Section: Anaesthesiology

Original Research Article

THORACIC SEGMENTAL SPINAL ANAESTHESIA WITH ISOBARIC LEVOBUPIVACAINE FOR FEEDING JEJUNOSTOMY: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Thoracic segmental spinal anaesthesia (TSSA) may provide an alternative to general anaesthesia for patients undergoing feeding jejunostomy. This study evaluated sensory blockade, haemodynamic changes, postoperative analgesia duration, and adverse effects of TSSA using isobaric levobupivacaine. **Materials and Methods:** This prospective observational study included 40 ASA III patients aged 18–65 years undergoing feeding jejunostomy. TSSA was performed at T8–T9 using 1.5 mL of 0.5% isobaric levobupivacaine (7.5 mg). Sensory block level, heart rate (HR), mean arterial pressure (MAP), postoperative numerical rating scale (NRS) pain scores, analgesia duration, and adverse effects were assessed. **Results:** Mean age was 60.2 ± 8.1 years; 28 (70%) patients were male and 12 (30%) female. Sensory blockade extended from T4 to L1 in 27 (67.5%) patients and T4 to L3 in 13 (32.5%). HR ranged from 78.7 ± 3.4 to 80.4 ± 3.8 beats/min, while MAP ranged from 71.9 ± 2.3 to 73.5 ± 2.8 mmHg. Mean postoperative analgesia duration was 342.4 ± 12.8 minutes. NRS scores were 1.6, 2.8, 2.7, 4.0, and 4.5 at 1, 3, 6, 12, and 24 hours, respectively. Bradycardia, hypotension, and nausea/vomiting occurred in 2 (5%) patients each; 36 (90%) had no reported adverse effects. **Conclusion:** TSSA with isobaric levobupivacaine appears feasible in selected ASA III patients undergoing feeding jejunostomy. Comparative studies are needed to establish its relative safety and effectiveness.

INTRODUCTION

Feeding jejunostomy is commonly performed to provide enteral nutritional access in patients with upper gastrointestinal malignancy, gastric outlet obstruction, or severe malnutrition who are unable to tolerate oral or gastric feeding.[1] Malnutrition is itself an important contributor to poor surgical outcomes, and enteral access through jejunostomy has been shown to reduce postoperative weight loss and limit the decline in serum albumin compared with patients who do not receive jejunostomy feeding. However, jejunostomy is not completely risk-free, with complication rates reported at around 17% and reoperation rates close to 3% in some series.[1,2] As patients requiring this procedure may have significant nutritional compromise and associated comorbidities, they may present with increased anaesthetic risk. In such patients, general anaesthesia (GA) has been associated with a greater likelihood of complications such as acute kidney injury compared with neuraxial techniques, as demonstrated in a meta-analysis involving more than 4,800 patients undergoing surgery under general versus neuraxial anaesthesia.[3]

Thoracic segmental spinal anaesthesia (TSSA) has re-emerged over the past two decades as an anaesthetic technique capable of providing dense, site-specific sensory and motor blockade for upper abdominal and thoracic procedures while sparing the lower limbs and avoiding many of the systemic effects associated with GA.[4] By administering a small volume of local anaesthetic directly at the thoracic level, TSSA produces a segmental block limited to the dermatomes required for surgery. This approach may provide haemodynamic stability, preserve spontaneous respiration, and allow early recovery, making it particularly attractive for frail or high-risk surgical patients who may otherwise have limited anaesthetic options.[4,5] Despite the increasing evidence supporting its use, TSSA remains relatively underused in routine anaesthetic practice, mainly

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because of limited familiarity with the technique and continuing concerns regarding its safety.5,6 Recent editorials and consensus efforts have emphasized the need for structured protocols, standardized bundles, and safety checklists to support the wider and safer use of TSSA.[6-9]

Isobaric levobupivacaine, the S-enantiomer of bupivacaine, is commonly considered for TSSA because of its lower cardiotoxic and neurotoxic potential compared with racemic bupivacaine while maintaining an effective sensory and motor block. In spinal anaesthesia, levobupivacaine has been shown to provide reliable sensory and motor blockade, with no significant difference in intraoperative haemodynamic stability compared with bupivacaine.[10] Therefore, the present study was designed to assess the adequacy of blockade, haemodynamic changes, duration of postoperative analgesia, and adverse effects associated with TSSA using isobaric levobupivacaine in patients undergoing feeding jejunostomy.

Aim

To evaluate the sensory blockade, intraoperative haemodynamic changes, duration of postoperative analgesia, and adverse effects associated with thoracic segmental spinal anaesthesia using isobaric levobupivacaine in patients undergoing feeding jejunostomy.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Anaesthesia, Tirunelveli Medical College and Hospital, Tirunelveli, India, over a period of 24 months. The study included patients undergoing feeding jejunostomy. Approval was obtained from the Institutional Ethics Committee before the commencement of the study.

Sample Size & Sampling Method

The sample size was calculated using OpenEpi software with a confidence level of 95% and 80% power. Based on values obtained from previous studies, the calculated sample size was 40 patients. Convenience sampling was used for participant selection.

Inclusion and Exclusion Criteria

Patients aged 18–65 years, of either sex, or classified as ASA physical status III were included. Patients with contraindications to spinal anaesthesia, chronic renal, liver, or lung diseases, coagulation abnormalities, coronary artery disease, or cardiac failure were excluded.

Study Tool

A structured proforma was used to record demographic and clinical characteristics, including age, sex, height, weight, and ASA physical status, as well as anaesthetic details, duration of surgery, sensory blockade, intraoperative haemodynamic parameters, postoperative pain scores, duration of postoperative analgesia, and adverse effects.

Anaesthetic Technique

Preanaesthetic assessment was performed, and written informed consent was obtained. Intravenous access was secured, and baseline blood pressure, heart rate (HR), ECG, and oxygen saturation were monitored. Equipment required for ventilation, oxygenation, and circulatory support was kept readily available.

Spinal anaesthesia was performed with the patient in the sitting position. The T8–T9 interspace was identified by surface anatomical landmarks, with the inferior angle of the scapula corresponding approximately to the T7 spinous process and the 12th rib margin corresponding to the L1 spinous process.

After painting and draping the back, a combined spinal–epidural set was used. The needle was directed cephalad, and the epidural space was identified using the loss-of-resistance technique. The spinal needle was then advanced through the epidural needle. This technique limited the length of spinal needle projecting beyond the epidural needle, thereby minimizing the risk of spinal cord injury. Free flow of cerebrospinal fluid was confirmed before administration of the intrathecal drug.

A volume of 1.5 mL of 0.5% isobaric levobupivacaine (7.5 mg) was administered intrathecally at the T8–T9 interspace. The patient was subsequently placed in the supine position.

Data Collection and Monitoring

The sensory level was assessed bilaterally using the pinprick method before commencement of surgery, and the highest sensory dermatome level achieved was recorded. HR and mean arterial pressure (MAP) were monitored at 5-minute intervals from baseline until the end of surgery. Episodes of bradycardia, hypotension, nausea, and vomiting were recorded.

Postoperative pain was assessed using a numerical rating scale (NRS) from 0 to 10, with 0 indicating no pain and 10 indicating the worst pain imaginable. Pain scores were recorded at 1, 3, 6, 12, and 24 hours postoperatively. The duration of postoperative analgesia was defined as the time interval from intrathecal administration of levobupivacaine to the first requirement for rescue analgesia. Postoperative adverse effects were assessed and documented for 24 hours.

Outcome Measures

The study outcomes included sensory block level, intraoperative haemodynamic changes, postoperative pain scores, duration of postoperative analgesia, and adverse effects associated with TSSA using isobaric levobupivacaine.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS software version 29. Continuous variables were expressed as mean and standard deviation or median and range, as appropriate. Categorical variables were expressed as frequencies and percentages. Appropriate descriptive statistical methods were used for analysis.

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RESULTS

The study included 40 patients. The mean age was 60.2 ± 8.1 years; 28 (70%) patients were male and 12 (30%) were female. All patients had ASA physical status III. The mean height was 157.5 ± 4.2 cm and mean weight was 57.4 ± 4.0 kg. The mean duration of surgery was 52.7 ± 4.5 minutes, and the mean duration of postoperative analgesia was 342.4 ± 12.8 minutes. [Table 1]

Table 1: Baseline demographic and clinical characteristics

Characteristic	Value
Age (years), mean ± SD	60.2 ± 8.1
Male, n (%)	28 (70%)
Female, n (%)	12 (30%)
ASA physical status III, n (%)	40 (100%)
Height (cm), mean ± SD	157.5 ± 4.2
Weight (kg), mean ± SD	57.4 ± 4.0
Duration of surgery (min), mean ± SD	52.7 ± 4.5
Duration of postoperative analgesia (min), mean ± SD	342.4 ± 12.8

The level of blockade was T4–L1 in 27 (67.5%) patients and T4–L3 in 13 (32.5%). Adverse effects included bradycardia in 2 (5%) patients, hypotension in 2 (5%), and nausea and vomiting in 2 (5%); 36 (90%) had no reported adverse effects. [Table 2]

Table 2: Level of blockade and adverse effects

	Parameter	N(%)
Level of blockade	T4 to L1	27(67.5%)
	T4 to L3	13(32.5%)
Adverse effects	Nil	36(90%)
	Bradycardia	2(5%)
	Hypotension	2(5%)
	Nausea & vomiting	2(5%)

HR ranged from 78.7 ± 3.4 to 80.4 ± 3.8 beats/min during monitoring (Figure 1), while MAP ranged from 71.9 ± 2.3 to 73.5 ± 2.8 mmHg (Figure 2).

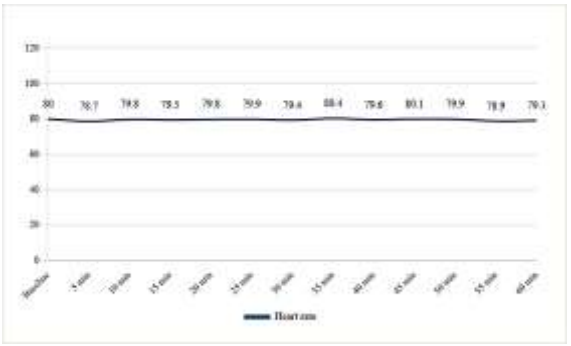

Figure 1: Intraoperative HR

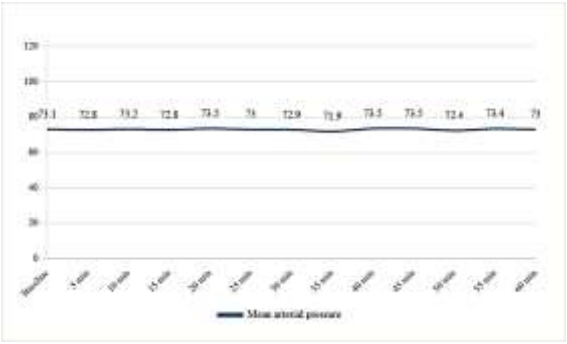

Figure 2: Intraoperative MAP

The mean postoperative pain score was 1.6 at 1 hour, 2.8 at 3 hours, 2.7 at 6 hours, 4.0 at 12 hours, and 4.5 at 24 hours. [Table 3]

Table 3: Postoperative pain score

Time	Pain score, mean
1 hour	1.6
3 hours	2.8
6 hours	2.7
12 hours	4
24 hours	4.5

DISCUSSION

TSSA may offer a useful alternative to GA for selected high-risk patients undergoing feeding jejunostomy. This study assessed blockade adequacy, haemodynamic changes, postoperative analgesia duration, and adverse effects of isobaric levobupivacaine. TSSA achieved a sensory blockade extending from T4 to L1 or L3, with stable intraoperative haemodynamics, few adverse effects, and sustained postoperative analgesia, these findings suggest that TSSA was feasible in this selected study of ASA III patients.

In our study, participants had a mean age of 60.2 years and were predominantly male, with all patients classified as ASA physical status III. The procedures were completed within a relatively short operative period, with postoperative analgesia maintained for a

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considerable duration. Similarly, Elzohry et al. studied 46 patients undergoing abdominal and laparoscopic procedures under TSSA or GA and reported its feasibility in high-risk surgical patients.[11] Similarly, Amro et al. reported three high-risk ASA III–IV patients who underwent TSSA with 7.5 mg levobupivacaine and 5 µg dexmedetomidine; all remained awake, spontaneously breathing, and haemodynamically stable without sedation, vasopressors, or airway intervention.[12] Gupta et al. compared GA with segmental thoracic spinal anaesthesia in patients undergoing modified radical mastectomy and included both ASA II and III patients, providing evidence from a broader-risk surgical population.[13] These findings suggest that TSSA can be feasibly used in selected higher-risk patients, while maintaining adequate surgical conditions and potentially reducing reliance on GA.

In the present study, TSSA produced sensory blockade extending from T4 to L1 in most patients and from T4 to L3 in the remainder. Adverse effects were uncommon, with bradycardia, hypotension, and nausea and vomiting reported in a small proportion of patients. Similarly, Nagar et al. compared two thoracic segmental spinal techniques for laparoscopic cholecystectomy and reported bradycardia and hypotension exceeding 10% of pre-induction values in two patients receiving isobaric levobupivacaine at T8–T10, whereas no such events occurred with hypobaric ropivacaine.[14] Similarly, Mazy et al. reported faster, wider, and longer sensory blockade with STSA than with TPVB, although hypotension was more frequent with STSA (62.9% vs. 25.7%).[15] In contrast, Elzohry et al. reported stable haemodynamics and fewer adverse effects with combined thoracic spinal-epidural anaesthesia compared with GA in abdominal and laparoscopic surgery.[11] These findings suggest that TSSA can provide reliable sensory blockade with generally limited adverse effects, although haemodynamic disturbances remain an important consideration requiring careful monitoring.

In our study, HR remained within a narrow range of 78.7 ± 3.4 to 80.4 ± 3.8 beats/min, while MAP ranged from 71.9 ± 2.3 to 73.5 ± 2.8 mmHg during intraoperative monitoring, with only minor fluctuations over the observation period. Similarly, Paliwal et al. compared segmental thoracic spinal anaesthesia with GA in 56 patients undergoing breast cancer surgery using isobaric levobupivacaine at the T5–T6 interspace and found no significant difference in MAP between groups, although bradycardia occurred more frequently at 15 minutes in the spinal group (28.5%; p = 0.004).[16] Hamdi et al. reported a significantly higher risk of hypotension with TSSA than with GA (RR 2.57, 95% CI 1.41–4.71; p = 0.002).17 In contrast, our patients maintained stable HR and MAP throughout surgery, suggesting that haemodynamic stability can be maintained with appropriate dosing and monitoring in selected ASA III patients undergoing feeding jejunostomy.

In our study, postoperative pain scores remained relatively low during the early postoperative period and increased overall over the 24-hour follow-up, reaching a mean score of 4.5 at 24 hours. Similarly, Paliwal et al. reported a significantly longer mean time to first rescue analgesia in the segmental thoracic spinal group than in the GA group (338.57 ± 40.70 vs. 33.21 ± 7.48 minutes), comparable to the duration of analgesia observed in our study.16 Hamdi et al. also found a significantly lower incidence of postoperative vomiting (RR 0.46, 95% CI 0.22–0.95; p = 0.04) and higher patient satisfaction (SMD 0.63, 95% CI 0.33–0.92; p < 0.0001) with TSSA than with GA.17 Similarly, Gupta et al. reported a significantly longer time to first rescue analgesia with segmental thoracic spinal anaesthesia than with GA (6.2 ± 1.9 vs. 4.9 ± 1.3 hours; p = 0.004), supporting its potential benefit for postoperative analgesia.[13] These findings suggest that TSSA may provide sustained postoperative analgesia and favourable postoperative analgesic outcomes, although comparative studies are needed to confirm its advantage.

CONCLUSION

TSSA with isobaric levobupivacaine was associated with an adequate sensory block, relatively stable intraoperative haemodynamic parameters, and few reported adverse effects in this selected cohort of ASA III patients undergoing feeding jejunostomy. The mean time to first rescue analgesia was approximately 5.7 hours. These findings suggest that TSSA may be a feasible anaesthetic option in selected patients; however, larger comparative studies are required to establish its relative safety and effectiveness.

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