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To Evaluate Analgesic Effect of Ultrasound Guided Pectoral Nerves I and II Blocks in Multimodal Analgesia for Breast Cancer Surgery

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ABSTRACT

Background: Postoperative pain management is a matter of concern for every anaesthesiologist. Postoperative pain control may result in improved cost effectiveness, more appropriate and efficient use of resources, and ultimately improved patient satisfaction.

Aim: To evaluate analgesic effect of ultrasound guided pectoral nerves I and II blocks in multimodal analgesia for breast cancer surgery.

Methods: This prospective observational study "Ultrasound guided pectoral nerves block as intraoperative and postoperative analgesia for breast cancer surgery" was conducted in postgraduate department of Anaesthesiology, critical care, and pain medicine at SMHS hospital and super speciality hospital, the associated hospitals of Government Medical College, Srinagar from 2018 to 2020 over a period of 18 months. We observed 68 patients over a period of eighteen months who had undergone breast cancer surgery. All patients received total 30 ml of 0.2% ropivacaine and 3ml 2% lignocaine which was a routine protocol in our institute. Sensory block assessment was done at 5 minutes intervals after completion of procedure up to 30 minute. A total sample size of 68 patients was calculated using PASSE (power and sample estimation) for study design and analysis. To obtain a 68 study sample size and design, a total of 88 patients were included in which 20 patients were excluded on the basis of study design and exclusion criteria. Statistical analysis was performed using Microsoft (MS) Office Excel Software (Microsoft Excel, Redmond, Washington: Microsoft 2003, Computer software). Results were expressed as mean ± standard deviation, number, and percentage (%). Data were analysed using post hoc analysis method. Normally distributed data were assessed using unpaired Student's t-test.

Results: Mean postoperative visual analogue scale score of study patients at 2, 6, 12, 24 hours. Mean VAS scores at 2-hour, 6-hour, 12-hour, 24 hours were 1.10 ± 0.18, 3.1.70 ± 1.10, 1.80 ± 1.50, 1.98 ± 1.43. Overall mean VAS score in the postoperative period is 2.20 ± 1.70 with minimum score of 1 and maximum score of 4. Time to request for first analgesia in study patients. Out of 68 patients 83.35% of patients requested for analgesia in first 24 hours. Mean time to request for first analgesia was 12.47.80 hours with minimum requirement at 6 hour and maximum requirement at 24 hours.

Conclusion: The pectoral nerves I and II blocks produce excellent analgesia when combined with general anaesthesia for breast cancer surgery. They are simple, easy-to-learn techniques, having easily identifiable landmarks based on good anatomical and ultrasound knowledge, making them an excellent alternative to the conventional thoracic paravertebral and neuraxial blocks for modified radical mastectomy, with or without axillary lymph node dissection.

Key words: Breast cancer surgery, Modified radical mastectomy, Ultrasound, Pectoral nerves I and II Blocks, Postoperative pain

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INTRODUCTION

The International Association for the Study of Pain, defines pain as "an emotionally charged and physically unpleasant experience associated with actual or potential existence of tissue damage, or described in terms of such damage'' [1]. Uncontrolled perioperative pain may increase patient morbidity and mortality. Postoperative pain management is a matter of concern for every anaesthesiologist. Postoperative pain control may result in improved cost effectiveness, more appropriate and efficient use of resources, and ultimately improved patient satisfaction [2]. Despite recognition of the importance of effective pain control, up to 70% of patients still complain of moderate to severe pain postoperatively [3]. Unrelieved acute pain after surgery usually elicits pathophysiologic neural alterations, including not only peripheral but also central sensitization which evolves into chronic pain syndromes. Preventing the establishment of altered central processing by analgesic treatment may result in short-term (e.g.,

reduction in postoperative pain and accelerated recovery) and long-term (e.g., reduction in chronic pain and improvement in Health Related Quality of Life) benefits during a patient's convalescence [4].

Breast cancer is increasingly becoming the most common cancer among females in India. It accounts for around 25%–32% of all female cancers in India as per the National Cancer Registry [5]. Advances in oncology have led to effective treatment of breast cancers. Availability of better chemotherapeutic agents has made breast surgery possible for tumours that were previously considered inoperable.

In spite of all the advancements in surgical, medical and radiation oncology, the risk of recurrence and metastases persists for breast cancer. The perioperative period is characterized by the presence of circulating tumour cells and minimal residual disease, which may lead to tumour recurrence. Many factors in the perioperative period have been implicated in the increased risk of recurrence. These factors include anaesthetic technique, use of opioids, inadequate pain control, hypoxia, hyperglycaemia, hypotension, allogeneic blood transfusion and inadvertent intraoperative hypothermia [6]. The surgical intervention itself is responsible for systemic shedding of tumour cells and thus increasing the risk of metastases.

MATERIAL AND METHODS

This prospective observational study "Ultrasound guided pectoral nerves block as intraoperative and postoperative analgesia for breast cancer surgery" was conducted in postgraduate department of Anaesthesiology, critical care and pain medicine at SMHS hospital and super speciality hospital, the associated hospitals of Government Medical College, Srinagar from 2018 to 2020 over a period of 18 months.

After approval from ethical committee of the Institution and written informed consent of the patients for participation in the study, we observed 68 patients over a period of eighteen months who had undergone breast cancer surgery. Inclusion and exclusion criteria were according to hospital protocols.

PRE-anaesthetic evaluation

Pre-anaesthetic evaluation was done 24 hrs prior to surgery as a part of our routine protocol. A thorough history was taken and general physical examination was carried out. Special emphasis was done on drug history, history of drug abuse, history of chronic pain and other comorbidities. A meticulous examination of cardiovascular system, respiratory system, central nervous system was done. Airway assessment was done to predict the airway status of the patient. All baseline investigations (complete blood count, kidney function test, liver function tests, bleeding time, clotting time, serum electrolytes, blood group, triple serology, chest x-ray and electrocardiography) were reviewed. Patients were advised to be nil per oral for at least 8 hours before surgery. Visual analogue scale was explained to them in common language and written informed consent was obtained.

Methods

After counselling and written informed consent, patients were taken to the procedure room and connected to multichannel monitor and baseline pulse rate, blood pressure, ECG, and spo2 were recorded. Intravenous line was placed in contralateral arm and injection pantoprazole 40mg and injection midazolam 1mg was given as premedication. Standard ASA monitoring was applied throughout the procedure. All blocks were performed by anaesthesiologist experienced in ultrasound guided blocks. All blocks were performed using portable ultrasound machine. All patients received total 30 ml of 0.2% ropivacaine and 3ml 2% lignocaine which was a routine protocol in our institute. Sensory block assessment was done at 5 minutes intervals after completion of procedure up to 30 minute.

PECS's blocks were performed according to the method described by Blancor, Fagardom and Parras melandot. Blocks were given under ultrasound guidance on the operative table prior to induction. With patient in supine position and head turned away from ultrasound probe and ultrasound machine on the side to be blocked, infraclavicular region and axillary region was cleaned using betadine. The arm was abducted about 90 degrees and 3ml 2 % lignocaine was used to anaesthetise skin and the probe was placed in paramedian orientation just making contact with the clavicle. Image generated to visualize clavicle, pectorals major and minor muscles, axillary vessels and 2nd rib and pleura lying adjacent. From this position probe was slid down in caudad direction, counting the ribs as we moved down. Once the 3rd rib was identified, the probe was rotated through 90 degrees and slid towards the lateral aspect of chest wall. Once we reached lateral aspect of pectoralis minor muscle, the image generated to visualize pectorals major, pectoralis minor, pectoral branch of thoracoacromial artery, 3rd and 4th rib. This was our optimal position for needle insertion and that was over the 4th rib. A 22 G touchy needle was advanced till it reached the facial plane between pectoralis major and minor. At this point we injected 10 ml of 0.2 percent ropivacaine. Now the needle was advanced further to recognize the fascial plane between pectoralis minor and serratus anterior. Here again we injected 20 ml of 0.2 percent ropivacaine to achieve the pecs 2 block. Each time drug was injected with negative aspiration every 3 ml to avoid I.V injection and the spread of local anaesthetic was also observed. Overall procedure of pecs block took about 15 minutes, and the onset time of analgesia was around 3 minutes after completion of the procedure. However, sufficient analgesia for surgical procedure was obtained after 15 minutes. We confirmed the anaesthetic area over T2-T6 dermatomes by pinprick test. The assessment of block was done every 5 minutes from completion of procedure until readiness for surgery. If the block was not efficient after 30 minutes from completion of procedure, it was considered unsuccessful block. Needle will be seen to

approach from the cephalad end. Local anaesthesia will be injected at two points. One in the space between pectoralis major and minor and the other in the compartment between pectoralis minor and serratus anterior. AA: axillary artery, AV: axillary vein, TAA: thoraco-acromial artery.

After block, according to our routine protocol, general anaesthesia induction was started and the patient was preoxygenated with 100% oxygen for 3 minutes. General anaesthesia was induced with inj. propofol 2.0-2.5 mg/kg iv followed by muscle relaxant inj. atracurium 0.5 mg/kg i.v to facilitate endotracheal intubation. The trachea was intubated with a cuffed endotracheal tube of appropriate size and controlled ventilation was started. Anaesthesia was maintained with nitrous oxide, oxygen and 1-1.5% isoflurane. Minute ventilation was adjusted to maintain end tidal CO2 concentration within normal range. Each patient received intermittent boluses of inj. atracurium 0.1 mg/kg to maintain adequate muscle relaxation. Intraoperatively patient monitoring was done. Hemodynamic fluctuations if occurred were managed accordingly.

BP and HR were maintained within normal range (not exceeding 20% of the baseline value). Each patient showing hemodynamic fluctuations were suspected of inadequate block after ruling out other causes of such hemodynamic fluctuations and were given Fentanyl 1 mcg/Kg. Ondansetron 0.1mg/kg was administered intraoperatively to all patients.

At the end of surgery, the neuromuscular blockade was antagonized with inj. neostigmine 0.05mg/kg and inj. glycopyrrolate 0.01 mg/kg and patients were intubated successfully and they were shifted to post anaesthesia care unit.

All patients stayed in post anaesthesia care unit for 24 hrs after the end of surgery. All multichannel monitors were connected and immediate postoperative vitals were recorded in post anaesthesia care unit. All results were recorded by the observer. The observations included mean VAS scores at 0, 2, 6, 12, 14, 24 hours after surgery, time to request for first rescue analgesia, total dose of rescue analgesia consumed in 24 hours and patient satisfaction. Paracetamol intravenous (1g) was used as rescue analgesia when VAS ≥ 4. Any patient complaining of pain after paracetamol was given second rescue analgesia i.e. Diclofenac intravenous after 1 hour. Patient satisfaction scores were assessed on the basis of a questionnaire and graded on a 4 point scale (excellent, very good, satisfactory and poor) (Figure 1).

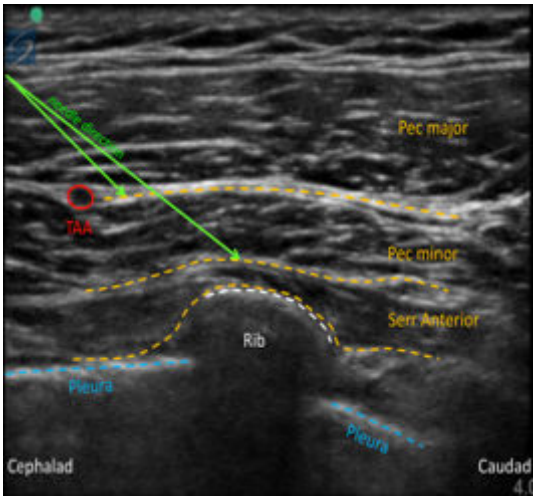

Figure 1: Blockage.

RESULTS

The age of study patients varied from 20 to 70 years with mean age of distribution was 45.3 ± 14.21 (20-70) years. Maximum number of study patients lied between the age of 40 and 49 years (Table 1). Mean weight of study patients was 63.7 ± 11.43 kilogram (kg). Maximum distribution of study patients lied between 60-70 kg.75% of study patients had ASA I status and 25% of study patients had ASA II status.

Table 1: Age wise distribution of study patients

Age (years)	Frequency	Percentage (%)
20-29	9	13.23
30-39	16	23.52
40-49	22	32.35
50-59	13	19.11
≥ 60	8	11.76
Total	68	100
Mean ± SD (Range)=45.3 ± 14.21 (20-70)		

Mean postoperative visual analogue scale score of study patients at 2, 6, 12, 24 hours. Mean VAS scores at 2-hour, 6-hour, 12-hour, 24 hours were 1.10 ± 0.18, 3.1.70 ± 1.10, 1.80 ± 1.50, 1.98 ± 1.43. Overall mean VAS score in the postoperative period is 2.20 ± 1.70 with minimum score of 1 and maximum score of 4 (Table 2).

Time to request for first analgesia in study patients. Out of 68 patients 83.35% of patients requested for analgesia in first 24 hours. Mean time to request for first analgesia was 12.47.80 hours with minimum requirement at 6 hour and maximum requirement at 24 hours (Fig 1). Total consumption of first and 2nd rescue analgesia (PCM and Diclofenac) among the study population was 125g

and 58.55mg respectively. Out of 68 patients studied 89.70% patient's shows excellent, 5.88% very good, 2.94% satisfactory and 1.47% of patient's shows satisfactory results postoperatively (Figure 2 and Figure 3).

Table 2: Showing postoperative VAS score of study patients.

Time Interval	Mean	SD	Min	Max
2 Hour	1.1	0.18	1	2
6 Hour	1.7	1.1	1	4
12 Hour	1.8	1.5	1	4
14 Hour	2.9	2.05	2	4
24 Hour	3	2.5	3	4
Overall	2.98	1.92	1	4

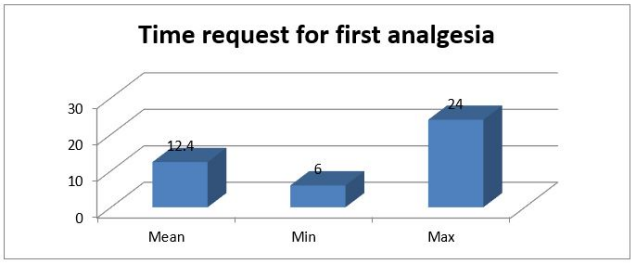

Figure 2: Time request for first analgesia.

Figure 3: Patient satisfaction.

DISCUSSION

Acute postoperative pain is an integral risk factor in the development of chronic postmastectomy pain; 40% of women will have severe acute postoperative pain after breast cancer surgery, whereas 50% will develop chronic postmastectomy pain with impaired quality of life [7,8]. Regional anesthesia techniques have provided better-quality acute-pain control and subsequently less chronic pain [9,10]. Proposed mechanisms for decreased persistent pain include decreased central sensitization (wind-up) and lower incidence of opioid-induced hyperalgesia [11,12]. Furthermore, effective acute pain control preserves immune function, both by suppressing the surgical stress response and by decreasing the need for general anaesthetics and opioids. Opioids, especially morphine, inhibit both cellular and humoral immune functions [13,14]. This effect may be responsible for the higher rates of postsurgical local recurrence and/or metastasis [14]. Thoracic epidural block, thoracic paravertebral block (TPVB), interpleural block, intercostal nerve block, interscalene block, and wound infiltration have all been used in anaesthesia and/or analgesia in breast cancer surgery [15-19]. Thoracic paravertebral block has been shown to provide superior analgesia, and there is some evidence suggesting decreased cancer recurrence rates with the use of thoracic paravertebral blocks [20,21]. Nonetheless, not all anaesthesiologists feel comfortable using such invasive techniques in breast cancer surgery. The pectoral nerve (Pecs) block, a less invasive novel technique described by Blanco et al [22,23]. Is an interfacial plane block where local anesthetic is deposited into the plane between the pectoralis major muscle and the pectoralis minor muscle (Pecs I block) and above the serratus anterior muscle at the third rib (Pecs II block). These novel techniques attempt to block the pectoral; intercostobrachial; intercostals III, IV, V, VI; and long thoracic nerves [23].

Taking all this in consideration we conducted a study at SMHS and Superspeciality hospital over a period of 18 months evaluating the analgesic effect of ultrasound guided pectoral nerves I and II blocks in multimodal analgesia for breast cancer surgery. In our study, the age of study patients varied from 20 to 70 years with mean age of distribution was 45.3 ± 14.21 years (20-70). The maximum number of study patients lied between the age group of 40 and 49 years. Out of all study patients 8.82% were males while 91.17% were females with female preponderance and the mean weight of study patients was 63.7 ± 11.43 kg with maximum distribution of study patients laid between 60-70 kg. Out of all study patients 75% of study patients had ASA1 and 25%had ASA2 status. In our study pain was assessed in postoperative period at 2 hour, 6 hour, 12 hour and 24 hour period using visual analogue scale. Mean VAS scores at 2-hour, 6 hour, 12 hour, 14 hour, 24 hour were 1.10 ± 0.18, 1.70 ± 1.10, 1.80 ± 1.50, 2.90 ± 2.05, 3.0 ± 2.50. Overall mean VAS score in the postoperative period was 2.98 ± 1.92 with minimum score of 1 and maximum score of 4. Out of 68 patients, 56 patients requested for analgesia in first 24 hours. Mean time to request for first rescue analgesia was 12.47.80 hours with minimum requirement at 6 hour and maximum requirement at 24 hours. Out of 68 patients studied 89.70% patients showed excellent satisfaction, 5.88% showed very good satisfaction, 2.94%

showed satisfactory and 1.47% showed poor satisfactory scores.

Similar findings were also observed by Ghada Mohammad Nabih Bashandy et al in 2015, in their study designed as Pectoral Nerves I and II Blocks in Multimodal Analgesia for Breast Cancer Surgery. They studied one hundred twenty adult female patients scheduled for elective unilateral modified radical mastectomy under general anaesthesia and randomly allocated to receive either general anaesthesia plus Pecs's block (Pecs group, n=60) or general anaesthesia alone (control group, n=60). In this study, statistically significant lower visual analogy scale pain scores were observed in the Pecs group than in the control group patients. Moreover, postoperative morphine consumption in the Pecs group was lower in the first 12 hours after surgery than in the control group. In addition, statistically significant lower intraoperative fentanyl consumption was observed in the Pecs group than in the control group. In the postanesthesia care unit, nausea and vomiting as well as sedation scores were lower in the Pecs group compared with the control group. Overall, postanaesthetic care unit and hospital stays were shorter in the Pecs group than in the control group.

The results of our study are in accordance with the study of Karim Youssef Kamal Hakim et al in 2019 [24]. In this randomized, double blinded, prospective study, VAS, time of the first analgesia, and total morphine consumption were statistically significantly different between the two studied groups with significantly higher values in the local anaesthesia group than Pecs group. Patient satisfaction was significantly higher in the Pecs group than in the local anaesthesia group.

In our study the mean VAS scores at 2-hour, 6-hour, 12 hour, 14 hour, 24 hour were 1.10 ± 0.18, 1.70 ± 1.10, 1.80 ± 1.50, 2.90 ± 2.05, 3.0 ± 2.50. Overall mean VAS score in the postoperative period was 2.98 ± 1.92 with minimum score of 1 and maximum score of 4. This is in accordance with the study by Mary Thomas, et al [25] in this prospective, randomized, placebo-controlled, triple-blinded study Sixty patients scheduled for modified radical mastectomy were enrolled in this study, they found that no patient in Group A required fentanyl. The mean time to first request for analgesia and mean dose of paracetamol required was 353.93 ± 135.03 min and 2.71 ± 0.462.71 g in Group A and 27.17 ± 18.08 min and 3.53 ± 1.074 g in Group B [P=0.002]. Significantly more patients in Group A had mild pain scores compared to Group B.

One advantage of Pecs block, requiring emphasis, is that it is not associated with sympathetic block as are the thoracic paravertebral block and epidural blocks. On the other hand, intravascular injection into the pectoral branch of the acromiothoracic artery is another possibility that could be considered. Complications should be easily avoided with proper ultrasound training and searching for the right pattern of spread of the local anesthetic [26].

CONCLUSION

The pectoral nerves I and II blocks produce excellent analgesia when combined with general anesthesia for breast cancer surgery. They are simple, easy-to-learn techniques, having easily identifiable landmarks based on good anatomical and ultrasound knowledge, making them an excellent alternative to the conventional thoracic paravertebral and neuraxial blocks for modified radical mastectomy, with or without axillary lymph node dissection.

- The pectoral nerves I and II blocks with ropivacaine delivered under vision reduced analgesic requirement and pain scores significantly. Detailed study of anatomy could reveal more such simple techniques for nerve blocks under vision for better postoperative pain relief in other surgeries.
- In our technique as the infiltration was done under vision and identification of the structures, we did not notice any block-related complications such as bleeding or pneumothorax or accidental intravascular injection.

CONFLICT OF INTEREST

Nil

SOURCE OF FUNDING

Nil

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