure, vital signs like HR, NIBP-systolic, diastolic, and mean, $ETCO_2$, SpO_2 and ECG were tracked [23, 24].
For pain relief during surgery, 1 mcg/kg of fentanyl was given before surgery. Every patient who had pain or a VAS score of more than 4 after surgery was given 1 mg/kg of tramadol through an IV. The onset time of sensory block, intraoperative hemodynamic stability, time to first analgesic request, postoperative tramadol consumption over 24 hours, and sedation scores were all recorded [25].
Ramsay Sedation Score was used to measure the level of sedation at 30, 2, 4, 6, and 8 hours after surgery. RSS 1=agitated, restless; 2=cooperative, calm; 3=responds to verbal commands while sleeping; 4=quick response to glabellar tap or loud voice while sleeping; 5=slow response to glabellar tap or loud voice; 6=no response to glabellar tap or loud voice. The Visual Analogue Scale is a simple way to measure how much pain a patient is feeling at a certain time. The information was given as mean standard deviation (SD). Unpaired t-test was used for demographic data, hemodynamic parameters, the start and length of sensory blockade and the length of analgesia. If the P-value was less than 0.001, it was seen as very important [26].

Processing of statistics: The two researchers used statistical tables that had already been made to get their own sets of data, talk about any differences, and settle them. Cochrane Collaboration's RevManS.1 software was used to do the analysis. Blood loss during surgery, blood loss after surgery, and total. The amount of blood loss was judged by the weighted mean difference (WMD), which is written as a confidence interval (CI); allogeneic blood transfusions and the number of people who got VTEs were odds ratio (OR) was used to figure out how good something was expressed as 95% CI. The fixed effect model is used when there is no statistical difference between the groups (P > 0:1, I2 50%) is used; when a study has statistically different groups of people (CP 0:1, I2 > 50%), the sensitivity analysis is used to find out if the source of heterogeneity can't get rid of heterogeneity, if there is clinical consistency, the random effects model shall be used; if not, a descriptive analysis shall be

done shall be taken on.

Observation and Results

Table 1: The demographic profile (age, weight, ASA grade), duration of surgery were comparable for both the groups

	Group PR	Group PRD	P value
Age (yr)	47.8±4.94	50.84±6.36	0.06
Weight (kg)	55±14.14	56.6±21.21	0.75
Duration of surgery (min)	119.2±28.28	120.8±28.28	0.84
ASA grade (1/2/3)	10:8:7	10:10:5	
	In percentage 40%, 32%, 28%	In percentage 40%, 40%, 20%	

Table 2: The demographic profile-BMI

Group	N	Mean	SD	P Value
PR	50	24.393	1.1036	0.350
PRD	50	24.157	1.2131	Not Significant

Both groups had about the same number of people in each group. The average age (in years) of Group PR (47.84.94) and Group PRD (50.846.36) is the same and not statistically different (P > 0.005). Both Group PR (5514.14 kg) and Group PRD (5621.21 kg) have similar weights, which are not statistically significant (P value > 0.005) (as shown in table 1 and 2). The difference between Group PR (119.228.28 minutes) and Group PRD (120.828.28 minutes) is not statistically important (P > 0.005). The average time until sensory block started was longer in group PR than in group PRD, which was statistically significant (as shown in table 3). The average length of pain relief was longer in group PRD than in group PR (as shown in table 4). There is a statistically significant difference between groups PR and PRD in how much tramadol they need (as shown in table 5 and 6). The patients were happier in the PRD group than in the PR group (as shown in table 7). Four of the 50 patients in the PR group got sick after surgery, but none of the patients in the PRD group did. This is not statistically significant. In the PRD group, 4 out of 50 patients had low blood pressure during surgery, but there were no cases of low blood pressure in the PR group, which is not statistically significant. Table 8 showing pulse rate of patients.

Table 3: Onset time of sensory block in both groups

	Group PR	Group PRD	Student t-test	P value	Inference
Onset of Sensory block (in Minutes)	4.76 ± 0.707	3.4±0.70	6.8348	0.0001	HS

Table 4: Total duration of analgesia in both groups

	Group PR	Group PRD	Student t-test	P value	Inference
Total duration of analgesia (min)	433.6 ±98.99	944 ± 608.11	4.142	0.0001	HS

Table 5: Time of onset of analgesia in both groups

Group	N	Mean	SD	P Value
PR	50	24.17	3.957	<0.001*
PRD	50	19.07	2.196	Significant

Table 6: Total consumption of tramadol (mg/kg) in 24 hr (post operatively)

	Group PR	Group PRD	Student t-test	P value	Inference
Total consumption of tramadol (mg/kg)	2.84 ± 0	0.88 ±0.707	13.861	0.0001	HS

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Table 7: Patient satisfaction score

	Group PR	Group PRD
Good	14 (28%)	42 (84%)
Average	28 (56%)	06 (12%)
Poor	08 (16%)	02 (4%)

Table 8: Pulse rate

Group	N	Mean	SD	P Value
PR	50	80.73	6.79	0.4
PRD	50	79.90	5.89	Not Significant

Discussion

Thoracic paravertebral block (TPVB) is a successful alternative to general anaesthesia for breast cancer surgery. It offers long-lasting pain relief after surgery, the possibility of being sent home early, and less nausea and vomiting after surgery (PONV). It cuts down on how long a person has to stay in the hospital, which lowers costs. Most of the time, ropivacaine, lignocaine, or a mix of these drugs are used to treat PVB. Adjuvants like opioids, epinephrine, dexamethasone, magnesium, clonidine, etc. were added to local anaesthetics in TPVBs to get a quick, dense and long-lasting block, but the results were either not clear or came with side effects [27]. Dexmedetomidine is a -2-adrenergic receptor agonist that is very selective. In clinically effective doses, it doesn't slow down breathing, but it still works as a painkiller, which could make it a useful and safe addition. Centrally mediated analgesia, 2 B-adrenoceptor mediated vasoconstriction, attenuation of the inflammatory response, and direct action on a peripheral nerve are all thought to be how 2-adrenoceptor agonist works to block peripheral nerves. So, this study was done to see how well dexmedetomidine works with ropivacaine in a thoracic paravertebral block for surgery on breast cancer [28].

In our study, the demographics of both groups were similar, and there was no statistically significant difference between them. Sensory block started sooner in the PRD group than in the PR group, which was statistically significant and suggests that adding dexmedetomidine has made sensory block start sooner [29]. Since dexmedetomidine is a selective 2-agonist, it activates the 2 adrenoceptors in the central nervous system (CNS). This stops the sympathetic nervous system from working, which lowers blood pressure and heart rate. In our study, the heart rate, systolic blood pressure, and diastolic blood pressure were all lower for 10 minutes in the PR group and 20 minutes in the PRD group, but this wasn't statistically significant [30]. After 20 minutes of induction, the average blood pressure was much lower in the PRD group than in the PR group. It seems to show that the effects of dexmedetomidine on the heart and blood vessels start as early as 20 minutes after taking the drug. We didn't find any big differences between the two groups' sedation scores. It seems to show that dexmedetomidine at a dose of 1ug/kg, when added to local anaesthetics, doesn't cause a lot of drowsiness. Compared to group PRD, group PR had a VAS score that was always high, even after painkillers were given [31].

In our study, the average length of total pain relief was longer in the PRD group than in the PR group (p value 0.0001). There is a statistically significant difference between the need for tramadol after surgery, which is higher in the PR group than in the PRD group. Most of the time, a patient's satisfaction in the days after surgery depends on how well their pain is being treated and how well they are doing overall. Both groups get good pain relief from TPVB, but those in the PRD group feel better than those in the PR group. In Group PR, 4 patients got sick after surgery and threw up, but in Group PRD, 4 patients got low blood pressure during surgery, which is not statistically significant [32].

There are some things wrong with this study. First of all, the effect of PVB was not looked at

before GA was given. This could not be done because it would have broken the blinding because both the patient and the anesthesiologist who gave the GA would have known which group the patient was in. But the effects of the block were checked right after reversal so that the anesthesiologist giving the GA wouldn't be able to see what was going on. For the patient, too, it seemed like a normal part of figuring out how much pain there was, so the blinding was kept [33].

The second flaw was that the study wasn't big enough to compare how often side effects happened. Patients who took dexmedetomidine were more likely to have low blood pressure and slow heart rates, but this difference was not statistically significant. Since the sample size calculation in our study wasn't based on how often side effects happened [34], it's likely that a bigger sample size would be needed to find any statistical significance between these parameters.

Conclusion

TPVB with ropivacaine and dexmedetomidine as an add-on can be a better choice for good pain relief and stable blood pressure during breast cancer surgery without complications or side effects. To sum up, PVB using dexmedetomidine 1 g/kg added to ropivacaine 0.5% in patients undergoing major breast cancer surgery under GA, i.e., MRM and breast conservation surgery with axillary lymph node dissection gives longer-lasting pain relief with less opioid use and fewer side effects than PVB with ropivacaine alone or GA without PVB. But good monitoring of the blood flow during surgery is needed when this combination is used. Also, bigger studies are needed to find out if side effects are much worse when dexmedetomidine is added to local anaesthetics in PVB as an adjuvant.

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