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Original Research Article

Comparative Study of Relationship between General Anesthesia and Thoracic Spinal Anesthesia in Total Laparoscopic Hysterectomy

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Abstract

Background: General anesthesia (GA) is usually used during total laparoscopic hysterectomy (TLH). Thoracic spinal anesthesia (TSA), however, might be a useful substitute, particularly for patients who are at high risk. The purpose of this randomized controlled experiment was to evaluate the safety and effectiveness of GA and TSA in TLH patients.

Methods: Group T (TSA) and group G (GA), each consisting of 15 patients, were randomly assigned to 30 patients scheduled for elective TLH. While group T received TSA (sub-arachnoid block at T8/9 or T9/10 with hyperbaric levo-bupivacaine 0.5%, 0.7 ml along with dexmedetomidine 4 g, followed by isobaric levo-bupivacaine 0.5% 1.5 ml with dexmedetomidine 6 g while seated), group G received conventional GA with intubation and mechanical ventilation. Our main goal was to examine the hemodynamic changes, and our secondary goal was to compare the two methods' intraoperative and postoperative side effects and need for rescue analgesia.

Results: For the study, all 30 individuals were examined. Patients in Group T had better hemodynamic stability, and after 30 minutes, the mean SBP of the two groups differed significantly (at 40 minutes p=0.043, at 60 minutes p=0.007). In group G, there were noticeably more patients in need of rescue analgesia. Group G experienced greater adverse events, such as intraoperative hypertension and postoperative sore throat.

Conclusion: For TLH, TSA offers a safe substitute for GA with improved hemodynamic stability, fewer adverse effects, and a lower need for rescue analgesia.

Keywords: Thoracic spinal anesthesia, Total laparoscopic hysterectomy, General anesthesia, Pneumoperitoneum.

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Introduction

A popular gynecological treatment is total laparoscopic hysterectomy (TLH). It has numerous benefits over typical abdominal hysterectomy, including less surgical morbidity, shorter hospital stays, and quicker recovery. [1]

However, anesthesiologists face difficulties because of the pathophysiological alterations brought on by pneumo-peritoneum and the Trendelenburg position on circulation and respiratory function. In order to avoid aspiration, respiratory embarrassment, and shoulder pain from pneumoperitoneum and the Trendelenburg position, these procedures are typically performed under general anesthesia (GA) with endotracheal intubation. [2, 3] For some patients who are not candidates for GA, neuraxial anesthesia (NA) is advantageous. Additionally, GA has a number of disadvantages.Patients get hypertensive episodes as a result of sympathetic activation during intubation and pneumoperitoneum, which does not happen with NA. Additionally, NA improves analgesia following surgery.[4–6] However, because of the unpredictable drug dissemination, conventional NA necessitates a higher dose of local anesthetic (LA), which increases intraoperative hypotension and occasionally results in insufficient relaxation.

Sub-arachnoid block at the thoracic level is known as thoracic spinal anesthesia (TSA). It offers a useful substitute for GA to address every issue in TLH [7,8]. The dermatomes in TLH that need to be inhibited range widely, from T-4 to S-5.

Material and Methods

This randomized controlled study was conducted at Katihar Medical College and Hospital, Katihar, Bihar from April 2025 to March 2025. Using a

computer-generated randomization technique, a total of thirty ASA (American Society of Anesthesiologists) grade I/II patients undergoing total laparoscopic hysterectomy were split into two groups of fifteen each: Group S, which received thoracic spinal anesthesia, and Group G, which received general anesthesia.

The study comprised patients who were 40 years of age or older, belonged to ASA grades 1 and 2, and provided written informed permission. Patients who had a BMI of more than 35 kg/m2 or who were contraindicated for neuraxial block were excluded.Following the acquisition of written informed consent, patients were brought into the operating room and linked to ASA standard monitoring, which included capnography, noninvasive blood pressure, pulse oximetry, and electrocardiograms. Vital signs were taken at baseline. A 20 G three-way cannula was used to secure intravenous access for each patient. In 15 minutes, all patients, regardless of group, were preloaded with 10 milliliters per kilogram of ringer lactate. All patients received intravenous (IV) ondansetron 4 mg, glycopyrrolate 0.2 mg, and midazolam 1 mg as premedication.

IBM SPSS Statistics version 22 was used for data analysis. Microsoft Excel was used to process the data. The Chi square test was used to compare groups of qualitative data that were expressed in percentages and proportions. Students't-tests were used to compare quantitative data that was measured as mean and standard deviation from mean (SD). If the probability was less than 0.005, it was deemed significant.

Results

There were no discernible differences between the two groups, Group T and Group G, each consisting of 15 participants, in terms of clinical and demographic factors.With p-values of 0.446, 0.356, and 0.444, respectively, the groups' ages, heights, and weights were comparable. With p-values of 1.00 and 0.880, respectively, both groups' distributions of American Society of Anesthesiologists (ASA) physical state classifications and surgical durations were comparable. Additionally, there was no significant difference in the prevalence of co-morbidities such as hypothyroidism, hypertension, coronary artery disease, and anemia (p-value of 0.498), suggesting that the groups were well-matched for additional comparative studies.(Table 1)

Table 1: Different types of variables of included patients

Variables	Group S(n=15)	Group G(n=15)	p-value
Age(yrs)	43.65±5.99	44.22±5.30	0.446
Height(cm)	155.75±6.96	157.01±4.99	0.356
Weight(kg)	58.50±4.96	59.01±4.42	0.444
ASA(I/II)	10/5	11/4	1.00
Duration of surgery (min)	105.76±32.51	107.02±34.82	0.880
Co-morbidity (Hypothy/HTN/CAD/Anaemic)	1/4/0/1	5/4/1/0	0.498

Table 2: Spinal procedure data of included patients

Variable	Group S (n=15)
Space (T_{9-10}/T_{10-11}/T_{11-12})	4/10/1
Attempts(1/2)	13/2
Approach(Midline/Paramedian)	9/6
Onset(minute) (mean±SD)	1.90±0.20

Ten of the fifteen subjects in Group T had a predilection for the T10-11 region, followed by T9-10 and T11-12, according to the spinal procedure data. Approaches were almost equally divided between midline (9) and paramedian (6), with the majority of procedures (13 out of 15) being successful on the first try. At 1.90 minutes (±0.20), the average onset time was short.

Table 3: Comparison of Intraoperative Hemodynamic Parameters (Mean ± SD)

Parameters	Group G (n=15)	Group T (n=15)	p-value
Mean HR bpm	97.67±.6.9	92.70±6.0	0.043
SBP mmHg	124.03±11.4	118.2±10.3	0.052
DBP mmHg	79.5±7.9	74.2±6.8	<0.001

In Group T no patients required rescue analgesia. In group G, 11 patients required rescue analgesia and 4 did not require any rescue analgesic.

Table 4: Showing Intra operative events of patients

	Hypotension	Bradycardia	Hypertension	Tachycardia	Shivering
Group T	2	2	0	0	1
Group G	0	0	7	11	0

Table 5: Showing Post-operative events of patients

	Pain abdomen	Sore throat	Headache
Group T	0	0	1
Group G	8	4	0

Table 6: Showing Rescue analgesia of patients

	Required	Not required
Group T	0	15
Group G	11	4

Discussion

Trendelenberg tilt and TLH avoid the occurrence of significant hypotension that could have resulted from extensive sympathetic blockage in TSA for TLH (T4 to S4-5). The right atrium and great veins' chronotropic stretch receptors are stimulated by sufficient venous return in this position because of gravity, even in spite of venous and arteriolar dialatation. HR and cardiac output are maintained as a result.[9, 10]

Because of careful preoperative mechanical bowel preparation followed by a minimal residue meal, the vision and access of the surgical field were unaffected by a trendelenberg tilt of just 10 to 15 degrees. There was no need to convert the TSSA instance to GA.

The stretching of the diaphragm caused by CO2 insufflation is the cause of shoulder tip pain during or after laparoscopic surgery. In order to prevent diaphragm straining, the intraperitoneal pressure following pneumoperitoneum in our trial was fixed at 12 mmHg with a flow rate of 5-6 l/min.

Through the phrenic nerve, which is spared in TSA, the central tendinous portion of the diaphragm provides sensory relay to C3, C4, and C5.

A review of the literature finds a variety of techniques that have been utilized to lessen shoulder tip pain, such as applying low pressure pneumoperitoneum (less than 10 mmHg) or spraying bupivacaine on the peritoneum behind the diaphragm. To prevent shoulder discomfort during the pneumoperitoneum stage, all TSA patients in our trial received 30 mg of ketamine and 30 g of fentanyl.

TSA has been used without incident in patients with significant lung disease, according to earlier research by Zundert et al. Patients using this approach have no respiratory pain despite the paralysis of the intercostal muscles of blocked dermatomes (T5–T12). This is due to the fact that the phrenic nerve, which is intact, provides the entire diaphragm—the essential muscle for inspiration—with its motor supply from the C3, 4, and 5 dermatome. Unlike GA, TSA maintains the central respiratory drive, which enables the minute ventilation to adapt even to the absorbed CO2.[11–14]Above the spinal cord ending above L1/L2, TSA is carried out. The main concerns include respiratory problems that could result from paralysis of the intercostal muscles, hemodynamic instability due to blocking of cardio-accelerator fibers, and potential damage to the spinal cord.

MRI studies, which show how the SC sways within the spinal canal from a posterior location at C5/6 to an anterior position at T4-T10 and then back to a posterior position at T12, can answer our first worry.[15] Imbelloni and associates examined 50 patients' MRIs when they were in a supine position in 2010. Their investigation found that the dura to cord distance (DTC) was 5.19 mm at T2, 7.75 mm at T5, and 5.88 mm at T10.[16] Park and associates have conducted similar research. Due to angulated thoracic spines, TSA needle piercings must be made at a 45-degree angle. Consequently, the DTC is raised even further. The low frequency of neurological problems in TSA is explained by this.[17]

TSA's effectiveness and safety have been demonstrated in a number of previous research. In their review study from 2022, Roux et al. outlined the role of TSA in the twenty-first century by rigorously evaluating all of the TSA-related publications. In the subset of individuals with particular GA risks, the function of TSA becomes important.[18]

Although TSA's function in laparoscopic procedures has been confirmed by a number of earlier investigations, its effectiveness for TLH has never been investigated. Our analysis compares TSA with the current gold standard method of GA. The objectives of anesthetic management in TLH are met by TSA.

Reduced incidence of postoperative nausea and vomiting, less blood loss during surgery, early discharge, minimal hemodynamic disturbances, improved intraoperative and postoperative analgesia, fewer cardiac and respiratory complications, and better suppression of the stress response to surgery are some of its benefits.[19–25]

Conclusion

Because it offers sufficient sensory and motor block with few hemodynamic disruptions and less need for post-operative analgesics, thoracic spinal anesthesia is a safe and efficient method for treating TLH. To determine the usefulness of this method, more randomized controlled trials in diverse cohort groups are necessary.

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