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Case Report

Anaesthesia Section

Thoracic Segmental Spinal Anaesthesia for Modified Radical Mastectomy: A Case Report

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ABSTRACT

Thoracic Segmental Spinal Anaesthesia (TSSA) serves as a safe and effective alternative to general anaesthesia in high-risk patients with respiratory comorbidities such as Chronic Obstructive Pulmonary Disease (COPD). By avoiding airway instrumentation, the respiratory complications of general anaesthesia, TSSA can be a viable alternative to general anaesthesia in patients undergoing surgeries like modified radical mastectomy. This case report describes a 72-year-old female with very severe COPD posted for modified radical mastectomy for infiltrating ductal carcinoma. Breast surgeries are usually conducted under general anaesthesia. However, general anaesthesia comes with various complications which include higher stress response, nausea and vomiting, inadequate analgesia, postoperative cognitive dysfunction and delirium, and increased length of hospitalisation. In critically ill patients, these complications can prove difficult to handle. An appropriate choice of regional anaesthesia technique can help alleviate some of these issues. One of these techniques includes TSSA. Due to her American Society of Anaesthesiologists (ASA) III status and high risk for pulmonary complications under general anaesthesia, TSSA was chosen. This is because it provides better clinical outcome especially in elderly and frail patients. As we were faced with a high-risk patient who was prone for multiple postoperative complications, an innovative mode of regional anaesthesia was used to overcome complications associated with general anaesthesia. The surgery was uneventful and completed without respiratory or haemodynamic compromise. Postoperative period was uneventful and patient was discharged on postoperative day 5. TSSA proved a safe, effective alternative to general anaesthesia, avoiding airway instrumentation and mitigating major perioperative risks in this high-risk patient.

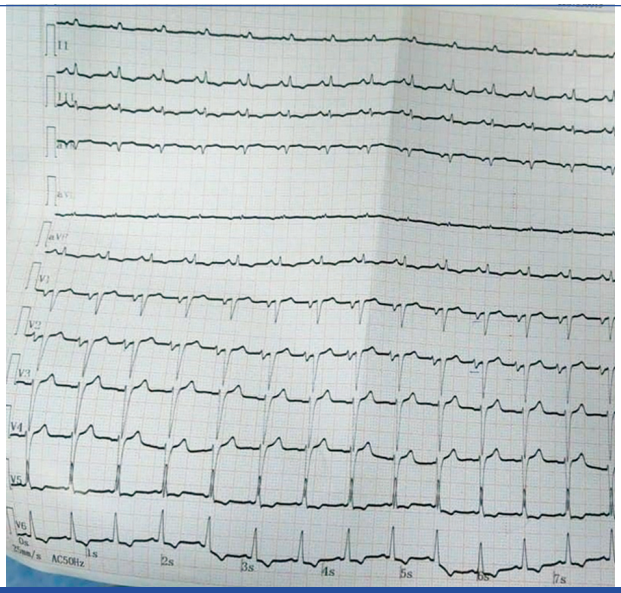
Keywords: Breast neoplasms, Chronic obstructive, Mastectomy, Segmental spinal anaesthesia

CASE REPORT

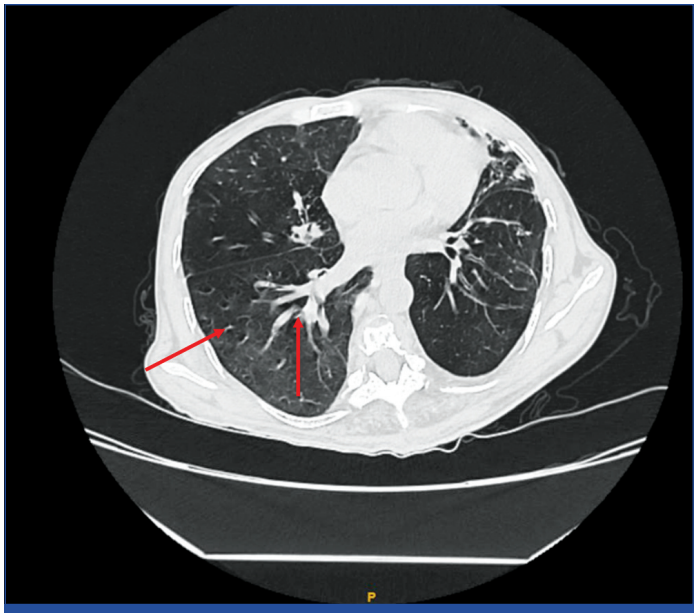
A 72-year-old female under the American Society of Anaesthesiologist (ASA) III patient presented to our hospital in the department of General Surgery with complaints of a lump in her right breast for nine months, which had an insidious onset, gradually increased to the current size of 8×8 cm and was associated with bloody discharge from the nipple and some skin changes over her right breast. A tru-cut biopsy revealed infiltrating ductal carcinoma of the right breast with stage IIIB. The patient was a known case of COPD since the past 10 years with poor compliance to medications. There was history of chronic exposure to biomass fuel for a period of over 50 years due to cooking over wood smoke. She gave history of breathlessness since 10 years with intermittent exacerbations, which had led to a considerable limitation of her daily routine activities. Her modified Medical Research Council (mMRC) dyspnoea scale grade was 3.

She also had episodes of cough with scanty whitish mucoid sputum. At the time of presentation, the patient reported that breathlessness had partially subsided and the cough had resolved. Patient was posted for right-sided modified radical mastectomy with axillary lymph node dissection and thereby sent for pre-anaesthetic checkup after due investigations.

On examination, the patient was 150 cm in height, weighed 40 kg, and had a Body Mass Index (BMI) of 17.7 kg/m^2. She was conscious and oriented. She was breathless at rest and could finish sentences of about 5-6 words before getting breathless. She was tachypnoeic with a respiratory rate of 24/minute. She was not cyanosed. The pulse rate was 68 beats/minute, and blood pressure was 132/80 mmHg. Room air saturation was 90%. Airway examination was unremarkable, with mouth opening of three fingers and Mallampati class II. Systemic examination of the respiratory system revealed reduced air entry in all lung fields, with bilateral basal crepitations. Other systems were normal. Haemogram showed haemoglobin of 12.8 gm/dL, leukocyte count of 10,400/mm^3, and platelet count of 1.8×10^5/µL. Electrocardiogram (ECG) revealed T-wave inversions in leads V2 to V6 [Table/Fig-1]. A cardiac consultation was done along with 2D echocardiography to rule out cor pulmonale. 2D echocardiography showed ejection fraction of 60% with no pulmonary hypertension. Respiratory physician consultation was conducted, along with spirometry. Spirometry revealed very severe COPD, with a Forced Expiratory Volume in One Second/Forced Vital Capacity (FEV_1/FVC) ratio <70% and FEV_1 ≤30%. High-Resolution Computed Tomography (HRCT) thorax revealed irregular spiculated soft-tissue density lesions in left upper lobe with multiple soft-tissue density nodules. Fibro-bronchiectatic changes in left upper lobe noted [Table/Fig-2]. Baseline blood gas analysis showed hypoxic, hypercapnic compensated respiratory acidosis [Table/Fig-3].



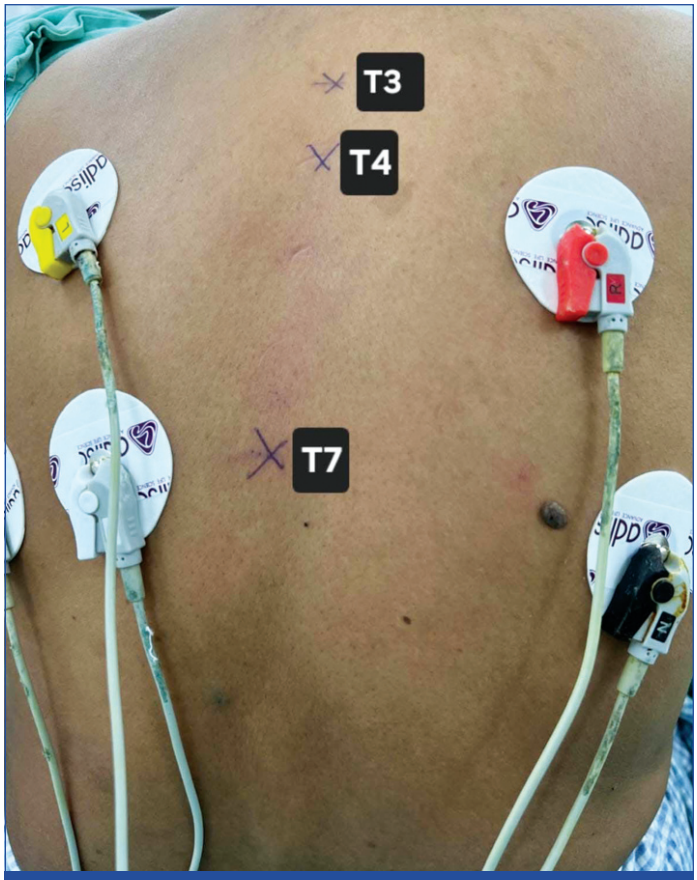
[Table/Fig-1]: ECG showing T wave inversions in leads V1-V6.



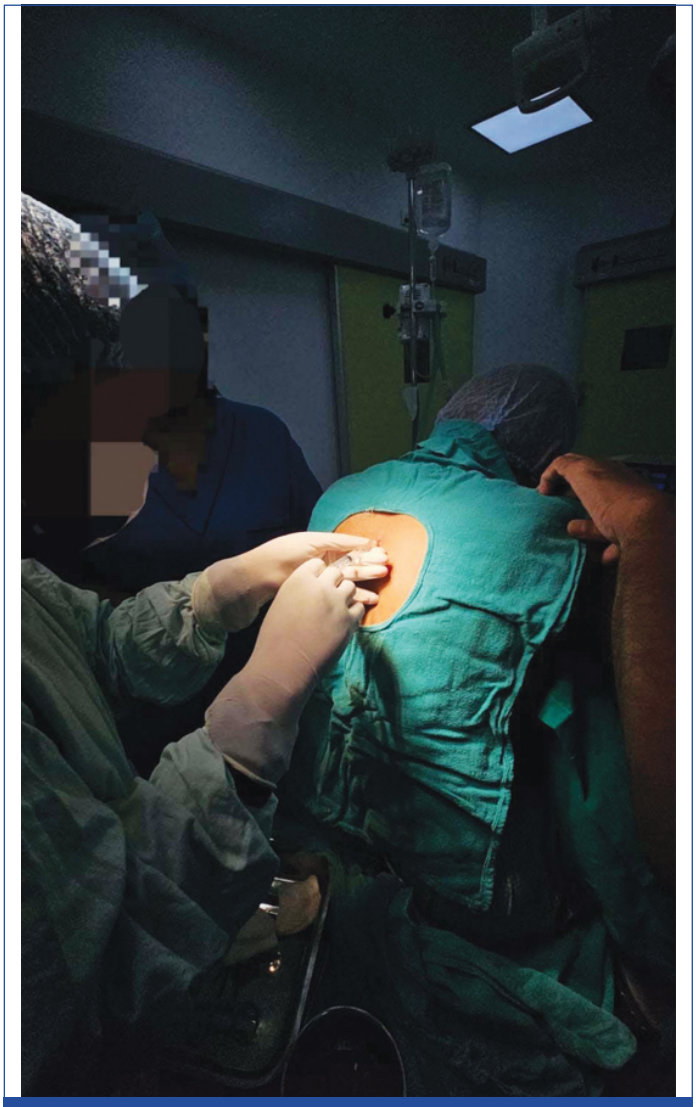
[Table/Fig-2]: HRCT image with fibro-bronchiectatic changes.

pH	7.42	SO2	90%
$paCO_2$	58 mmHg	HCO-3	26.6
paO_2	65 mmHg	Lactate	0.9 mmol/L

[Table/Fig-3]: Pre-operative arterial blood gas analysis showing hypoxic, hypercapnic compensated respiratory acidosis.



[Table/Fig-4]: Surface markings for thoracic spinal.



[Table/Fig-5]: Administration of Thoracic Segmental Spinal Anaesthesia (TSSA).

Upon being informed about the available anaesthesia options for the surgery, the patient consented to regional anaesthesia. The patient was thus posted for surgery under TSSA under ASA III. Patient was kept nil per os as per ASA guidelines. Approximately 0.5 mg of alprazolam was administered Per Oral (PO) as an anxiolytic the night prior to surgery. On the day of surgery, the patient was shifted to the operating room. Standard ASA multipara monitors were attached. An 18-gauge intravenous cannula was secured on the dorsum of the left wrist. Ringer's lactate fluid was administered at a rate of 10 mL/kg/h. Baseline readings of the vital parameters were noted. Intravenous (i.v.) fentanyl 1 µg/kg and intravenous (i.v.) midazolam 0.05 mg/kg were administered prior to placement of the thoracic spinal block. With the patient in sitting position, under all aseptic precautions 25 G Quincke's spinal needle was introduced at the T5-T6 level in the median approach [Table/Fig-4,5]. After obtaining free flow of Cerebrospinal Fluid (CSF), 1.5 mL of 0.5% levobupivacaine with 25 micrograms of fentanyl was administered. The level of blockade was fixed at T1. The patient was administered 100% oxygen at 5 L/min via a Hudson mask. Emergency drugs and airway cart was kept ready. Surgery was completed uneventfully in 1.5 hours, and the patient was shifted to postoperative recovery room for monitoring. The patient was discharged on day 5 and was asked to visit for follow-up check-up after two weeks for suture removal.

DISCUSSION

General anaesthesia is usually considered to be the standard mode of anaesthesia for breast cancer surgeries. However, it comes with its drawbacks like higher stress response, nausea and vomiting, inadequate analgesia, postoperative cognitive dysfunction and delirium, and increased length of hospitalisation. Regional anaesthesia techniques, on the other hand, are associated with lesser respiratory and cardiac complications. There is better attenuation of neuroendocrine stress response, superior postoperative analgesia, earlier gastrointestinal function recovery, lesser postoperative nausea and vomiting, earlier ambulation and shorter hospital stay, lower Deep Vein Thrombosis (DVT) incidence, lesser chances of infection and reduced costs when compared to general anaesthesia [1]. Various regional anaesthesia techniques available for breast

surgery include thoracic epidural, thoracic paravertebral block, Pectoral Nerve (PEC) blocks, and TSSA [1]. A major advantage is the avoidance of airway instrumentation and its potential complications. This is especially beneficial in critically ill patients or those with comorbidities at risk for developing complications in the perioperative period. In this case report, we discuss the application of TSSA in a patient undergoing surgery for breast carcinoma with COPD, which put her at greater risk of perioperative pulmonary complications. Thoracic spinal anaesthesia involves the intrathecal administration of local anaesthetic agents at spaces as high as T4-T5 to T10-T11[2]. Breast surgeries are generally conducted under general anaesthesia [3]. However, regional anaesthesia techniques provide an attractive alternative in the face of patients with comorbidities and in order to avoid the plethora of side effects due to general anaesthesia. Of these techniques, thoracic spinal anaesthesia has seen a growing resurgence of interest and has been successfully used in patients undergoing breast surgeries [4]. As discussed in our case, the patient was an elderly patient who was a diagnosed case of COPD. General anaesthesia with endotracheal tube placement entailed respiratory risks like bronchospasm, atelectasis, ventilation perfusion mismatch and exacerbation of pulmonary changes with COPD. Cardiac compromise with reduced venous return as seen with positive pressure ventilation resulting in reduced cardiac output was also a concern in our elderly patient. As our patient had a compromised respiratory functioning as revealed by our pre-anaesthetic checkup, general anaesthesia was avoided to prevent postoperative pulmonary complications. TSSA was thus successfully conducted in order to avoid such complications. There were anticipated difficulties that warranted attention during the perioperative period. One major cause of concern was injury to the spinal cord while introducing the spinal needle through the dura mater into the subarachnoid space. The second cause was ventilatory impairment due to thoracic block. Haemodynamic instability following the neuraxial block was another point of anxiety in our patient. Haemodynamic goals for our patient with strategies used for achieving these goals are as follows [Table/Fig-6] [5].

Haemodynamic goal	Strategy applied
Normotension, prevention of hypotension	Secure wide bore intravenous cannula and intravenous fluid loading, vasopressor drugs such as injection ephedrine or injection mephentermine.
Prevention of bradycardia	Injection atropine (0.01 mg/kg)

[Table/Fig-6]: Haemodynamic goals and strategies applied [5].

There is hesitation with the practice of thoracic spinal anaesthesia. This is due to unique anatomical and physiological considerations, as well as the precision required. There is fear of injury to the spinal cord by the spinal needle, total spinal block because of cephalad spread of local anaesthetic drug and cardiac accelerator sympathetic fibres blockade leading to haemodynamic instability [6]. Iatrogenic injury can be avoided by keeping in mind the distance of the dura mater to the spinal cord. Studies have shown that this distance, measured with MRI, is 5.19 mm at the T2 level, 7.75 mm at the T5 level, and 5.88 mm at the T10 level [6]. The spinal cord is thus positioned much anteriorly in the thoracic region as compared to the cervical and lumbar regions [6,7]. In addition, the spinal cord and the cauda equina touch the dura mater posteriorly in the lumbar region and anteriorly in the thoracic region. The approximate 45-50°angle of insertion of the spinal needle at T5 and T6 allows for safe advancement of the spinal needle without damaging the spinal cord, as there is sharp angulation of the spinous processes and thus the distance from the posterior surface of the spinal cord and needle tip [6]. Unlike lumbar spinal anaesthesia, segmental spinal anaesthesia provides better haemodynamic stability and fewer side-effects due to the less extensive sympathetic blockade on account of fewer dermatomal involvement [8]. There is earlier recovery, mobilisation and voiding of urine [9]. Thoracic segmental spinal can be administered as a single-shot spinal or as a continuous spinal. Drugs utilised are typically levobupivacaine, bupivacaine or ropivacaine, both as isobaric and hyperbaric formulations with added adjuvants [10]. The thoracic nerve roots are thinner than the lumbar nerve roots, and there is lesser CSF volume. This allows for more effective nerve blockade with less dilution and less volume of local anaesthetic [11]. Thus, there are fewer chances of high spinal as the volume of drug administered is less. Moreover, the natural concavity of the thoracic spine ensures that the drug, especially hyperbaric solutions, gets deposited at the lowest point of concavity, that is, T5-T6 levels. Another cause for concern is cardio-respiratory depression. Bradycardia is anticipated due to blockade of cardiac accelerator fibres (T1-T4). Treatment of this involves the use of injection atropine at a dose of 0.01 mg/kg. Hypotension is also less profound due to the less extensive sympathetic block and due to the non-involvement of the lower limbs. Hypotension, in case it occurs, is managed with vasopressors and intravenous fluid co-loading. The diaphragm, which is innervated by the phrenic nerve C3-5, is not affected as cervical fibres are not blocked. Hence, respiratory distress is avoided [11].

Khan MKU et al., discussed a case of a 65-year-old male patient with severe COPD on medications who underwent emergency laparotomy followed by open cholecystectomy. As the authors wanted to avoid pulmonary complications associated with general anaesthesia as well as minimise postoperative pulmonary complications, regional anaesthesia technique of thoracic segmental spinal with epidural anaesthesia. A cause of concern was potential injury to the spinal cord; however, studies have shown that the distance between the dura mater and the spinal cord is greatest at the T5–T6 level, while the shortest distances are observed at T2 and T10 [12] . Moreover, the fear of respiratory depression was avoided since cervical levels were not blocked and the diaphragm is innervated by C3, C4. Haemodynamic changes and hypotension were insignificant despite neuraxial blockade as low dose of local anaesthetic was used, and the patient remained conscious throughout the procedure. This case report is similar to our case in terms of application of regional anaesthesia in an elderly patient with COPD in order to avoid perioperative pulmonary complications [13].

Kapu B et al., reported a case of a 60-year-old female patient with severe obstructive pulmonary disease who underwent a modified radical mastectomy, undergoing TSSA similar to our patient. It was conducted safely and without any adverse event [14]. It allowed for avoidance of tracheal intubation and thus avoiding postoperative pulmonary complications alongside provision of good analgesia, better haemodynamic status and early recovery and discharge.

A prospective feasibility study was conducted by Mahmoud AA et al., on 25 patients undergoing simple breast surgery under segmental spinal anaesthesia. It was concluded that this mode of anaesthesia was effective with minimal haemodynamic effects and good patient satisfaction [15].

The advantages of good postoperative analgesia, early mobilisation, and reduced Postoperative Nausea and Vomiting (PONV) make TSSA a feasible option that can be used routinely.

CONCLUSION(S)

The case report demonstrates the successful and safe application of TSSA for an elderly female patient with COPD for modified radical mastectomy which is usually performed under general anaesthesia. General anaesthesia when used for patients with chronic compromised conditions lead to greater pulmonary complications like ventilator dependence and mortality and necessitates use of alternative techniques such as TSSA. Caution is to be practised while choosing this mode of regional anaesthesia and is not to be used for superficial neck/upper limb surgeries, for paediatric cases without the expertise of a paediatric anaesthesiologist and in absence of a valid indication. It should not be proceeded without backup airway plans. TSSA may be used as an effective alternative to general anaesthesia for patients undergoing breast surgeries, especially

those with significant medical illnesses and comorbidities that put them at risk of developing major perioperative complications.

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