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Comparison Of Segmental Spinal Anesthesia With General Anesthesia For Modified Radical Mastectomy: A Prospective Randomized-Controlled Study

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Abstract
Background and Aims: Breast surgery is associated with significant postoperative pain and distress. Thoracic segmental spinal anaesthesia has come as a good alternative to general anesthesia (GA), providing better analgesia, with lesser requirement of opioids and post operative nausea -vomiting. This study aims to compare segmental spinal and GA for modified radical mastectomies in breast surgeries.
Material and Methods: Our study enrolled 56 female patients scheduled to undergo modified radical mastectomy for breast cancer. They were randomly divided into two groups, GroupG (received General Anaesthesia) and group S (received thoracic spinal anesthesia with 0.75% isobaric ropivacaine at T5–T6 inter spaces). Study objectives were hemodynamic fluctuations, perioperative complications, time to first rescue analgesic, and total opioid consumption in first 24 h. Data were expressed as mean (SD) or number (%) as indicated and were compared using Chi-square, Fisher's exact, or Student's ttest as appropriate.
Results: Nausea and vomiting were significantly higher in group G compared to group S (P = 0.01). Mean time to rescue analgesia was 33.21±7.48 min in group G as compared to 338.57±40.70in group S and opioid consumption was also significantly lower in group S (70.00 ± 27.38) as compared to group G (366.07 ± 59.40). There was no significant difference in hemodynamic parameters. Postoperative analgesia was significantly better in group S as compared to group G.
Conclusion: Thoracic segmental spinal anesthesia technique provides better satisfaction with better postoperative analgesia and fewer complications in patients undergoing breast cancer surgery compared to GA.
Keywords: *General anesthesia, isobaric ropivacaine, segmental thoracic spinal anesthesia*

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I. Introduction

General anesthesia (GA) is the most commonly accepted technique for modified radical mastectomies in breast cancers. However, the associated longer hospital stays due to pain and nausea vomiting along with hemodynamic disturbances attributed to use of intra and post op opiods for analgesia demand for an alternative technique.[1]

Regional anesthesia techniques for breast surgeries like thoracic epidural[3] and paravertebral blocks,[4] are effective but the possibility of a failed block alon with longer time for onset and large volume of local anesthetic used with the potential of local anesthetic toxicity are considerable factors. On the contrary, in case of segmental spinal, dose required for blocking the required dermatomes is very low as compared to other techniques, while motor control over the lower extremities is retained. As patients are awake during the process, they often require counselling to manage anxiety.

A few studies have been conducted where researchers have successfully used segmental spinal anaesthesia for surgeries like laparoscopic cholecystectomies as an alternative to GA.[5,6]

II. Materials And Methods

Our study was a prospective, randomized-controlled study conducted in the Department of Anesthesiology and Critical Care at a tertiary care centre. After obtaining informed consent in writing, 56 female patients aged between 20 and 65 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II and scheduled for modified radical mastectomy (between December 2023 and July 2024), were enrolled. Exclusion criteria noted were patient refusal, any contraindication for spinal anesthesia, cardiac disease, inflammatory breast cancer and BMI (body mass index) above 35 kg/m^2.

Standard preoperative evaluation was done. Any chemotherapy and/or radiotherapy cycles were documented. Preoperative echocardiogram was advised to check for cardiac changes in response to cardiotoxic

chemotherapeutic agents prescribed to these patients, as per institutional protocol. All patients were given details regarding both procedures (thoracic segmental spinal anesthesia and GA) and numerical rating scale (NRS) for pain in their local language.

Randomization was done using computer-generated random number table and allocation concealment was done using sequentially numbered opaque sealed envelope that were opened on the day of surgery prior to induction. Patients were designated their group as per the envelope number as group S (Segmental spinal) or group G (General anaesthesia).

Patients were fasted for 8 hours for solids and 2 hours for clear liquids with an IV drip of Ringer lactate at the maintenance dose as calculated by the Holliday Segar formula.After shifting to the operating room, ASA standard monitoring including continuous electrocardiogram, noninvasive blood pressure, and pulse oximetry were attached and baseline vitals [heart rate (HR), mean arterial pressure (MAP), and peripheral oxygen saturation (SpO_2)] were recorded.

Thereafter, according to the group, patients underwent their assigned procedure, either segmental thoracic spinal anesthesia or general anesthesia.

Patients enrolled in group S received spinal block under all aseptic precautions after painting and draping the puncture site (T5–T6). Infiltration with 3-5 mL of 1% lignocaine was done. The puncture was performed via a median approach with a 27-G Quincke spinal needle. Free flow of clear CSF was observed and a mixture of 1.2mL 0.75% isobaric ropivacaine was injected slowly. Patients were then placed in the supine position for the rest of the procedure and the onset of sensory block [response to pinprick from the lower border of the clavicle (T2) to the inferior costal margin (T8)]was noted at every 2 min. The block was considered failed if the sensory block was not achieved in the field even after 10 min. Patients with failed block were administered standard GA and were excluded from the study.

Patients enrolled in group G received GA. Premedication (IV midazolam 0.02 mg/kg and IV fentanyl 2 mcg/kg) was administered and patients were pre-oxygenated with 6–8 L/min flow and 1.0 FiO_2 of oxygen for 3 min. Propofol was used as inducing agent (2 mg/kg) slowly while IV atracurium besylate at 0.5mg/kg was used as relaxant. After intubation, anesthesia was maintained with sevoflurane and nitrous oxide with 40% oxygen in air to maintain a MAC between 0.8 -1. At the end of surgery, neuromuscular blockade was reversed with 50 mcg/kg neostigmine and 10mcg/kg of glycopyrrolate and trachea was extubated when patient responded to verbal commands.

Vitals including Mean Arterial Pressures , Heart Rate, and SpO2, were recorded at every 5 min after induction till the end of surgery. Episodes of hypotension (fall in MAP by 30% from baseline) and bradycardia (HRless than 60 beats/min) were treated with IV crystalloid bolus or IV mephentermine 6mg and IV atropine 0.01mg/kg for significant bradycardia (HR <40 beats/min). Other perioperative complications such as the occurrence of paresthesia, nausea, vomiting, pruritus, and urinary retention were also recorded. Postoperative pain was assessed, by anaesthesia resident posted in Post op ICU blinded to the group allocation, using NRS (0–10: 0 =no pain and 10 =worst imaginable pain) after receiving patients in post-anesthesia care unit (PACU) (0 h) and then at every 2 h interval till 12 h and then at 24 h. Patients were prescribed IV paracetamol 1 g every 6 hourly and pain between two doses of paracetamol, if present was treated with IV tramadol 1mg/kg (rescue analgesic). Time to first rescue analgesia and total opioid consumption over 24 h was recorded.

The sample size calculation was calculated using a previous study which showed a 2.7 ±0.8 (mean ±SD) patient satisfaction score in patient receiving GA. As per our hypothesis, segmental spinal was expected to have lower NRS and a decreased need for rescue analgesics as compared to those who received GA. The sample size required to obtain power of the study (1−b) at 80%, would be 28 in each group. We have included 30 patients in each group.

Data collected were compiled and analyzed statistically using Statistical Package for Social Sciences version 20 (IBM SPSSStatistics for Version 21.0. Categorical data were compared using Chi-square test, whereas continuous variables were compared using Student's t −test or the Mann–Whitney U − test .Pvalue < 0.05 was considered statistically significant.

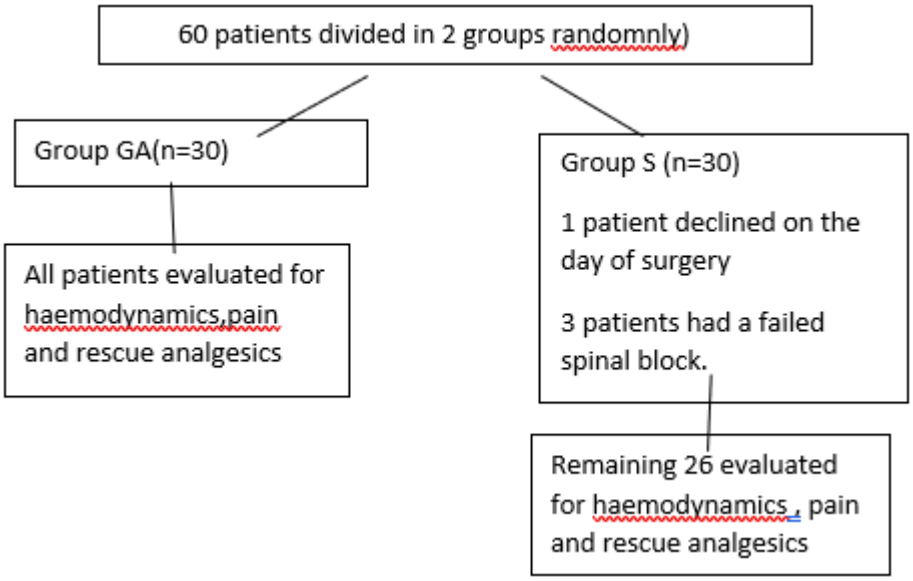


Figure 1: Consort flow diagram

Table 1: Comparison of demographic profile and duration of surgery between study groups

Variable	Group S	Group G	*P*
Age (years)	51.96±9.93	52.35±0.15	0.895
BMI (kg/m^2)	24.63±1.50	24.84±1.8	0.637
ASAI/II	23/5 (82.14/17.86)	21/7(75/25)	0.514
Duration of surgery (min)	75.53±24.43	66.96±12.34	0.103

Table 2: Comparison of time to first analgesic request, number of patients requiring rescue analgesia, and total opioid consumption between study groups

Parameters	Group T	Group G	*P*
Total opioid consumption (mg)	70.00±27.38	366.07±59.40	<0.0001
No. of patients requiring rescue analgesia	5 (17.85%)	28 (100%)	<0.0001
Time of first analgesia (min)	338.57±40.70	33.21±7.48	<0.001

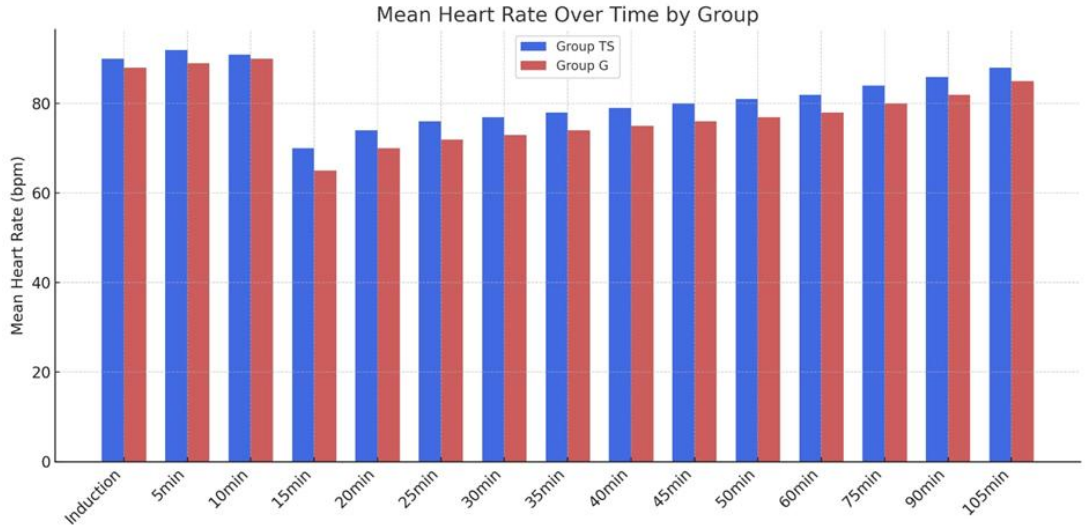
Table 3: Comparison of NRS score at different time point between study groups

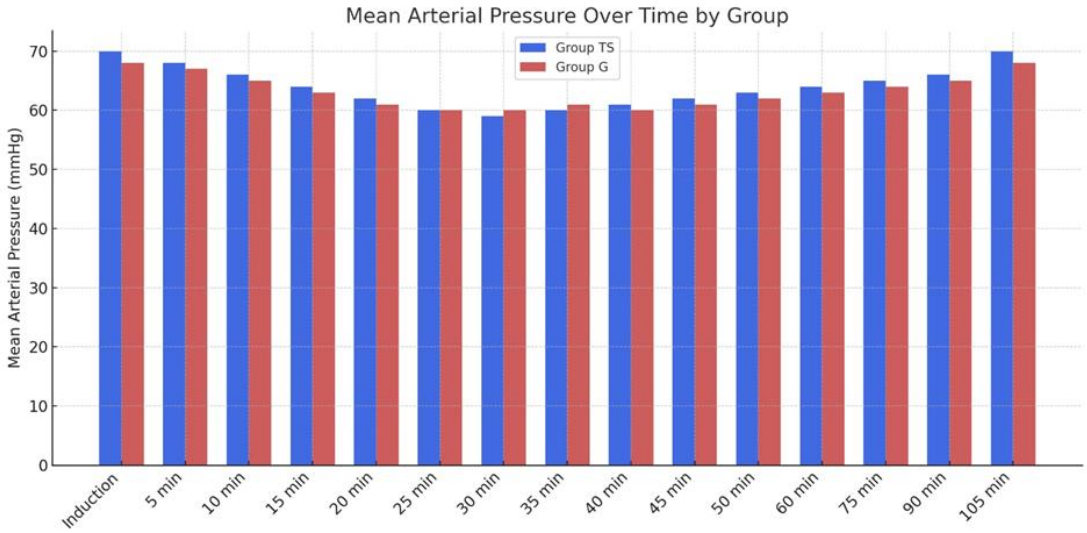
Time (h)	Group S	Group G	P
0	1 (1, 2)	6 (4, 8)	<0.0001
2	1 (1, 2)	5 (4, 7)	<0.0001
4	2 (1, 3)	5 (4, 7)	<0.0001
6	2 (1, 3)	5 (4, 6)	<0.0001
8	3 (2, 4)	4 (3, 6)	<0.0001
10	2 (1, 3)	6 (4, 8)	<0.0001
12	3 (2, 5)	4 (3, 6)	<0.0001
24	1 (1, 2)	2 (1, 3)	0.0004

III. Results

A total of 60 patients were screened for enrollment; out of them in 3 patients the effect of block did not come while 1 female declined to participate on the morning of surgery due to anxiety ; remaining 56 patients were studied [Figure 1]. The demographic profile [age and body mass index (BMI)], ASA physical status, and duration of surgery were comparable between groups [Table 1].

MAP showed no significant difference between the groups [Figure 3]. The time to first rescue analgesic request was significantly higher in group S (338.57 ± 40.70 min) compared to group G (33.21 ± 7.48 min) ($P < 0.001$) [Table 2].The NRS scores were significantly better in group S at all time point of observation [Table 3] leading to significantly lesser opioid consumption over 24 h in group S (70.00 ±27.38 mg) as compared to group G (366.07 ±59.40mg) [Table 2]. Three patients in group S (10.71%) experienced paresthesia during spinal puncture, which resolved after stylet removal and needle withdrawal, without sequelae. Nausea and vomiting were significantly higher in group G as compared to group S ($P = 0.051$ and $P = 0.01$). 5 patients in group S developed bradycardia (HR < 40 beats per min) within 10 min of spinal and were treated with atropine.





IV. Discussion

As per our study, segmental spinal anaesthesia provides better control of post-operative pain, lesser usage of rescue analgesics leading to a decrease in the total opioid consumption, and hence lesser duration of hospital stay.

Although incidence of bradycardia in the first 30 min was higher after thoracic spinal anesthesia, only 3 patients required intervention. This technique could also be beneficial to the patient with relative contraindications for GA. Problems with midthoracic spinal are the potential risk of neuronal injury and possibility of high spinal from the spread of local anesthetic in the cephlad direction. Therefore a higher index of suspicion is advised. The importance of proper dosing of drug cannot be overstated. The stellate needs to be withdrawn as soon as ligamentum flavum is penetrated so as to avoid spinal cord injury.

Similar studies using 1 mL plain bupivacaine (5 mg/mL) and 0.3 mL fentanyl (50 □g/mL) in minor breast surgery (lumpectomy or simple mastectomy) under segmental spinal anesthesia at T5-T6 level are documented [7]

No respiratory complications such as dyspnea or hypoxia (SpO_2 <94%) were noted in group S.

Similar results were obtained in a case report, where a patient with COPD with severe emphysema on oxygen therapy underwent cholecystectomy under the thoracic CSE technique, with a minute dose of local anesthetic, without any respiratory complications.[5]

Hemodynamic changes studied were MAP and HR. MAP changes were minor and insignificant; in spite of the neuraxial blockade, this is because the motor power of the lower limbs was preserved, a low dose of local anesthetic was used, and the patient remained conscious throughout the procedure, avoiding central depression of circulation. Bradycardia occurred in eight patients (28.57%) in group S, where 3 were teeated with atropine. In contrast, Imbelloni,[20] used a similar low dose of hyperbaric bupivacaine (7.5 mg) in combination with fentanyl

(T10–T11) and achieved less bradycardia (2.85%), whereas Elakany et al.[6] proved that hypotension and bradycardia developed in 15% of cases, who received segmental thoracic spinal anesthesia.

Effect of thoracic spinal anesthesia in laparoscopic cholecystectomy as studied by Yousef et al.[8] was similar as our study where an effective pain control was obtained leading to overall healthy patient and hence lesser stay in hospital , most of them getting discharged by day2- 3 of surgery contrary to GA group getting discharged only by day 5-6 of surgery.

Ellakany et al.[10] who studied thoracic spinal anesthesia concluded that it was safe for patients undergoing abdominal cancer surgery.

Our study has a few limitations. First, we could not follow our patients for a long term period, our observation was limited only to the in-hospital settings. Second , the study population can be increased so as to observe changes in hemodynamics more precisely.Thirdly, since it is a single shot spinal , we cannot rule out the time constraints for the surgeries. Unlike General anaesthesia, we might not be able to prolong the surgery duration.

V. Conclusion

Low dose single-shot segmental spinal anesthesia with a local anesthetic can be used as a substitute to GA in patients undergoing modified radical mastectomies as we observed in this study that it resulted in faster recovery and better patient outcomes and hence, early hospital discharge.

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Nil.

Conflicts Of Interest
There are no conflicts of interest.

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