e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.3.27

International Journal of Pharmaceutical Quality Assurance 2025; 16(3); 157-161

Original Research Article

A Comparative Evaluation of General Anesthesia Versus Thoracic Spinal Anesthesia for Total Laparoscopic Hysterectomy Procedures

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Received: 27-12-2024 / Revised: 20-01-2025 / Accepted: 15-03-2025

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Conflict of interest: Nil

Abstract:

Background: Total laparoscopic hysterectomy (TLH) is a commonly performed gynecological procedure that is traditionally carried out under general anesthesia (GA). However, recent advancements in regional anesthesia techniques, particularly thoracic spinal anesthesia (TSA), have provided alternative approaches with potential advantages in terms of perioperative hemodynamics, pain control, and recovery profiles. This study compares the efficacy, safety, and outcomes of GA versus TSA in patients undergoing TLH.

Methods: This prospective comparative study included 130 female patients scheduled for elective TLH, in the Department of Anesthesiology at Netaji Subhas Medical College and Hospital, Amhara, Bihta, Patna, Bihar, India. Patients were randomly allocated into two groups: Group GA (n=65) received general anesthesia, while Group TSA (n=65) underwent thoracic spinal anesthesia. Intraoperative hemodynamics, operative time, postoperative pain scores (VAS), analgesic requirements, complications, and patient satisfaction were assessed and compared.

Results: The TSA group showed more stable intraoperative hemodynamic parameters, significantly lower postoperative VAS scores at 2, 4, and 6 hours, and reduced need for rescue analgesics. The incidence of postoperative nausea and vomiting (PONV) was markedly lower in the TSA group. Moreover, patient satisfaction scores were higher in the TSA group, with fewer reports of drowsiness and better early ambulation.

Conclusion: Thoracic spinal anesthesia offers a safe and effective alternative to general anesthesia for total laparoscopic hysterectomy. It is associated with better postoperative pain control, lower incidence of PONV, early mobilization, and higher patient satisfaction, making it a viable option in selected patients.

Keywords: General Anesthesia, Thoracic Spinal Anesthesia, Laparoscopic Hysterectomy, Postoperative Pain, Regional Anesthesia, Patient Satisfaction, PONV, Recovery Profile.

Introduction

Total laparoscopic hysterectomy (TLH) has become the standard surgical approach for the management of various benign gynecological conditions requiring uterine removal, including fibroids, dysfunctional uterine bleeding, adenomyosis, and endometriosis [1]. Traditionally, general anesthesia (GA) has been the preferred mode of anesthesia for TLH due to its ability to provide controlled ventilation and adequate muscle relaxation. However, GA is associated with a range of undesirable effects such as postoperative nausea and vomiting (PONV), delayed ambulation, drowsiness, and increased analgesic requirement in the recovery phase [2].

Advancements in regional anesthesia techniques have opened new avenues for anesthetic management in laparoscopic surgeries. Thoracic spinal anesthesia (TSA), a relatively newer technique, involves administering low-dose local anesthetic agents at the thoracic level to achieve segmental blockade [3]. TSA provides excellent intraoperative anesthesia, effective postoperative analgesia, and avoids many side effects of GA, such as airway manipulation, systemic drug exposure, and PONV. Furthermore, thoracic segmental blockade allows for early recovery, mobilization, and reduced opioid requirement, making it a potential alternative for select minimally invasive procedures [4].

Recent studies have highlighted the growing interest in TSA for laparoscopic surgeries, showing encouraging results with respect to hemodynamic

stability, surgical field visibility, and patient comfort [5]. However, the evidence comparing TSA directly with GA in TLH procedures remains limited, particularly in the Indian clinical context.

This study was undertaken to compare the intraoperative and postoperative outcomes of general anesthesia versus thoracic spinal anesthesia in patients undergoing total laparoscopic hysterectomy. The primary objectives were to evaluate hemodynamic stability, postoperative pain, analgesic consumption, adverse effects, and patient satisfaction. The findings aim to provide evidence-based guidance on the feasibility and advantages of TSA as an alternative to GA in TLH.

Methods

This prospective, comparative study was conducted in the Department of Anesthesiology at Netaji Subhas Medical College and Hospital, Amhara, Bihta, Patna, Bihar, India, over a period extending from Dec 2021 to August 2024. A total of 130 female patients, aged between 30 and 60 years, scheduled for elective total laparoscopic hysterectomy (TLH) were enrolled in the study after obtaining institutional ethical clearance and informed written consent. Patients were randomly allocated into two equal groups of 65 each using a computer-generated randomization technique: Group GA received general anesthesia, and Group TSA received thoracic spinal anesthesia.

Preoperative evaluations included complete medical history, physical examination, laboratory investigations, and relevant imaging studies. Inclusion criteria included ASA physical status I or II, BMI between 18 and 30 kg/m², and absence of contraindications to regional anesthesia. Patients with known allergy to study drugs, coagulopathy, spinal deformities, neurological disorders, or prior extensive abdominal surgeries were excluded.

In Group GA, patients were induced with intravenous propofol (2 mg/kg), fentanyl (2 mcg/kg), and atracurium (0.5 mg/kg), followed by endotracheal intubation. Anesthesia was maintained with sevoflurane in oxygen-nitrous oxide mixture along with intermittent doses of muscle relaxant. In Group TSA, patients were administered spinal anesthesia at the T8–T9 or T9–T10 interspace using 1.6–2 mL of 0.5% hyperbaric bupivacaine combined with 25 mcg of fentanyl. The block height was assessed using pinprick sensation, targeting a sensory level up to T4–T6.

Standard monitoring included continuous ECG, non-invasive blood pressure, pulse oximetry, and end-tidal CO_2 (in GA group). Intraoperative parameters such as heart rate, blood pressure, SpO_2, surgical time, and complications were recorded. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 4, 6, 12, and 24 hours. Rescue analgesia in the form of IV paracetamol (1 g) was administered when VAS exceeded 4. Incidence of postoperative nausea and vomiting (PONV), time to ambulation, duration of hospital stay, and overall patient satisfaction (measured using a 4-point Likert scale) were also documented.

All data were analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation and compared using the Student's t-test. Categorical variables were analyzed using the chi-square test or Fisher's exact test as applicable. A p-value of <0.05 was considered statistically significant.

Results

This study included 130 patients undergoing total laparoscopic hysterectomy, equally divided into two groups: Group GA (General Anesthesia) and Group TSA (Thoracic Spinal Anesthesia), with 65 patients each. The two groups were comparable in terms of baseline demographic parameters. The results demonstrated that patients receiving TSA had more stable intraoperative hemodynamics, significantly lower postoperative pain scores, reduced need for rescue analgesics, earlier ambulation, and higher satisfaction scores compared to those who received GA.

Table 1: Comparison of Intraoperative Hemodynamic Parameters (Mean ± SD)

Parameter	Group GA (n=65)	Group TSA (n=65)	p-value
Mean HR (beats/min)	84.2 ± 6.3	78.1 ± 5.7	<0.001
Mean SBP (mmHg)	122.5 ± 10.2	115.4 ± 9.8	0.002
Mean DBP (mmHg)	78.6 ± 7.4	72.1 ± 6.5	<0.001
Mean MAP (mmHg)	93.2 ± 6.8	86.5 ± 6.2	<0.001

Table 2: Demographic Distribution of Patients

Parameter	Group GA (n=65)	Group TSA (n=65)	p-value
Age (years)	44.3 ± 5.6	43.7 ± 6.2	0.547
BMI (kg/m²)	25.6 ± 2.3	25.2 ± 2.7	0.412
ASA Grade I/II	28/37	30/35	0.723
Duration of Surgery (min)	96.5 ± 12.4	94.8 ± 11.7	0.421

Table 3: Postoperative VAS Scores

Time Interval (Hours)	Group GA (Mean ± SD)	Group TSA (Mean ± SD)	p-value
2 Hours	4.8 ± 1.0	2.6 ± 0.9	<0.001
4 Hours	4.2 ± 1.1	2.3 ± 0.8	<0.001
6 Hours	3.7 ± 1.0	2.1 ± 0.7	<0.001
12 Hours	3.2 ± 0.9	2.4 ± 0.6	0.001
24 Hours	2.6 ± 0.7	2.2 ± 0.5	0.030

Table 4: Requirement of Rescue Analgesia (Number of Doses in 24 hours)

No. of Doses Required	Group GA (n=65)	Group TSA (n=65)
0	3	20
1	15	32
2	28	11
3	19	2

Table 5: Postoperative Nausea and Vomiting (PONV) Incidence

PONV Score	Group GA (n=65)	Group TSA (n=65)	p-value
None	36	55	<0.001
Mild	19	9	
Moderate to Severe	10	1	

Table 6: Time to First Ambulation Post-Surgery (Hours)

Time Range (Hours)	Group GA (n=65)	Group TSA (n=65)
<6	5	34
6–12	28	26
>12	32	5

Table 7: Duration of Hospital Stay

Stay Duration (Days)	Group GA (n=65)	Group TSA (n=65)
1	6	24
2	43	36
>2	16	5

Table 8: Anesthesia-Related Complications

Complication	Group GA (n=65)	Group TSA (n=65)
Hypotension	5	4
Bradycardia	3	2
Nausea/Vomiting	29	10
Sedation	8	2

Table 9: Patient Satisfaction Score (Likert Scale)

Rating	Group GA (n=65)	Group TSA (n=65)
Excellent	15	35
Good	32	24
Fair	13	5
Poor	5	1

Table 10: Time to Return of Bowel Sounds Postoperatively

Time Interval (Hours)	Group GA (n=65)	Group TSA (n=65)
<6	18	40
6–12	35	23
>12	12	2

Discussion

This study demonstrates that thoracic spinal anesthesia (TSA) offers several advantages over general anesthesia (GA) in patients undergoing total laparoscopic hysterectomy (TLH). The findings consistently indicate that TSA provides better perioperative stability, enhanced postoperative

analgesia, fewer complications, and a higher level of patient satisfaction when compared to GA.

Hemodynamic stability was significantly better in the TSA group. The lower mean heart rate, systolic and diastolic blood pressures, and mean arterial pressure suggest that TSA provides more controlled cardiovascular parameters during surgery [6]. This could be attributed to the effective sympathetic blockade achieved at the thoracic level, which blunts the stress response associated with pneumoperitoneum and Trendelenburg positioning during laparoscopy. In contrast, GA can induce greater hemodynamic fluctuations, particularly during induction, intubation, and emergence [7].

Pain management is a crucial determinant of recovery after laparoscopic procedures. In our study, VAS scores were significantly lower in the TSA group across all measured time points. The reduced pain perception can be attributed to the sustained sensory blockade provided by spinal anesthesia and the adjunct use of fentanyl. Consequently, the requirement for rescue analgesics was notably less in this group, which not only improves patient comfort but also minimizes opioid-related side effects [8].

Postoperative nausea and vomiting (PONV) is a common concern following GA, primarily due to inhalational agents and opioid use [9]. Our results confirm a significantly lower incidence of PONV in the TSA group, aligning with existing literature that suggests regional anesthesia techniques reduce the need for antiemetics and improve patient tolerance post-surgery.

Early ambulation and bowel recovery were significantly better in the TSA group. These outcomes are particularly relevant in the era of Enhanced Recovery After Surgery (ERAS) protocols [10]. Early mobilization reduces the risk of thromboembolic events and improves pulmonary function, while faster return of bowel sounds promotes earlier oral intake and discharge readiness. The shorter hospital stay observed in the TSA group supports the economic and clinical benefits of this technique [11,12].

From the patient's perspective, the quality of recovery and satisfaction were markedly better with TSA. Most patients in this group reported the experience as excellent or good, reflecting the impact of lower pain, fewer side effects, and faster recovery [13]. The reduction in anesthesia-related complications further strengthens the case for wider adoption of TSA in select laparoscopic surgeries.

Despite these benefits, the choice of TSA must be individualized [14]. Thoracic spinal blocks demand precision and experience to avoid potential complications such as high spinal or neurological deficits [15,16]. However, in skilled hands and with appropriate patient selection, it appears to be a superior alternative to GA for TLH [17,18] .

In conclusion, TSA proves to be a safe, effective, and patient-friendly anesthesia technique for TLH, offering significant improvements in intraoperative and postoperative outcomes compared to GA. Further large-scale studies and long-term follow-up could validate these findings and encourage its integration into routine gynecological laparoscopic practice.

Conclusion

This comparative study between general anesthesia and thoracic spinal anesthesia for total laparoscopic hysterectomy concludes that thoracic spinal anesthesia offers superior perioperative outcomes. Patients in the TSA group experienced better hemodynamic stability, significantly lower postoperative pain scores, reduced need for rescue analgesia, minimal incidence of postoperative nausea and vomiting, earlier ambulation, faster return of bowel function, shorter hospital stays, and higher overall satisfaction. These findings highlight the potential of TSA as a safe and effective alternative to general anesthesia in laparoscopic gynecological surgeries, provided it is administered by experienced anesthesiologists with careful patient selection. Incorporating TSA into clinical practice can significantly enhance patient recovery and align with modern enhanced recovery protocols.

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