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POSTOPERATIVE ANALGESIA FOLLOWING PECTORAL NERVE BLOCK IN CONSERVATIVE BREAST SURGERIES: A COMPARATIVE STUDY TO ASSESS ROPIVACAINE VERSUS ROPIVACAINE WITH DEXMEDETOMIDINE

Anaesthesiology

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ABSTRACT

Local anesthetics when used in blocks are characterized by slower onset and shorter duration of action, when used in larger doses can cause systemic toxicity. Hence, adjuvants are used to better the quality of blocks. Here, Dexmedetomidine is used as an adjuvantin PECS block to assess duration of action, hemodynamic effects, and side-effects. In this study we have compared 40 patients undergoing breast surgeries under general anaesthesia who were divided into two groups of 20 patients each of which Group A received Ropivacaine alone and Group B received Ropivacaine and Dexmedetomidine. Assessment was done for duration of action, VAS scores, analgesic drug usage, sedation scoring, satisfaction scores and incidence of side- effects and complications. Our study concluded that Dexmedetomidine provides prolonged duration of block and has given excellent analgesia post-operatively. Mean time to first rescue analgesic in patients who received Ropivacaine was 6.85± 0.74 hrs vs. 16.56 ± 4.97 hrs in those who received Ropivacaine with Dexmedetomidine ($p<0.001$). Rescue analgesics were required in a lesser number than the control group.

KEYWORDS

Pecs Block, Ropivacaine, Dexmedetomidine, Ropivacaine, Breast Surgery, Postoperative Analgesia

INTRODUCTION

Oncological breast surgery is associated with post-operative pain and restricted upper limb movements despite the trend towards less invasive procedures[1]. They are prone to develop complications such as chronic pain[2,3,4]. Post-operative pain management is usually multimodal which includes oral or intra- venous acetaminophen, non-steroidal anti-inflammatory drugs, opioids, peripheral nerve block or epidural as patient-controlled analgesia. Regional anaesthesia techniques are done to reduce acute postoperative pain and chronic pain after breast surgery[5]. Thoracic epidural, paravertebral and intercostal nerve blocks can develop perioperative complications and are not preferred [3,6,7] Pectoral nerve block is a novel superficial and lesser invasive block that provides good analgesia during and after surgeries and is devoid of hemodynamic effects[8,9,10,11].

Nerve blocks are limited by short duration of action and wearing of block before postoperative period of worst pain. Although the analgesic duration can be prolonged by increasing total dose of local , the risk of toxicity is also increased[2]. Ropivacaine is a long-acting amide with greater degree of motor sensory differentiation with a higher threshold for toxicity[12,13]. Dexmedetomidine is newer, selective shorter acting alpha-2 receptor agonist with good analgesic properties [3,6]. It produces analgesia by central action, alpha receptor action, attenuation of inflammatory responses and direct action on peripheral nerves[8].Ultrasound guidance provides better visualization of structures and improved analgesic effects by clearly seeing the diffusion of drug in the desired planes but also reduced the risk of complications associated with performing a block blindly[2]. The study was done to evaluate whether dexmedetomidine is a safe adjunct to ropivacaine, providing better and prolonged post-operative analgesia thereby allowing early mobilization of the patient and reducing the associated complications, when compared with the use of ropivacaine alone[2].

METHODS

The study was conducted at a 250 bedded tertiary care super specialty hospital following the due approval of hospital ethics and scientific committee after obtaining informed consent of patient to be inducted as subject of study. This was a prospective double blinded randomized controlled study on 20 in each group (total 40 patients). The data from the study was analyzed by the SPSS version 16.0 (IBM Corp, Armonk, NK, USA). Unpaired t test was applied for demographic data, analgesic efficacy, VAS, and hemodynamic parameters. Chi square test was applied for sex, ASA grades, sedation scores and PSS. p value was considered significant if <0.05. Inclusion criteria was women undergoing Elective breast surgeries, more than 18 years, ASA grade I and II. Exclusion criteria were patient refusal, Coagulopathy, ASA III and above, patients with chest wall deformity, infection at the site of injection, hypersensitivity to local anesthetics and Dexmedetomidine and patients with severe hepatic or renal disorders.

All patients scheduled to undergo elective breast surgeries were evaluated during pre-anesthetic check-up and the procedure and Visual Analogue Scores was explained to everyone and they were randomly allocated into 2 groups. A written informed consent was taken from all patients. Investigations included Hemoglobin, total leucocyte count, differential leucocyte count, blood sugar, serum creatinine, Chest X-Ray and ECG. Pre-operative fasting of 8 hours was ensured and premedicated with oral Pantoprazole 40mg on the previous night and 2 hours prior to surgery.

After shifting the patient to OT, intravenous access was obtained and preoperative baseline vitals including blood pressure (SBP and DBP), oxygen saturation and heart rate (HR) were noted and crystalloid infusion was started. Inj. Fentanyl 2 µg/kg was given over 30 seconds after preoxygenation with 100% O2 for 5min. General anaesthesia was induced with Propofol 2mg/kg and Vecuronium 0.1mg/kg and ventilation done for 3 min and airway secured with an endotracheal tube Anaesthesia was maintained with Isoflurane and O2/N20 mixture with 40% inspired Oxygen.

The block was performed by a senior anesthesiologist with experience in ultrasound guided regional anesthesia. The patient was prepared with chlorhexidine gluconate and sterility maintained. The patient was made to lie in the supine position and the head was turned away. A shoulder pillow was placed at the patient's back and the upper limb was abducted. The anesthesiologist stood at the patient's head and an ultrasound machine was placed near the patient's arm. On the side of operation with arms abducted, a high-frequency linear probe(12MHz) was placed below the lateral third of the clavicle and axillary artery and vein were identified and then the probe was moved infero-laterally until pectoralis major and minor and serratus anterior were identified at the level between third and fourth ribs. A 23 G Quincke's spinal needle was advanced in plane with the transducer in a medial-lateral direction.

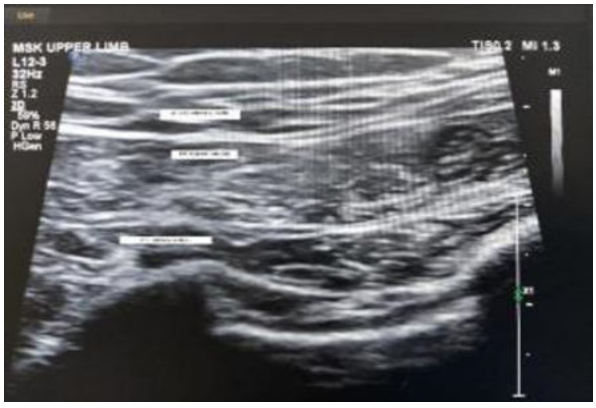


Figure1. Ultrasound Anatomy of PECS Block

For the PECS I block, the probe was placed on anterior chest to confirm the location of the inter-fascial plane between the pectoralis major and pectoralis minor muscles at the 3rd rib, and local anesthetic 10mL was injected at the inter-fascial plane. For the PECS II block, the local anesthetic was injected in two parts. The first injection was the same as PECS I block. For the second injection the probe placed to locate the inter-fascial plane between the pectoralis minor and the serratus anterior muscles at the 4th rib on the anterior axillary line and local anesthetic 20 mL was injected at the inter-fascial plane. The local anesthetic for the blocks was injected in 5 ccaliquots, with aspiration after each aliquotto avoid intravascular injection. In both groups 10 ml was injected into the interfascial plane between the two pectoralis muscles. The probe was moved distally and towards the axilla. At the level of third rib the serratus anterior muscle was identified and the needle was reinserted and the remaining 20 ml was injected into the interfascial plane between pectoralis minor and serratus anterior muscles. Pectoral I block acts on the medial and lateral pectoral nerves, while pectoral II block works on the long thoracic nerve, thoracodorsal nerve, and anterior divisions of the thoracic intercostal nerves from T2 to T6 .

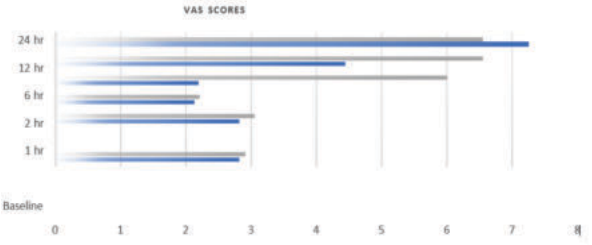
GROUP A received US guided PECS – II block with 30 ml 0.2 % Ropivacaine. GROUP B received US guided PECS – II block with 30 ml 0.2 % Ropivacaine+ 1microgram/kg Dexmedetomidine.

Out of this 30 ml, 10 ml given for PECS – I and 20ml given for PECS – II block in both the groups.

Preoperative baseline parameters were recorded in both the groups followed by recordings at timed intervals, till 24 hours postoperatively. If SBP or HR values increased intra-operatively by ⩾15% from baseline values, fentanyl increments (0.5ug/kg) was given intravenously and total intra- operative fentanyl consumption will be recorded in both groups. Bradycardia was considered if heart rate decreased by ⩾15% and hypotension when systolic blood pressure decreased by ⩾15% from their baseline values. Bradycardia and hypotension were treated with IV Glycopyrrolate 0.01 mg/kg and IV Ephedrine 0.1 – 0.2 mg/kg respectively. Neuromuscular blockade was then reversed with IV Neostigmine 0.05mg/kg and IV Glycopyrrolate 0.01mg/kg. Adverse events such as hypotension, bradycardia and hypoxemia and postoperative sedation, nausea, vomiting was recorded. In PACU, patient perception of pain was assessed at rest using VAS scale (0 – 10) by an observer, who was blinded to the group. IV Paracetamol was given as the first rescue analgesia for postoperative pain relief if pain score> 3 or when it was requested by the patients and tramadol given as the second rescue analgesic. Time to first analgesic request will be recorded from the completion of PECS block to first given Tramadol dose and counted as the duration of analgesia. Total postoperative rescue analgesic consumption was noted in 24 hours. Nausea and vomiting were treated with IV Ondansetron 0.1mg/kg. Sedation was assessed by Modified Ramsay sedation score and Satisfaction score was assessed was using Patient satisfaction scoring system.

RESULTS

The differences between the groups were not significant with respect to age, ASA grading. Vital parameters at baseline, Intraoperative and postoperative Systolic, Diastolic and Mean arterial pressures did not show any differences between the groups. There were differences between the groups with respect to heart rate at 15,30,60 and 90 mins with p-value <0.05. There were no differences in oxygen saturation as well. Independent t test was done and analysis showed that there was statistically significant differences between the 2 groups in VAS scores with p value <0.001 at 6 and 12 hours postoperatively. Patient satisfaction scores similarly were significant upto 12 hours with p value <0.01. There were no differences in sedation as well. Mean analgesic duration in group B was 16.56 hours when compared to a mean of 6.85 hours in group A. This was found to be very significant statistically. Also Mean VAS scores were better in the dexmedetomidine group. Consequently, the number of rescue analgesics required were less than group A. This was found to be statistically significant.



	Baseline		1 hr	2 hr	6 hr	12 hr	24 hr
Group A Mean	2.9		3.05	2.2	6	6.55	6.55
Group B Mean	2.81		2.81	2.12	2.18	4.43	7.25

Figure 3: Chart showing improved scores of mean VAS in group B up to 12 hours

Table 3: Analgesic efficacy between the groups. Group B showed extended duration of analgesia

Analgesic efficacy	Group B		Group A		p value
	Mean	SD	Mean	SD	
Time of firstrescue analgesia (hours)	16.56	4.97	6.85	0.74	<0.001
Mean VASscore at first rescue analgesia	6.06	0.57	7.20	0.76	<0.001
Total rescue analgesics in24 hrs	1.87	0.34	4.45	0.51	<0.001

DISCUSSION

Our study analyzed the efficacy of Dexmedetomidine in combination with Ropivacaine in US-guided Pectoral nerve block for postoperative pain relief among 40 patients undergoing breast surgeries who were randomly allocated into two groups of 20 each.

Analysis showed that there was a statistically significant difference between the two groups in terms of their intraoperative and postoperative heart rates. Group B had heart rates of 68.87 ± 5.82, 67.81 ± 4.90, 66.37 ± 4.36 and 66.68 ± 4.58 at 15 min, 30 min, 60min and 90 min respectively, while group A had heart rates of 75.9 ± 4.96, 75.4 ± 4.54, 75.7 ± 5.21, 73.00 ± 5.48 at 15min, 30min, 60min and 90 min respectively with p values< 0.05. Similar findings were obtained by Kaur etaland Abdelgalelet al in their stud with a statistically significant difference in HR between two groups[2,6]. It is to be noted that changes in heart rate were observed did not require any active treatment. This effect is due to the inhibition of central sympathetic outflow overriding direct stimulation. The absence of bradycardiain these studies is because of injection into tissues and not intravenously. Caution must be observed while using this drug invulnerable patient groups.

Differences in Systolic Blood Pressure (SBP) values both intraoperatively and postoperatively between the 2 groups in our study were not observed. Group B had SBP values of 118.31 ±11.95, 115.75 ± 10.27, 114.50 ± 10.05 and 116.0 ± 11.24 at 15 min, 30 min, 60 min and 90 min respectively. Group A had SBP values of 118.10 ± 10.01,116.10 ± 9.00, 115.70 ± 8.16 and 115.80 ± 8.72 at 15 min, 30 min, 60 min and 90 min respectively showing no significant differences in their Systolic blood pressure measurements. Kaur et al in their study found statistically significant differences in SBP from 20 min that extended into the postoperative periods. Patients in the Group who received Ropivacaine and Dexmedetomidine had SBP values of 114.3 ± 6.7, 113.1 ± 5.7, 109.5 ± 5.9 and 115.5 ± 6.0 at 15 min, 30 min, 60 min and 90 min respectively while group who received Ropivacaine alone had SBP values of 123.3 ± 6.99, 124.3 ± 7.8, 123.3

± 7.2 and 124.6 ± 6.5 at 15 min, 30 min, 60 min and 90 min respectively (p<0.01). Also Manzooretal in their study found that though there was statistically significant differences in BP between the 2 groups at10 min postsurgical incision, it was not clinically significant with none of the patients requiring vasopressor supports[8]. However, they have mentioned that the fall in blood pressure did not require any treatment and probably due toreduction of release of norepinephrine which wasn't observed in our study.

Differences in Diastolic Blood Pressure (DBP) values both intraoperativelyand postoperatively between the 2 groups in our study were not observed. Group B had DBP values of 71.62 ± 6.57, 69.81 ± 7.19, 70.12 ± 8.01 and 68.56 ± 8.45 at 15 min, 30 min, 60 min and 90 min respectively. While group A had DBP values of 72.00 ± 6.41, 70.85 ± 7.11, 71.10 ± 8.09 and 70.25 ± 8.58 at 15 min, 30 min, 60 min and 90 min respectively again showing statistically no significant differences in their DBP values both intraoperatively and postoperatively between the 2 groups in our study. Manzoor et al in their study also found that though there was statistically significant differences in BP between the 2 groups at 10 min postsurgical incision, it was not clinically significant with none of the patients requiring vasopressor supports[8]. However, Kaur et al in their study found statistically significant differences in DBP from 20 min that extended into the postoperative periods. . In our study, MAP values,Spo2 were not significant between the 2 groups.

Mean time to first rescue analgesic in patients who received Ropivacaine was 6.85± 0.74 hrs vs. 16.56 ± 4.97 hrs in those who received Ropivacaine with Dexmedetomidine (p<0.001). This compares well with the study done by Kaur et al where the mean time to first rescue analgesia was statistically longer in Ropivacaine with Dexmedetomidine group 7.82 ± 1.35 hrs as compared to Ropivacaine group 4.97 ± 0.7hrs (p = 0.000). Also, Abdelgalelet al in their studyfound that demand of first rescue analgesic was significantly longer (p<0.05) in Ropivacaine with Dexmedetomidine group 4.31 ± 0.77 minutes as compared to Ropivacaine group 1.87 ± 0.47 minutes (p<0.05). This shows that the addition of Dexmedetomidine to Ropivacaine increases the duration of analgesia by a significant margin and is comparable to other studies as mentioned. This would be a useful adjunct to local anesthetics in breast surgeries where pectoral nerve blocks can provide prolonged analgesia with a single dose and intervention, without the need for additional analgesics intravenously during the initial post- operative period.

Assessment of results from data performing to the number of rescue analgesic doses required in 24 hours showed a mean of 4.45 ± 0.51 (Ropivacaine alone dose) and 1.87±0.34(Ropivacaine+ Dexme detomidine dose) in our study.The rescue analgesic dose provided was 1g of Injection paracetamol given intravenously. Similar results were obtained with studies by Kaur etaland Bakr et al[14]. On comparison of VAS scores in both groups we found that mean VAS score at first rescue analgesia were significantly lower in group B 6.06 ± 0.57 as comparedto the group A 7.2 ± 0.76 (p <0.001) which is statistically significant. In concordance to above, Kaur et al[2] also reported similar statistically significant lowering in the postoperative VAS pain scores in the Ropivacaine and Dexmedetomidine group 2.3 ± 0.6 compared with those in Ropivacaine alone at 4 hours 2.9 ± 0.9 (p = 0.003)and 2.4 ± 0.7 and 3.1 ± 0.8(p=0.000) at 5 hours postoperatively. These findings are similar to the results of a study by Bakr et al[14] who reported reduction in the VAS scores which started immediately until 12 hours postoperatively.

On comparing sedation between the two groups using Modified Ramsay Sedation score we found that there is no significant difference in the scores between the two groups. Similar results were seen with a study conducted by Othman et al (p > 0.05)15.On comparing the patient satisfaction scores as well, there was statistically significant differences with higher scores in the group B with PSS of 1 and 2 hours and 2 at 6 and 12 hours postoperatively as compared to the group A with PSS of 2 at 2nd hour postoperatively and 1 at 6 and 12 hours postoperatively (p value< 0.001). Manzoor et al also found similar statistically significant differences(p<0.001)[8].

There were no complications related to the PECS block in both the groups in our study like nausea, vomiting, sedation. This could be because of experienced personnel performing the procedure and the associated use of Ultrasonography to reduce the margin of error in delivering the drug, in the correct plane. Dexmedetomidine has selective affinity for alpha-2 receptor which permits its application in sedation and analgesia without unwanted vascular effects.

CONCLUSION:

There are several adjuvants used in regional nerve blocks. Dexmedetomidine is a newer Alpha 2 agonist used to improve the quality of block and prolong the duration of analgesia provided. We found that Dexmedetomidine added to Ropivacaine at a dose of 1 microgram/kg, when used in PECS block prolonged the duration of analgesia along with lower VAS scores, excellent hemodynamic stability and minimal sedation. The use of ultrasound to perform the procedure made it safer and accurate with a single intervention. Hence PECS block when performed with Dexmedetomidine can provide better analgesia and a comfortable postoperative period to women undergoing breast surgeries.

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