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Original Research Article

A STUDY ON THE EFFICACY OF ERECTOR SPINAE PLANE BLOCK WITH ROPIVACAINE AS POST-OP ANALGESIA FOR MODIFIED RADICAL MASTECTOMY SURGERY

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Abstract

Background: The erector spinae plane (ESP) block is a newly defined regional anaesthesia technique first described in 2016. The present study aimed to study ESP block efficacy with ropivacaine as post-op analgesia for modified radical mastectomy surgery. **Materials and Methods:** Sixty patients were randomised to the ESP block group (Group A) and only the general anaesthesia group (Group B), n=30 per group. Intraoperative and Postoperatively patients were monitored for mean heart rate, systolic blood pressure, and diastolic blood pressure at regular intervals. The vital signs and the pain score, according to NRS, were recorded at 0, 2, 4, 6, 8, 12 and 24 hours postoperatively by an invigilator. If a pain score above four was recorded, rescue analgesic Inj Tramadol 100mg was given through the intramuscular route. **Results:** The parameters like mean height, weight, and age of patients in both groups were comparable. The various hemodynamic parameters such as intraoperative heart rate, systolic blood pressure, and diastolic blood pressure were reported statistically significant in both groups from 10 min. to 60 min. The postoperative heart rate, systolic, and diastolic blood pressure were statistically significant in Group 1, which showed lesser values than in Group 2. The pain score by postoperative numerical rating scale (NRS) in Group 1 was statistically significant compared to Group 2. The mean rescue analgesia for Group 1 had a lower score than Group 2, which was statistically significant. **Conclusion:** ESP block combined with ropivacaine treatment effectively reduced early postoperative pain and improved recovery after mastectomy surgery.

INTRODUCTION

Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer-related mortality among females in more than 100 countries.[1] The traditional therapeutic approaches for breast cancer include surgery, radiation therapy, chemotherapy, Immunotherapy and endocrine therapy. Surgical resection is still considered to be the primary and most effective therapy.[2] Of all the various treatment modalities, operative resection is most effective in treating breast cancer when the cancer is limited to a localised anatomic area to ensure the tumour's complete removal and an adequate margin of surrounding breast tissue must be removed.[2] Most of the pain originates from the axillary component of the surgery. The management of postoperative pain is important for early mobilisation and the well-being of surgical patients. In addition, optimal management of acute postoperative pain may influence the development of chronic pain.[3]

Effective pain relief is of the utmost importance in treating patients undergoing surgery. Pain relief has significant physiological benefits; hence, monitoring pain relief is increasingly becoming an important postoperative quality measure.[4] However, breast surgery is usually associated with varying intensity and duration of postoperative pain. In addition, poor management of acute postoperative pain may lead to persistent postoperative pain, also known as chronic pain, affecting approximately 25 to 60% of

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patients.[5] Therefore, it is necessary to provide appropriate perioperative interventions to alleviate postoperative pain in such patients.

The erector spinae plane (ESP) block is a relatively new regional blocking technique that can effectively reduce postoperative pain in various surgical procedures such as breast, thoracic, abdominal and lumbar surgery. It was first described in 2016 by Forero as a successful interfacial plane block for thoracic neuropathic pain.[6] Bonvicini et al. first reported a case of clinical use of ESPB for postoperative pain control after breast surgery, which promoted rapid recovery following surgery.[7] In the following two years, the application of ESP block in breast surgery has risen dramatically. Nevertheless, the effectiveness of ESP block is still controversial. Hence present was carried out to study the efficacy of ESP block with ropivacaine as post-op analgesia for modified radical mastectomy surgery.

MATERIALS AND METHODS

This is a prospective comparative study done in the government Coimbatore Medical College and Hospital, Coimbatore, Tamil Nadu, in the Department of Anaesthesiology, operation theatre and postoperative ICU or postoperative ward in the patients undergoing modified radical mastectomy surgeries for one year (January 2020 to December 2020). After getting institutional ethical committee approval and written informed consent, 60 patients were chosen for this study.

Inclusion Criteria

All female patients were willing to participate in the study with written consent; patients aged 18- 65 with ASA grading of I and II were included.

Exclusion Criteria

Patients with local infection at the block site, coagulopathy, morbid obesity, allergy to local anaesthetics and uncontrolled hypertension or ischemic heart disease, patients suffering renal dysfunction, pre-existing neurological defects and psychiatric illness, and patients unwilling to participate were excluded.

Methodology

All the patients were evaluated a day before assessing their fitness for the surgical procedure undergoing general anaesthesia. Patients have explained the numerical rating scale (NRS) for pain ranging from 0 to 10, where 0 stands for no pain and ten stands for worst imaginable pain. The NRS is a segmented numeric version of the visual analogue scale (VAS) in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of their pain (Fig 1). The usual format is a horizontal bar or line. Like the VAS, the NRS is anchored by terms describing pain severity extremes.8

All patients were fasting overnight and given an oral premedication of Ranitidine 150 mg orally the night before and 2 hours before surgery as per standard anaesthesia and surgical protocol. Patients undergoing modified radical mastectomy under general anaesthesia were randomly assigned into two groups, and a single invigilator was carried out for all observations. Group 1: Patients received ESP block using 0.4 ml per kg of 0.2% Ropivacaine, and Group 2: Patients did not receive any block, only general anaesthesia.

ESP Block Administration

After verifying and being satisfied with the pre-anaesthetic checkout and after securing the 18 Gauze i/v cannula, the patient was subjected to monitoring which included an electrocardiogram (ECG), heart rate (HR), non-invasive blood pressure (NIBP) and pulse oximeter (SpO2). Patients who received the block underwent an ultrasound-guided ESP block before induction of anaesthesia in the theatre.

Patients sitting in the spinous process of the C7 to T6 vertebra were marked with a permanent skin marker, and the block was performed in this position. The areas were prepared from the cervical and thoracic paravertebral region with 5% povidone-iodine solution and surgical spirit. A high frequency (5-10 MHz) linear ultrasound probe was placed 3 cm laterally to the spinous process in the sagittal paramedian plane at the T4 level. After giving skin infiltration with 3-5 ml of 2% lignocaine, a 23G Quincke spinal needle was inserted in the caudal to cephalad direction until the tip lies between the transverse process and erector spinae muscle. 3-5 ml of normal saline was injected after negative aspiration to confirm the plane of drug delivery. 0.4 ml per kg of 0.2% ropivacaine was injected after negative aspiration under ultrasound guidance.

Anaesthesia Technique

Standard general anaesthesia technique was used during the surgery in both groups. Analgesia was given with an injection of fentanyl, one microgram per kg, followed by induction with propofol 2-3 mg /kg body weight till the loss of verbal response. Injection of Atracurium, 0.5 mg per kg, was used to facilitate intubation. General anaesthesia was maintained with 60% nitrous oxide in an oxygen and sevoflurane mixture. The patient was monitored for ECG, HR, NIBP and SpO2. The heart rate, both systolic and diastolic blood pressure, was recorded before induction (baseline) and after intubation, every 5 minutes till 60mins of the procedure.

All the patients received a continuous infusion of ringer lactate at 8-10 ml/kg/hr and Inj Dexamethasone at 8 mg. If there is a 20% increase in mean arterial pressure or more from baseline for two consecutive readings, one microgram/kg bonus of intravenous fentanyl was given for both groups. Hypotension where MAP < 20% was treated with normal saline bolus and I/V; Ephedrine 6-12 mg if required. Bradycardia (HR <40) was treated with Inj Atropine 0.6 mg. Half an hour before the end of the

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surgery, Inj. Ondansetron 0.1 mg/kg was administered.

At the end of the surgery, the residual neuromuscular blockade was reversed with iv; glycopyrrolate 10 microgram/kg and I/V; neostigmine 50 microgram/kg. Once the patient was fully awake, followed the verbal command and breathed adequately, the patient was extubated after thorough oral cavity suctioning. The patient was shifted to the recovery room for further management.

Postoperative Assessment

After the patient was shifted to the postoperative room or ICU, the patient was monitored for mean heart rate, systolic blood pressure, and diastolic blood pressure at regular intervals. An invigilator recorded the vital signs and the pain score according to NRS at 0, 2, 4, 6, 8, 12 and 24 hours postoperatively. All these observations were noted in the proforma attached and analysed statistically using appropriate statistics. If a pain score above four was recorded, rescue analgesic Inj Tramadol 100mg was given through the intramuscular route.

Statistical Analysis

The collected data was entered in Microsoft Excel (windows 11) and analysed using the statistical package for social sciences (SPSS-19). To find an association between two categorical variables Pearson chi-square test was used. The value of $P<0.05$ is considered statically significant.

RESULTS

The parameters like mean height, weight, and age of patients in both groups were comparable.

Table 1: Observation of demographic and intraoperative hemodynamic parameters of patients in both groups

Parameters	Observation N (%)		P-value
	Group 1 (GA+ESP) (N=30)	Group 2 (GA) (N=30)	
Height (Mean cm± SD)	158.13±6.118 cm	155.67±6.375 cm	0.115
Weight (Mean Kg± SD)	63.1±12.60	62.53±11.05	0.839
Age (Mean Year ± SD)	54±4.8	53±3.7	0.759
Intra-operative Heart Rate (Mean± SD)			
Baseline	86.2±7.194	85.57±12.705	0.06
5 min	82.7±13.779	89.53±12.632	0.07
10 min	82.83±14.02	81.43±9.944	0.005
15 min	83.33±13.241	79.5±7.041	0.006
30 min	75.9±10.752	79.03±6.764	0.0001
60 min	77.07±12.937	78.63±6.657	0.001
At Extubation	78.2±6.754	84.6±10.969	0.05
Intra-operative Systolic Blood pressure (Mean± SD)			
Baseline	134.47±12.528	125±16.218	0.06
5 min	130.93±13.921	124.07±12.905	0.07
10 min	119.57±13.064	124.2±12.805	0.006
15 min	118.6±14.148	124.33±11.651	0.002
30 min	120.6±16.654	123.67±9.643	0.001
60 min	119.57±15.097	124.73±10.783	0.001
At Extubation	125.77±10.467	127.67±7.092	0.05
Intra-operative DBP (Mean± SD)			
Baseline	75.23±10.997	72.5±7.807	0.06
5 min	67.73±14.969	80.83±11.792	0.001
10 min	71.67±15.029	75.67±5.683	0.01
15 min	72.2±15.584	75.47±4.925	0.02
30 min	77.43±16.107	76.7±5.491	0.05
60 min	77.93±11.129	74.67±5.074	0.02
At Extubation	69.93±7.395	70.37±13.395	0.06

The various hemodynamic parameters such as intraoperative heart rate, systolic blood pressure, and diastolic blood pressure were reported statistically significant ($p<0.05$) in both groups from 10 min. to 60 min. However, all the above parameters were comparable at 5 min time point. Regarding the postoperative heart rate, there was a statistically significant difference in Group 1, which showed lesser values than Group 2. In the postoperative period, the systolic and diastolic blood pressure showed reduced values in group 1 compared to group 2, which was statistically significant (p-value <0.05) [Table 2].

Table 2: Observation of postoperative parameters of patients in both groups

Parameters	Observation N (%)		P-value
	Group 1 (GA+ESP) (N=30)	Group 2 (GA) (N=30)	
Heart Rate (Mean± SD)			
0 hr.	78.86±4.732	82.66±13.618	0.121
2 hr.	79.83±5.705	95.43±11.193	0.000

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4 hr.	78.00±6.918	89.76±10.775	0.000
6 hr.	81.86±7.920	91.50±10.009	0.000
8 hr.	79.267±5.800	86.50±10.002	0.000
12 hr.	79.10±7.979	90.56±14.036	0.000
24 hr.	79.83±7.777	82.73±8.468	0.217
SBP (Mean± SD)			
0 hr.	114.17±6.864	117.7±16.00	0.217
2 hr.	117.07±5.589	131.90±12.87	0.000
4 hr.	115.13±4.960	127.67±13.28	0.000
6 hr.	120.97±10.58	132.33±12.83	0.000
8 hr.	119.50±8.83	128.46±11.39	0.000
12 hr.	116.40±11.34	126.53±15.613	0.001
24 hr.	113.63±17.508	113.63±8.442	0.549
DBP (Mean± SD)			
0 hr.	72.80±5.821	76.43±10.769	0.068
2 hr.	77.33±7.822	85.13±9.98	0.001
4 hr.	73.96±8.368	85.90±8.639	0.000
6 hr.	76.30±9.002	87.06±7.138	0.000
8 hr.	74.73±9.727	79.2±10.046	0.092
12 hr.	73.23±8.357	81.8±10.558	0.000
24 hr.	74.43±8.295	75.5±7.343	0.620
Numeric rating scale (Mean± SD)			
0 hr.	0.8±0.847	1.33±1.845	0.122
2 hr.	1.47±0.819	2.40±1.569	0.005
4 hr.	1.46±0.86	2.00±1.781	0.001
6 hr.	1.67±1.18	2.3±1.510	0.002
8 hr.	1.57±1.278	1.8±1.27	0.05
12 hr.	1.27±1.172	2.47±1.756	0.001
24 hr.	1.43±1.135	1.37±0.718	0.801
Mean Rescue Analgesic (mean± SD)	0.9±0.693	1.21±0.726	0.002

In the present study, the pain score by postoperative numerical rating (NRS) scale in group 1 was statistically significant ($p<0.05$) compared to group 2. The mean rescue analgesia for group 1 had a lesser score compared to group 2, which was statistically significant ($p<0.05$) [Table 2 & Figure 1].

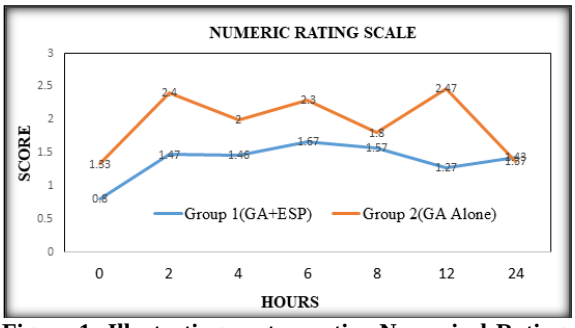

Figure 1: Illustrating postoperative Numerical Rating Scale

DISCUSSION

Several studies were done with various pharmacological agents with various regional techniques to provide adequate analgesia during the postoperative period.[3,4] In our study, both groups are demographically comparable in age, ASA, physical status, surgery duration of anaesthesia and recovery characteristics. Our primary outcome was to compare the pain scores between the two groups to analyse the duration of pain relief. The secondary outcome was to compare the time for the first rescue analgesic and the total amount of analgesia required over the first 24 hours of duration. The pain score from the time of extubation, 2, 4, 6, 8, and 12 hours till 24 hours, were monitored for two groups for GA with ESP block and plain GA were statistically significant. The pain scores in patients with plain GA showed higher values from 4 hours postoperatively, while those who received ESP showed higher values from the 8th hour postoperatively.

This is the first randomised prospective control study to find the efficacy of 0.2% ropivacaine as erector spinae block as post-op analgesia in modified radical mastectomy patients. A similar study done by Singh S et al. about ultrasound-guided erector spinae plane block for MRM patients showed the effectiveness of block for post-op analgesia.[9]

Oghoshi et al. performed a similar study USG guided ESP block the patients undergoing mastectomy and reconstruction with tissue expander.[10] The author had put a catheter at the T5 level beneath the erector spinae muscle after injecting 20 ml of 0.375% of ropivacaine. The catheter was connected to a patient-controlled analgesia pump in both patients (0.2% ropivacaine, basal infusion-8ml/hr, bolus- 3 ml, lockout-30 minutes). The first patient had an NRS score of 0 on postoperative days 1 and 2 and sensory spread to dermatome T2-T8. But in our study, where we had given a single shot plane ESP block, the NRS score was 0 for 40% of the people in group 1 for 8 to 10 hours in the postoperative period.

Altiparmak et al. performed an ultrasound-guided ESPB in 42 patients who underwent a mastectomy, using two concentrations of bupivacaine (0.375% and 0.25%). The mean 24 hr. postoperative tramadol

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consumption was 149.52 ± 25.39 mg in the 0.375% group and 199.52 ± 32.78 mg in the 0.25% group (p=0.001). In the 0.375% group, the NRS scores were significantly lower at every time point compared with those in the bupivacaine 0.25% group.[11]

Similarly, in our study, we used 0.2% of ropivacaine as the drug, which resulted in tramadol usage in similar quality of mean rescue analgesia of 0.9±0.693 in the group subjected to ESP block. The time to first rescue analgesia was compared in two groups, where group 1 showed a delay in time for administration of the first dose of rescue analgesia compared to group 2. The results showed a significant difference (p =0.002) between the two groups, where the duration of analgesia was longer in group 1. These findings in the present study follow earlier reported investigations.[12]

The hemodynamic stability postoperatively showed a statistical difference from the time of extubation to 24 hours post-surgery, where group 1 was better than group 2. Even though there are various drugs for pain management, with the administration of regional anaesthesia in the form of erector spinae plane block, the use of other intravenous and intramuscular drugs could be limited to a greater extent, thereby reducing the side effects of those drugs.[13] This would also help in early recovery and discharge of the patient.

CONCLUSION

This study has shown that the ultrasound-guided single injection ESP block using 0.2% ropivacaine provides adequate postoperative analgesia, and the time for the first rescue analgesic was prolonged compared to patients who underwent surgery under plain general anaesthesia. The study concludes that ESP block is a technique that has great advantages over conventional techniques performed close to the neuraxis. The duration of analgesia was very much prolonged in patients who received the ESP block, and they had to receive very few opioids.

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