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Research Article

QUALITY AND EFFICACY OF GENERAL ANESTHESIA VERSUS SEGMENTAL THORACIC SPINAL ANESTHESIA IN MODIFIED RADICAL MASTECTOMY SURGERY: A SINGLE-CENTER OBSERVATIONAL STUDY

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ABSTRACT

Objective: Surgical resection remains the most important treatment modality for breast cancers. Recent research suggests that the choice of anesthesia technique might also have a role in the recurrence of the disease. We compared quality and efficacy of the conventional general anesthesia technique with segmental thoracic spinal (STS) anesthesia technique used in modified radical mastectomy.

Methods: 60 American Society of Anesthesiologists II/III patients were divided into two groups Group C (Control group) and Group S (Study group). Group C patients were induced with standard anesthesia regimen while Group S patients were given STS at T4–T5 inter space with 1.5 mL of 0.5% hyperbaric levobupivacaine along with 15 µg of fentanyl with conscious sedation. Hemodynamics, pain score, time for first rescue analgesia, experience of anesthesiologist, surgeon, and patients were recorded.

Results: Time for induction in group S is significantly longer (Group C 17.4±3.8 vs. 36.2±7.2 min, in Group S). The duration of surgery (56±13.6 min vs. 76.4±15.9 min) was also significantly longer, while reversal period was shorter in Group S (9.2±6.2 and 6.3±5.7 min). Modified Aldrete's recovery score achieved quickly in Group C (16.8±4.9 vs. 29.7±9.8 min), but postoperative analgesia was better in Group S as first rescue analgesic sode required after 6.2±1.9 h in Gr. S while in Gr. C time duration was 4.9±1.3 h. Length of stay in hospital was more in Group S, (Group C 45.4±4.8 vs. Group S 56.3±8.5 [h]) while ease and comfort of surgeon anesthesiologist and patient satisfaction score were more in Group C.

Conclusion: STS anesthesia is feasible for breast carcinoma surgeries but it is easier for surgeon and anesthesiologist to manage patient under general anesthesia. STS anesthesia has advantage in terms of early post-operative analgesia and will definitely be helpful in cases where patient is not fit for general anesthesia.

Keywords: Anesthesia recovery period, Enhanced recovery after surgery, General anesthesia, Modified radical mastectomy, Quality control, Spinal anesthesia.

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INTRODUCTION

Breast cancers are the most common cancers of women worldwide. Surgical resection remains the main modality of curative management and is often a part of multi-modal treatment plan with other regimens such as hormonal therapy, chemotherapy, immune-modulation, and radiotherapy [1].

Anesthesia management for breast cancer surgery has evolved over the past few decades, and the focus is now more on reducing stress, pain management, and early recovery. A recent study concluded that the choice of anesthesia technique might have a role in the recurrence of breast carcinomas [2]. This recurrence of disease is thought to be associated with increase interleukin-10 levels during perioperative period and prolonged use of opioid are also linked with immunomodulation and recurrence of breast cancers [3].

The nature of breast surgery also has a cosmetic, psychological, and social impact and is associated with high level of anxiety in the young females undergoing surgery. Many anesthetic implications resulting from systemic effects of chemotherapy on hepato-renal, cardiac, endocrine, respiratory, and coagulation system also exist. Thus, breast cancer surgeries are operative procedure that requires proper preoperative assessment and optimization of their comorbidities and planning of anesthesia technique along with postoperative analgesia management plan.

There are multiple anesthesia management strategies for such type of surgery, but most of these surgeries are performed under general anesthesia. Recently, there are lots of interesting reports coming in literature about increasing acceptance of segmental thoracic spinal (STS) anesthesia technique for thoracic and upper abdominal surgeries. Researchers successfully used STS technique for patients undergoing modified radical mastectomy and other breast surgeries [4,5]. However, literature lack information about ease of intraoperative patient management by anesthesiologist, experience of patients and quality of surgical exposure by the surgeons and their satisfaction scores under STS block.

To assess the above deficient areas, we designed a study to compare quality and efficacy of STS anesthesia with conventional general anesthesia technique used in modified radical mastectomy as a single-center observational study and evaluated ease of surgery and anesthesia administration, hemodynamic stability, duration of surgery, patient satisfaction, and postoperative side-effects and length of stay (LOS) in hospital.

METHODS

This observational study was conducted in a university hospital. After obtaining ethical committee clearance and written informed consent from all participants, we enrolled patients who underwent unilateral mastectomy from January to August 2022.

We calculated the sample size with this equation $n=\frac{pq}{d^2}\times z\alpha^2$ and with confidence level: 95%, width of confident interval: ±5.5% assuming p=35%.

Where n is the required sample size; p is the magnitude of satisfaction; $Z\alpha^2$ is the value (*Z*-statistic) at the 95% confidence level (α = 0.05) which is 1.96; *d* is the margin of error 5% (0.05) with 10% non-response rate; and the final sample size was *n*=30.

Patients aged 18–60 years with the American Society of Anesthesiologist physical status II–III were included. Patients with the following conditions were excluded: (1) pregnancy or lactation; (2) coagulation disorders; (3) skin lesion at the thoracic block site; (4) history of allergy to drugs used in study; (5) inability to cooperate; and (6) body mass index (BMI) >32 kg/m^2.

On the day of surgery, all patients received pre-medication with intravenous (I.V.) midazolam 0.03 mg/kg and glycopyrrolate 0.02 mg/kg, 30 min before induction. As they were shifted to the operating room, patients were either planned for receiving conventional general anesthesia (Control group: Group C) or STS block with conscious sedation group (Study group: Group S) on the discretion of concern anesthesiologist.

In the operating room, these patients were connected to standard monitoring equipment (electrocardiogram, non-invasive blood pressure, and pulse oximetry) as per protocol, and baseline values were recorded. In the control group, all patients were pre-oxygenated with 100% oxygen for 3 min and general anesthesia was induced with response-based slow I.V. administration of 1% propofol, and patients were asked to hold 20 mL syringe in their hands at the time of dropping of this syringe muscle relaxant vecuronium was administered 0.08 mg/kg technique. After 3 min of positive ventilation, Orotracheal intubation was done with an appropriate size endotracheal tube, and patients were put on controlled ventilation to maintain $EtCo_2$ of 40±5 mmHg and peak airway pressure of 20±5 cm of H_2O. Analgesia was provided with I.V. fentanyl 2 μg/kg and multi modal analgesia with I.V. paracetamol 1 g, dexamethasone 8 mg and magnesium 20 mg/kg. Anesthesia was maintained with oxygen: air: isoflurane with MAC of 1.0. After surgical closure of wound inhalation agents were shut and neuromuscular block was reversed with neostigmine and glycopyrrolate (0.05 mg/kg and 4 μg/kg). Patients were extubated when they achieved hand grip to hold 20 mL syringe again firmly without dropping when asked, and after that patients were shifted out to post anesthesia care unit (PACU) for observation.

In the study group (Group S), neuraxial block was performed using the mid-line sitting approach at T4–T5 vertebral level. After aseptic preparation of skin, with 25 G 9 cm B.D. Quinke's spinal needle, sub-arachnoid space was negotiated and confirmed with free flow of clear cerebrospinal fluid and 1.5 mL of hyperbaric levobupivaciane 0.5% with 15 mcg of fentanyl with total volume of 1.8 mL was injected. The patient was put in lateral position to ipsilateral side for 8 min, level and quality of block was confirmed. Patients who did not have acceptable levels of block were termed as block failure cases and they were converted to general anesthesia technique.

Propofol 1% IV infusion was started at the dose of 100–150 μg/kg/min according to response to keep Ramsay sedation score of 3. After surgical closure of wound, propofol infusion was stopped and patient were observed till they become fully conscious and then only shifted out to PACU.

Evaluation tools and scores used were:

1. Time taken for incision after monitoring of baseline vital parameters (Ease of anesthesia administration)
2. Hemodynamic variation, more than 20% of baseline for hemodynamic stability.
3. Time duration of surgery (Ease of surgery)
4. Time taken to shifting out of patient after achieving Modified Alderet Score of 10 from completion of dressing to PACU (early recovery profile)
5. Time taken to achieve post anesthesia discharge scoring system (PADSS) of 10 in PACU.
6. Post-operative adverse events such as postoperative nausea and vomiting (PONV), urine retention, headache, voice change, and others.
7. Total LOS in hospital
8. Overall experience of anesthesiologist regarding ease of anesthesia administration, which was assessed using the rating scale ranging from Easy to manage=5, comfortable=4, not so comfortable=3, somewhat difficult=2, very difficult=1
9. Surgical satisfaction was evaluated by one surgeon and recorded according to a 5-point score: Muscle relaxation, bleeding control, cautery fasciculation, ease of surgical closure, total surgical time taken linked to Likert scale (5: Excellent, 4: Good, 3: Satisfactory, 2: Poor, 1: Very poor)
10. Patient satisfaction score was calculated as mean value of 3 variables:
    a. Pain control was rated on scale as 5=Excellent, 4=Good 3=Satisfactory 2=Adequate, 1=poor control.
    b. Nausea and Vomiting was rated on an ordinal scale as: 5=No PONV, 4=Some un-easiness but no nausea, 3=Only Nausea no vomittings, Nausea which require treatment 2=or Severe PONV=1.
    c. Headache: No headache 5, some discomfort 4, heaviness overhead 3, Intermittent headache 2 and severe headache=1

A combined score of above three and divided by 3 was recorded as the final score.

RESULTS

Two patients of the study group were converted to general anesthesia due to failure of STS and thus removed from the study, which makes a total of 28 patients in group S. Statistical analysis was done with Students *t*-test for numerical data and Fisher's exact test for categorical variables.

DISCUSSION

Modern anesthesia techniques are more and more focused toward enhanced recovery after surgery (ERAS) protocols which has proven to shortened hospital stays and reduced use of analgesic requirements after common surgical procedure [6]. It has been documented that STS anesthesia is safe and has advantage in providing better postoperative pain relief. The proponents of STS claim that dose of local anesthetic agent required to block selected spinal segments is exceedingly low when given the specific site and it ensures effect of drug only on selected section of the spinal cord thus causing less fluctuations in hemodynamic parameters, good quality of analgesia and muscle relaxation without obtundation of central reflexes and other neurological complications. Patients are able to move their lower limbs and control over micturition negate use of urinary catheter. All these factors are associated with early recovery in accordance with ERAS protocol [7-9]. But anesthesia for modified radical mastectomy involves many more concerns [10]. The mean age of patients in our study were 36.8±4.2 and 37±3.9 (mean±2 standard deviation) years, and weight is 62.6±12.2 and 58.8±9.7 kg in Group C and Group S patients, respectively, this difference is statistically non-significant (Table 1). In this age group, patients are more concerned with exposure, cosmetic, aesthetic and psycho-social issues thus were more anxious even under conscious sedation and demanded for general anesthesia.

In Group C, induction of anesthesia was significantly earlier than Group S (17.4±3.8 and 36.2±7.2 min, respectively). As STS block technique is newer one, require steep angle of insertion in guarded manner till free

Table 1: Demographic and perioperative data

Variable (±2SD)	Gr. C 30	Gr. S 28	p-value
Age (yrs.)	36.8±4.2	37.3±9	0.76
Weight (kg)	62.6±12.2	58.8±9.7	0.19
ASA Gr.II/III	20/10	15/13	0.424
Incision. time (min)	**17.4±3.8**	**36.2±7.2**	**0.00***
Induction to incision			
Duration of surgery (min)	**56±12.6**	**76.4±15.9**	**0.00***
Incision to dressing			
Reversal time (min)	9.2±6.2	6.3±5.7	0.69
Dressing to detachment of monitors			
Post-operative recovery period			
Mod. Aldrete's score of 10 times (min)	**16.8±4.9**	**29.7±9.8**	**0.00***
Time for first rescue analgesia	**4.9±1.3 h**	**6.2±1.9 h**	**0.004***
PADSS post anesthesia discharge score 10 times (h)	15.7±3.8	24.1±6.3	0.17
Length of stay in hospital (h)	**45.4±0.8**	**56.3±8.5**	**0.00***

ASA: American Society of Anesthesiologists, PADSS: Post anesthesia discharge scoring system, SD: Standard deviation, *p value<0.05

flow of clear cerebrospinal fluid was confirmed, along with 8 min. of drug fixation time in ipsilateral position causes time taken for making incision after initiation of anesthesia procedure was significantly more in study group than control group. Although all surgery were same and done by same surgical team on single breast, time taken for completion of surgery was significantly more in study group (56±12.6 and 76.4±15.9 min) p<0.05 (Table 1) and possible valid explanation for this is surgeons are bothered by cautery twitches which were interfering with surgical dissection and disturbing surgical field and inadequate muscle relaxation mostly during deep dissection in axillary area. Intraoperative hemodynamics were more stable in group C during first 15 minutes while during emergence and extubation hemodynamics were significantly more stable in Group S. (Graphs 1 and 2). Emergence time (coming back to consciousness) was early in study group as these patient do not require reversal and extubation and It took only 6.3±5.7 min in comparison to control group which require 9.2±6.2 min (Table 1) for reversal of anesthesia after dressing of surgical site. Immediate and early recovery from anesthesia as reflected by Modified Alderets and PADSS score were quick in group C mainly due to time taken to recover upper limb or and lower limb weakness in group S (Table 2). We have used levobupivacaine 0.5% hyperbaric for sub-arachnoid block due its neuro and cardioprotective properties as the targeted spinal segments were in close proximity of T2–T4 sensory components of the sympathetic supply of heart, but no major adverse event related to hemodynamic stability is encountered. Modified Aldrete score of 10 was achieved early in Group C (16.8±4.9 min) in comparison to Group S (29.7±9.8 min) due to longer time taken for recovery of adequate strength of hand grip (holding 20 mL syringe firmly) postoperatively (Table 2). First rescue analgesic time was earlier in control group and this finding is similar to previous studies [4,5] which acknowledge advantage of STS in providing better pain management (Table 1). Post anesthesia discharge score of 10 was also achieved early in Group C in comparison with Group S 15.7±3.8 and 24.1±6.3 h but it was not statistically significant.

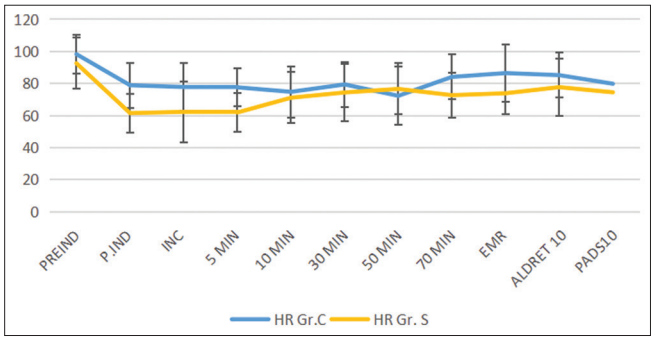
LOS in hospital was also significantly long in study group as neuraxial block patients required non ambulatory state for 12 h [11] and this parameter was not evaluated by previous researches [5].

Anxiety related to procedure along with prognosis constantly bothers them in post-operative area also and Amsterdam Preoperative Anxiety Score (APAIS) [12] remains more than 3 in 73% of our study population. Acceptance for general anesthesia was more than neuraxial block due to perturbation of adverse effects related to spinal anesthesia, though we encountered none. Our findings do not correlate with study by Elakany and Abdelhamid [5] probably due to difference in duration of

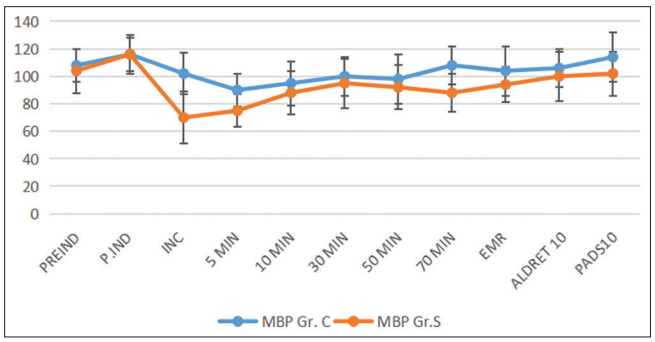
Table 2: Patient, surgeon, and anesthesiologist satisfaction score

Variable	Gr. C 30	Gr. S 28	p-value	Statistical test
Patient satisfaction score				
I/o Anxiety APAIS# >12	**0**	**8**	**0.006***	fe
PONV	4	2	0.067	fe
PDPH	0	0	1	fe
Urine, Retention	0	1	0.482	fe
Temp. upper limb weakness	0	4	0.113	fe
Surgeon satisfaction data				
Bleeding in sex site	1	3	0.344	fe
Inadequate muscle relax	**0**	**7**	**0.003***	fe
Country twitch	**1**	**14**	**0.00***	fe
Axillary exposure difficulty	**1**	**7**	**0.023***	fe
Wound complication	1	0	1	fe
Anesthesiologist experience regarding ease of anesth administration				
Very comfortable	**24**	**0**	**0.00***	**fe**
Manageable	**6**	**13**	**0.049***	fe
Not easy to manage	**0**	**15**	**0.00***	**fe**
Aborted	0	2	0.2	fe

PONV: Postoperative nausea and vomiting, PDPH: Post-dural puncture headache, fe: Fisher's exact test, APASIS: Amsterdam preoperative anxiety score. *p value<0.05



Graphs 1: Perioperative heart rate at different study periods



Graphs 2: Perioperative mean arterial blood pressures at different study periods

surgery. Two patients in Group S were converted to general anesthesia due to failed spinal after spinal drug was injected and thus received dual anesthesia therefore were not included for data analysis.

CONCLUSION

STS anesthesia is feasible and might have advantage in terms of post-operative analgesia at 3 h. after surgery when compared with general anesthesia during Modified radical mastectomy but most of the patients need extra supplementation with I.V. sedation during axillary clearance. Surgeons are not enthusiastic about this new technique as twitch response to cautery bothers them and most patients wish for

general anesthesia over spinal anesthesia. STS can be considered as a sole anesthetic in breast cancer surgery in patients those are not fit for general anesthesia, but standard care of patients undergoing modified radical mastectomy surgery remain general anesthesia with short-acting drugs and multi-modal analgesia.

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CONFLICTS OF INTEREST

The authors declare no competing interests.

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APPENDIX

Appendix 1: Amsterdam preoperative anxiety score

APAIS Score: 1: Not at all, 2:Some concerns, 3: Most of the time, 4: Throughout Sx, 5:Extremely bothered		
A	Constantly bothered about anaesthesia	
B	Thinking about anaesthesia procedure constantly	
C	Wants to know more about anaesthesia procedure	
D	Worried about the surgical procedure	
E	Thinking about procedure constantly	
F	Wants to know more about surgical procedure	Total score points