



THORACIC SEGMENTAL SPINAL ANESTHESIA FOR UMBILICAL HERNIA REPAIR SURGERIES

Anaesthesiology

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ABSTRACT

Introduction: Segmental Spinal Anaesthesia (SSA) is a specialized regional anaesthesia technique designed for precise and targeted block of specific spinal segments, offering advantages over traditional spinal anaesthesia in terms of reduced drug dosage and minimized side effects. This study was aimed to assess the feasibility and efficacy of SSA in patients undergoing elective umbilical hernia surgery. **Methodology:** 10 patients, aged 18-60 years and classified as ASA grade I & II, were selected after approval from ethical committee. Preoperative evaluations included thorough systemic examination and necessary laboratory investigations. SSA was performed using landmarks identified at T12-L1, and injections of 0.5% hyperbaric bupivacaine followed by 0.75% isobaric ropivacaine with fentanyl 25µg were administered. Parameters recorded included changes in pulse rate, blood pressure, peripheral SPO2. Onset of sensory level targeted at T6 dermatomal level, onset of motor block (assessed by Modified Bromage scale), two segment regression time, complete block regression time and surgical duration were assessed. **Results:** SSA gives effective sensory and motor blockage within targeted dermatomes. All patients achieved adequate surgical anaesthesia without the need for conversion to general anaesthesia. Postoperative outcomes were favorable, with no significant complications observed during or after the procedure.

KEYWORDS

Thoracic Segmental Spinal Anesthesia, Umbilical Hernia Repair, Hyperbaric Bupivacaine, 0.75% Isobaric Ropivacain

INTRODUCTION

Segmental Spinal anaesthesia specialized technique employed in regional anesthesia, aiming to provide targeted and precise blocking of specific Spinal Segments for surgical procedures^[1]. This technique involves the injection of local agents into specific spinal segments, effectively blocking nerve impulse & inducing temporary loss of sensation and motor function in the desired region of the body. SSA offers advantage of a reduced drug dosage and minimized side effects compared to traditional spinal anesthesia, making it a valuable option for procedures involving limited surgical areas. Various studies have proven the feasibility & efficacy of segmental spinal anesthesia in high-risk patients.^[1] There is greater risk of injuring spinal cord if spinal anesthesia is given above L1. The anatomy of thoracic spinal canal with magnetic resonance imaging in 50 patients were studied and concluded that there is a low incidence of neurological complications during thoracic segmental neuraxial anesthesia.^[2] Some hemodynamic changes occur even in thoracic segmental spinal anesthesia but these changes are less than lumbar spinal anesthesia because here we use small amount of drug and due to which diluted concentration of drug decreases and therefore chances of hemodynamic changes are less.^[3,4] This technique has many advantages like post-operative analgesia, which reduces the use of opioid for postoperative pain reducing their side effects, maintain spontaneous breathing and advantage of remaining conscious throughout the procedure, decreases the postoperative cognitive dysfunction. There is earlier recovery of gastric motility and better postoperative pain control.



Fig. 1: Sagittal gradient echo study of the thoracic spine. The cord is enlarged from T9 to T12, outlined by high signal CSF

Materials & Method:

After approval from ethical committee 10 patients between ages 18-60 years of ASA grade I & II scheduled for umbilical hernia surgery were selected. Pre anesthetic checkup was done 1 day prior to surgery as well as on the day of surgery. Patients were examined thoroughly for any systemic disease and lab investigations were conducted as per the institute protocols. Age, Sex, Height, Weight were recorded. All patients were kept Nil per oral overnight.

Inclusion Criteria:

1. Patient willing to participate in the study
2. Patients belonging to ASA class I & II
3. Patients with age between 18-60 years of either gender
4. Patients undergoing elective umbilical hernia surgeries.

Exclusion criteria:

1. Patients with age below 18 or above 60 years
2. ASA class III & Above
3. Contraindication of spinal anaesthesia such as patient's refusal, coagulopathy, cardiorespiratory problems, neurological disease with high ICP, allergic to used drugs, local sepsis at the site of injection.
4. Emergency surgeries Preliminaries: Procedure was explained and written informed consent for including in research was obtained.

IV access with 20 Gz needle secured.

Procedure: All patients received 500ml RL, IV preoperatively prior to spinal blockade. Patients were attached to multipara monitor and baseline NIBP, PR & SPO2 were recorded, after explaining the procedure. Patients were placed in sitting position & under AAP painting & draping was done. Intercristal line corresponding to L4 spine were used as a landmark. After identification of exact intervertebral space using prominent bony landmark, T12-L1 Intervertebral space was used for SSA. Before giving spinal 2 cc INJ LIGNOCAINE 2% were used to anesthetize that area. SSA was given using 23 Gz Quincke's needle via midline approach. Free flow of CSF was noted & negative aspiration for blood was checked. Drug INJ 0.5%

Bupivacaine 0.5 cc (hyperbaric) was injected first, after that isobaric

1.2cc inj ropivacaine 0.75% with fentanyl 25 µg making volume of 1.7cc taken in same syringe were injected. 1st Injection Hyperbaric was given, then isobaric given. Patient was placed in supine position and table was kept straight till desired block effect achieved and monitored throughout the procedure as well as postoperatively.

Data recorded:

1. Changes in pulse rate
2. Blood pressure changes (systolic, diastolic & MAP)
3. Changes in peripheral SPO2
4. T6 Dermatomal level (tested by pinprick at 1 min intervals) was targeted for spinal block
5. Onset of motor block assessed by MODIFIED BROMAGE SCORE
6. Two segment regression time
7. Maximum level attained at upper dermatome & lower dermatome
8. Duration of surgery from incision time
9. Time to achieve MODIFIED BROMAGE SCORE "0"
10. Time for rescue analgesia vas score ≥4

RESULTS:

SSA using above mentioned intervertebral space & drugs resulted in:

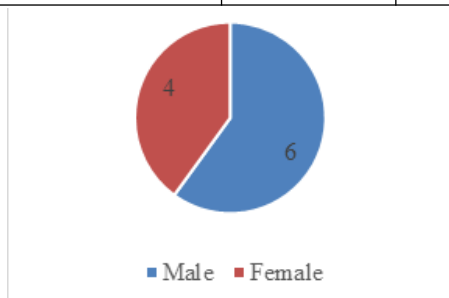
- Excellent sensory anaesthesia
- Adequate motor block
- No PONV
- Less hemodynamic changes
- No respiratory depression
- Early mobilization within 5-6 hrs.
- Postop analgesia requirements within 7-8 hrs.

We have followed up patients till 24hrs for any complications related to SSA. OUT of 10, one patient had hypotension which was managed with 6mg of mephenteramin.

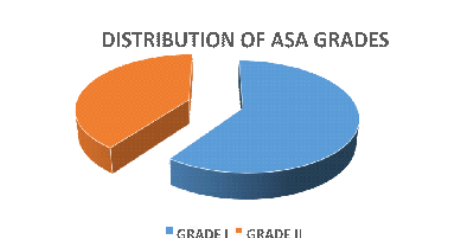
One male patient who was 6 FEET 4 INCH tall and muscular, the block effect had regressed within 1 hr., patient complained of pain. It was managed with sedation and ketamine.

Table 1: Distribution of participants according to demographic data

Demographic data		MEAN ±SD
Age (Years)		47±11.86
Anthropometric parameter	Weight (Kg)	73±14.87
	Height (Cm)	166 ±15.14
	BMI(Kg/M ²)	26±5.8
Gender	Male	6
	Female	4
ASA Grade	I	5
	II	5



Graph 1: Gender distribution



Graph 2: Distribution of ASA grade

Table 2: Mean & S.D. of variables

RECORDED DATA	MEAN±SD
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T6 DERMATOMAL LEVEL (TESTED BY PINPRICK AT 1 MIN INTERVALS) WAS TARGETED FOR SPINAL BLOCK	2±0.63
ONSET OF MOTOR BLOCK ASSESSED BY MODIFIED BROMAGE SCALE SCORE ≥3	3.8±0.7
TWO SEGMENT REGRESSION TIME	185±56.8
MAXIMUM LEVEL ATTAINED AT UPPER DERMATOME & LOWER DERMATOME	T6-L5
DURATION OF SURGERY FROM INCISION TIME	88±24
TIME TO ACHIEVE MODIFIED BROMAGE SCORE =0	330±64.8
TIME FOR RESCUE ANALGESIA VAS SCORE ≥4	780±10

DISCUSSION:

In the study onset of sensory and motor block achieved within approximately 2 mins and 4 mins respectively. Average duration of surgery was around 80-100 mins. Time to achieve modified Bromage score 0 was around 5.5 hrs. Need for rescue analgesia with VAS score ≥4 was around 8-10 hrs. Upper level achieved in 9 out of 10 patients was at T6 level whereas in one patient it was at T4 level. Lower level achieved in patients was between L5 –S5 level [most common being L5 level].

Efficacy and Clinical Utility of SSA

Our findings demonstrate that SSA effectively achieved targeted sensory blockade at the T6 dermatomal level in all patients, ensuring adequate anaesthesia throughout the surgical procedure. This is consistent with previous studies indicating SSA's ability to offer reliable and predictable anaesthesia for various surgical interventions, including abdominal and lower limb procedures (Kotze et al., 2018; Ruan et al., 2020).^[7]

In the study main purpose for using hyperbaric bupivacaine before isobaric was to achieve motor block for better relaxation. The choice of hyperbaric bupivacaine combined with isobaric ropivacaine and fentanyl provided a balanced approach to achieving both rapid onset and prolonged duration of anaesthesia, essential for maintaining surgical conditions without necessitating conversion to general anaesthesia. The use of fentanyl in the mixture also contributed to enhanced analgesia, reducing the need for additional intraoperative analgesics and promoting patient comfort (Talawar et al., 2019).^[8]

Safety Profile and Complications

Importantly, SSA demonstrated a favorable safety profile with minimal intraoperative and postoperative complications. This aligns well with studies highlighting SSA's reduced incidence of hypotension, respiratory depression, and urinary retention compared to traditional spinal anaesthetic methods (Mukherjee et al., 2017; Chaudhuri et al., 2021). The absence of significant adverse events underestimates SSA's suitability for use in high-risk cases with major comorbidities, contributing to overall patient safety and satisfaction^[10,11]

Clinical Implications

The clinical implications of SSA in umbilical hernia surgery extends beyond its immediate anaesthetic benefits. Efficient surgical duration and early recovery time observed in our study suggests potential cost-effectiveness and improved resource utilization in surgical settings.

Limitations Small sample size and single center design are major limitations of the study, as they prevent generalizability of study findings to a larger population or different surgical context. Future studies could benefit from multi-center trials with larger cohorts to validate our findings and further elucidate SSA's comparative advantages over conventional anaesthesia methods.

CONCLUSION:

Segmental spinal anaesthesia (SSA) emerged as a robust technique for providing precise and effective anaesthesia in patients undergoing umbilical hernia surgery. Our study demonstrated consistent achievement of targeted sensory blockade at the T6 dermatomal level, facilitating successful surgical procedures without the need for general anaesthesia conversion. SSA stands as a reliable alternative to traditional spinal anaesthesia for umbilical hernia surgeries, offering

precise anaesthetic management with minimal systemic impact.

Key highlights include:

- Safety and Efficacy: SSA with a combination of hyperbaric bupivacaine and isobaric ropivacaine with fentanyl exhibited a favorable safety profile, ensuring adequate anaesthesia and minimal perioperative complications.
- Patient Satisfaction: The technique met clinical expectations with efficient surgical durations and reliable sensory block levels, providing patient comfort and procedural

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