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A case series of thoracic segmental spinal anesthesia for elective gynecological laparoscopic surgeries

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Abstract

Introduction: Laparoscopic gynaecological surgeries are typically performed under general anaesthesia. While a few studies have explored the use of spinal anaesthesia for these procedures, they have been limited by issues such as shoulder tip pain. However, with growing interest in using thoracic segmental spinal anaesthesia for laparoscopic abdominal procedures, its potential application in gynaecological procedures can be explored. Due to dearth of literature on the same, we chose to conduct a case series involving 10 patients undergoing elective gynaecological laparoscopic surgeries with thoracic segmental spinal anaesthesia. Our objectives were to assess perioperative hemodynamic stability, the incidence of shoulder tip pain, patient tolerance of vaginal manipulation, and the time to post-operative voiding.

Materials and Methods: 10 patients of 18-40 years ASA grade 1 & 2 posted for elective gynaecological laparoscopic surgeries. Exclusion criteria were patients of ASA grade 3-4, patients who had contraindications for spinal anaesthesia, patients with known hypersensitivity to study drugs and patient refusal to participate in the study. Thoracic segmental spinal anaesthesia was attempted with patient sitting position in T9-10 space with 25G Quincke spinal needle and 1.4 ml of isobaric 0.5% levobupivacaine was given. Intraoperative vitals were noted, shoulder tip pain and pain on vaginal manipulation was noted. Postoperative voiding time was noted.

Results: We achieved a sensory level of T4-L3 in all patients. Hypotension (>20% fall from baseline) occurred in all patients but could be managed with 6 mg Mephentermine. No patient complained of shoulder tip pain. However, patients did complaint of discomfort on vaginal manipulation which was managed with Injection Ketamine 20 mg. Duration of analgesia was 150-180 min. All patients voided urine spontaneously within 3 hours.

Conclusion: Thoracic segmental spinal anaesthesia is an effective technique for gynaecological laparoscopic surgeries providing adequate surgical anaesthesia

Keywords: Thoracic segmental spinal anaesthesia, laparoscopic surgery

Introduction

Laparoscopic surgeries are routinely performed under general anaesthesia. Attempts to perform these surgeries under spinal anaesthesia were met with haemodynamic instability and shoulder tip pain. However, recently there is renewed interest in performing laparoscopic surgeries under thoracic segmental spinal anaesthesia. Thoracic segmental spinal anaesthesia is a technique in regional anaesthesia that may offer a better alternative to general anaesthesia for a certain number of procedures, such as laparoscopic surgeries, especially in patients carrying high risk under general anaesthesia. This approach has been found to help maintain hemodynamic stability and reduce the side effects typically associated with general anaesthesia. Traditionally, spinal anaesthesia is given in lumbar region to avoid injury to spinal cord. But clinical and MRI studies have demonstrated that thoracic segmental spinal anaesthesia is a safe technique as there is a sufficient distance between the spinal cord and dura in the thoracic region cord as the cord is closer to anterior dura in thoracic region. Despite recent studies on thoracic segmental spinal anaesthesia in laparoscopic surgeries, there is a lack of research specifically focused on gynaecological laparoscopic surgeries. So, in this case series, we discuss management of 10 cases of elective gynaecological laparoscopic surgeries under thoracic segmental spinal anaesthesia.

Aim

The primary goal of this case series is to evaluate the safety and efficacy of thoracic segmental spinal anaesthesia (TSSA) as an anaesthesia method for elective gynaecological laparoscopic surgeries.

Objectives

1. To assess the intra-operative hemodynamic stability of patients who are undergoing elective gynaecological laparoscopic surgeries under TSSA
2. To evaluate efficacy of TSSA in providing adequate perioperative anaesthesia and analgesia
3. To identify any complications or adverse effects associated with the use of TSSA in elective gynaecological laparoscopic surgeries

Inclusion Criteria

- 18-45 years old females posted for elective gynaecological laparoscopic surgeries
- ASA grade 1 & 2 patients

Exclusion Criteria

- Patients having known contraindications for spinal anaesthesia
- Patients having hypersensitivity to study drugs
- Patient refusal to participate in the study

Methodology

- This case series was undertaken after informed written consent. Patients were assessed preoperatively and preparation were as per standard protocols. In the preoperative visit, patients were explained in detail about thoracic segmental spinal anaesthesia. On the day of surgery, standard non-invasive monitors were applied and baseline vitals were noted. IV line was secured. Patients were preloaded before surgery with Inj Ringer Lactate at 10 ml/kg.

- Under all strict aseptic and antiseptic precautions with patients in sitting position; Thoracic segmental spinal anaesthesia was performed in T9-10 subarachnoid space with 25G Quincke spinal needle by median or para median approach. After free flow of clear CSF, 1.4 ml of isobaric 0.5% levobupivacaine was injected. Paraesthesia and or any difficulty in spinal anaesthesia were noted.
- The patients were then placed in supine position. The level of sensory blockade was checked using method of pin prick. Onset of sensory and the segmental level achieved was noted.
- All patients were spontaneously breathing on Venti mask @4-6 litre of oxygen.
- Baseline hemodynamic vitals, oxygen saturation, and respiratory rate were recorded upon admission to the operating theatre, then for every 3 minutes till the surgery ended.
- Hypotension was defined as fall in mean BP greater than 20% of baseline and bradycardia was defined as fall in pulse rate greater than 20% of baseline. Hypotension was counteracted with Inj Mephentermine 6 mg iv and Bradycardia was counteracted with Inj Atropine 0.6 mg.
- Intraoperative discomfort of patients, shoulder tip pain was noted. Also, pain on vaginal manipulation was noted.
- At the completion of procedure, all the patients were observed in recovery area for 30 minutes and then shifted to ward.
- Postoperative voiding time was noted down. Duration of motor and sensory blockade and duration of analgesia was noted. Complications if any were noted.

Results

Table 1: Operation Variables

Conversion to General Anaesthesia, % (n)	0 (0)
Conversion to Laparotomy, % (n)	0 (0)
Operative duration(min) mean \pm SE	41.3 \pm 3.91
SA duration (min) mean \pm SE	103.1 \pm 5.23
Pain in abdomen, % (n)	0 (0)
Right shoulder tip pain, % (n)	0 (0)
Vomiting/Nausea, % (n)	0 (0)
Headache, % (n)	0 (0)
Hypotension, % (n)	70 (7)
Mephentermine use, % (n)	
0 dose	30 (3)
1 dose	70 (7)
2 doses	0 (0)
Anxiety, % (n)	0 (0)
Pain on vaginal manipulation, % (n)	80 (8)
Ketamine bolus, % (n)	
0 dose	20 (2)
1 dose	80 (8)

Table 2: Post-operative variables

Overall complications, % (n)	0 (0)
Post operative nausea and vomiting, % (n)	0 (0)
Retention of Urine, % (n)	0 (0)
Neurological complications, % (n)	0 (0)
Duration of analgesia (in hours)	3 \pm 2

Overall VAS score, mean \pm SE	3 \pm 1
VAS score in first 3 hours, mean \pm SE Pain with VAS >4, % (n)	1 (1)
Analgesia dose requirement (n), % (n)	40 (4)
0	40 (4)
1	20 (2)
2	0 (0)
3	
Rt shoulder pain, % (n)	0 (0)
Duration of hospital stay (days), median (range)	1.5 (1-2)
Patient's satisfaction grade, % (n)	
High	90 (9)
Fair	10 (1)
Bad	0 (0)
Surgeon's satisfaction grade, % (n)	
High	100 (10)
Fair	0 (0)
Bad	0 (0)

Discussion

Thoracic segmental spinal anaesthesia provides several advantages over general anaesthesia or lumbar spinal anaesthesia in some cases. This technique enables certain major surgeries to be performed on awake patients who carry high risk for complications or mortality under general anaesthesia reducing the risk for the patient. The primary rationale for using thoracic segmental spinal anaesthesia is to avoid exposing patients carrying high risk to the risks of general anaesthesia while still delivering an effective and safe anaesthetic option. According to a study carried out by Diego Raimondo a, Giulia Borghese a, Manuela Mastronardi a,^[1] Women in SA group reported markedly lesser pain scores at all the postoperative time period detections in comparison to the GA group. The most notable and significant difference was observed one-hour post-surgery, where a statistically significant 6-point difference in the VAS score was seen. This finding could probably be due to the recent infusion of spinal drug in the SA group while patients in the GA group, having regained their consciousness, were experiencing their first pain in postoperative period. Spinal anaesthesia (SA) continued to demonstrate a statistically significant analgesic advantage over the comparison group at multiple postoperative time points—specifically at 8, 12, 24, and 48 hours—indicating a sustained effect on pain control. Notably, none of the patients in the SA cohort required rescue intravenous opioid administration throughout the observed postoperative period, thus highlighting the efficacy of SA in minimizing the need for additional analgesic interventions. Furthermore, patients in the SA group experienced a faster return of bowel function and were able to ambulate sooner, indicating a more favourable and an efficient recovery trajectory. These factors likely contributed to better pain control by preventing paralytic ileus and reducing muscle pain and fatigue from prolonged bed rest. Our study showed that patients receiving spinal anaesthesia had better pain control compared to those on opioids, with a decreased need for opioids during or after the procedure, thus lowering the incidence of side effects associated with these drugs. Additionally, patients in the SA group experienced faster recovery of bowel function and fewer complications, leading to greater overall patient satisfaction.

As per a study carried out by Genti Shatri; Abhishek Singh,^[2] this procedure can also be of great value for postoperative pain in combination with multimodal

analgesia. Additionally, the lower anesthetic dose used in thoracic spinal anesthesia results in minimal hemodynamic instability. Our study demonstrated that thoracic spinal anaesthesia enables high-risk patients to undergo surgeries safely that typically require extended hospital stays, while maintaining safety throughout the process.

In spite of general anaesthesia representing the standard of care while carrying out major thoracic and abdominal surgeries, thoracic spinal anaesthesia has been inculcated into the armamentarium of a wide range of anaesthetists around the world. Although large-scale randomized trials are currently lacking, evidence from small cohort studies and numerous case reports supports the use of thoracic spinal anaesthesia as a safe, feasible, and effective alternative to traditional anesthetic approaches. It is particularly beneficial for patients in whom other anaesthetic methods may pose a higher risk. Another major concern with TSSA which was observed in a study carried out by Dr BL Mathur and Dr AK Mathur^[3] is a high thoracic blockade has the potential to affect the intercostal nerves which supply the intercostal muscles that aid in breathing. Blockade of the cardioaccelerator nerve fibres originating from the T1 to T4 spinal segments and a high neuraxial block can potentially result in significant bradycardia due to unopposed vagal tone. However, our study demonstrated that the diaphragmatic function—the key component and primary muscle of inspiratory effort—remains intact, as its motor innervation is derived exclusively from the cervical spinal roots C3, C4, and C5 via the phrenic nerve. As a result, respiratory function is preserved and patients are able to breathe comfortably. This preservation of diaphragmatic activity suggests that even higher levels of thoracic blockade does not compromise respiratory function, supporting the safety profile of this technique. The intercostal muscles, which are primarily involved in forceful expiration, are minimally impacted due to the limited and short-lived motor blockade associated with thoracic segmental spinal anaesthesia (TSSA). Furthermore, since the nerves arising in lumbosacral region are spared, there is no significant pooling of blood in the lower limbs. This helps maintain filling of the right atrium, allowing the chronotropic stretch receptors in the right atrium and great veins to continue regulating heart rate effectively.

It has been noted in the study carried out by Dr BL Mathur and Dr AK Mathur^[3] that approximately 1 ml of isobaric local anaesthetic spreads across 3 to 4 spinal segments both

above and below the injection site. Studies have demonstrated that the volume of cerebrospinal fluid (CSF) in the thoracic region is lower compared to the lumbar or cervical segments, and that the thoracic nerve rootlets are notably thinner. As a result, there is less dilution of the anaesthetic at each spinal segment, and the thinner nerve roots are more easily susceptible to blockade. This contributes to a shorter latency period, with the onset of action being almost immediate, which is observed in our study. Also, Thoracic segmental spinal anaesthesia (TSSA) can be achieved using roughly half the dose of local anaesthetic required for lumbar spinal anaesthesia. The reduced dosage of local anesthetic in segmental spinal anaesthesia offers several advantages, including lesser fluctuations in hemodynamics, a limited motor block in thoracic region, and only a transient motor blockade in the lumbar region. The mild motor block in the lumbar area is likely a result of the minimal diffusion of the isobaric drug into the lumbar canal. This selective motor involvement facilitates a faster postoperative recovery, with patients often experiencing an earlier return of bladder function.

Conclusion

Single dose thoracic segmental spinal anaesthesia with low dose of isobaric levobupivacaine is an effective technique of anaesthesia for gynaecological laparoscopic surgeries providing faster recovery, better postoperative analgesia and good patient and surgeon satisfaction. Vaginal manipulation did cause discomfort but could be adequately addressed with sedation not requiring conversion to GA.

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