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"Comparison of General and Regional Anesthesia in Laparoscopic Gynecological Surgeries: Recovery and Pain Outcomes"

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KEYWORDS

Laparoscopy, Gynecological surgeries, General anesthesia, Regional Anesthesia, Subarachnoid block

ABSTRACT:

Introduction: Laparoscopic surgery has become the gold standard for the surgical care of several benign gynecological illnesses, such as endometriosis, leiomyoma, adhesions, and infertility, because of its "minimally invasive" nature, which reduces surgical damage, discomfort, and hospitalization time. In this study, we aimed to compare general anesthesia with regional anesthesia in laparoscopic gynecological surgeries in terms of pain outcomes and recovery.

Methods: This cross-sectional study was conducted in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from July 2023 to June 2024. This study included 100 patients who underwent laparoscopic gynecological surgeries and were then divided into two groups: Group

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A- Patients who received regional anesthesia, such as SAB (Subarachnoid block), and Group B- Patients who received general anesthesia.

Result: The baseline characteristics were comparable between the groups, with no significant differences in mean age, BMI, parity, ASA status, or indications for surgery. Postoperatively, the GA group had significantly higher MAP (99.37 ± 8.62 mmHg vs. 90.04 ± 8.36 mmHg, p = 0.041) and longer hospital stays (5.0 ± 1.1 days vs. 4.5 ± 0.6 days, p = 0.001). Pain scores at 8 hours postoperatively were significantly lower in the RA Group (2.17 ± 1.97 vs. 3.93 ± 1.53, p = 0.002). The RA group reported fewer complications, with a higher proportion of patients experiencing no complications (62% vs. 56%).

Conclusion: This study showed that regional anesthesia demonstrated better postoperative outcomes, including shorter hospital stays, lower pain scores at 8 hours, and fewer complications, compared to general anesthesia. These findings suggest that RA may be a preferable option for laparoscopic gynecological surgical procedures.

Introduction

Laparoscopic surgery has become the gold standard for the surgical care of several benign gynecological illnesses, such as endometriosis, leiomyoma, adhesions, and infertility, because of its "minimally invasive" nature, which reduces surgical damage, discomfort, and hospitalization time. [1, 2] General anesthesia (GA) in conjunction with controlled ventilation has long been known to be the safest technique for laparoscopic procedures because it maintains end-tidal carbon dioxide (ETCO2) within a normal range, which may increase due to abdominal insufflation. [2–4]

GA is the preferred and predominant technique for laparoscopic surgeries such as adnexal surgery, total hysterectomy, and myomectomy in the gynecologic field because it controls surgical pain and improves patient comfort with pneumoperitoneum and Trendelenburg position. General anesthesia provides a secure airway and allows for the precise control of ventilation to reduce hypercarbia. [2,5]

However, regional anesthesia such as SA has been regarded as a suitable alternative to GA in recent years, considering the complications of GA in some diseases and conditions, such as pulmonary diseases, chronic obstructive pulmonary disease, asthma, musculoskeletal disorders, and muscular disorders. [3] Recently, according to general surgeons' experience, the combination of minimally invasive surgery and regional anesthesia appeared to increase laparoscopic procedures. [6-8]

Regional anesthesia, such as combined spinal and epidural anesthesia (CSEA), includes a reduction in the side effects of general anesthetics such as nausea, vomiting, sore throat, dental injury, sedation, postoperative atelectasis, and hypoventilation. [9,10] Sequelae of general anesthesia, such as airway trauma, myalgia, and sore throat, can be avoided with regional anesthesia. The latter also allows for earlier cognitive recovery and oral intake in the immediate postoperative period, whereas its long-term benefits have not yet been demonstrated. [11]

Additional potential benefits of regional anesthesia include rapid recovery, effective postoperative analgesia, and early ambulation and recovery. However, the implementation of laparoscopic surgery under regional anesthesia has been limited. Adverse consequences of regional anesthesia include severe hypotension, shoulder pain from irritated diaphragms, and breathing discomfort from pneumoperitoneum. Cholecystectomy was the most common reason for regional anesthesia in laparoscopic surgery, with appendectomy being the least common. [12–14] A more favorable cardiovascular function is achieved by doing laparoscopic cholecystectomy in a reverse Trendelenburg posture. Laparoscopic appendectomy has a comparatively quick operating time. Since gynecologic laparoscopic surgery is done in the Trendelenburg position, regional anesthesia could not be used for this procedure. Regional anesthesia used in combination with gasless laparoscopy can be an alternative to overcome the limitation of performing

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gynecologic minimally invasive surgery in the Trendelenburg position.[11]

Therefore, in this study, we aimed to compare general anesthesia with regional anesthesia in laparoscopic gynecological surgeries in terms of pain outcomes and recovery.

Methodology & Materials

This cross-sectional study was conducted in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from July 2023 to June 2024. We included 100 hospitalized patients who underwent laparoscopic gynecological surgeries. Patients were divided into two groups: Group A- Patients who received regional anesthesia, such as SAB (Subarachnoid block), and Group B- Patients who received general anesthesia.

These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged more than 18 years; b)Patients who underwent laparoscopic gynecological surgeries; c) Patients who were willing to participate were included in the study And a) Patients with any surgical history; b) Patients with Coagulopathy or receiving anticoagulants; c) Patients with known allergy/hypersensitivity to anesthetic drugs; d) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.) were excluded from our study.

Anesthetics in RA and GA: The GA drugs included midazolam, fentanyl, propofol, suxamethonium, and vecuronium. In the SA group, under sterile conditions, and in a seated position, a Quincke spinal needle (size: G27) was used to inject bupivacaine heavy along with fentanyl at the L3-L4 interspace and consequently to induce anesthesia. [15] The RA (SAB) Group received 12.5 mg (2.5 ml) of 0.5% bupivacaine heavy and 25 µg of fentanyl.

Data Collection: Informed written consent was taken from the patients. The demographic and physical characteristics of patients were obtained pre-operatively. Data were recorded for age, height, BMI, parity, tumor marker (CA 125) level, total operative time, set-up time, estimated blood loss, and type of surgery. All routine monitors for noninvasive blood pressure and heart rate measurements and pulse oximeter (oxygen saturation [SpO_2]) were attached, and the baseline values of vital signs were recorded. Hypotension (systolic arterial pressure < 90 mmHg), bradycardia (heart rate < 50 beats/ min), and hypoxemia (SpO_2 < 90%) were recorded. Visual Analogic Scale was used to measure the pain levels.

Statistical Analysis: All data were recorded systematically in a pre-formatted data collection form. Quantitative data was expressed as mean and standard deviation, and qualitative data was expressed as frequency distribution and percentage. The differences between groups were analyzed by the student t-test. A p-value <0.05 was considered significant. Statistical analysis was performed by using SPSS 20 (Statistical Package for Social Sciences) for Windows version 10.

Results

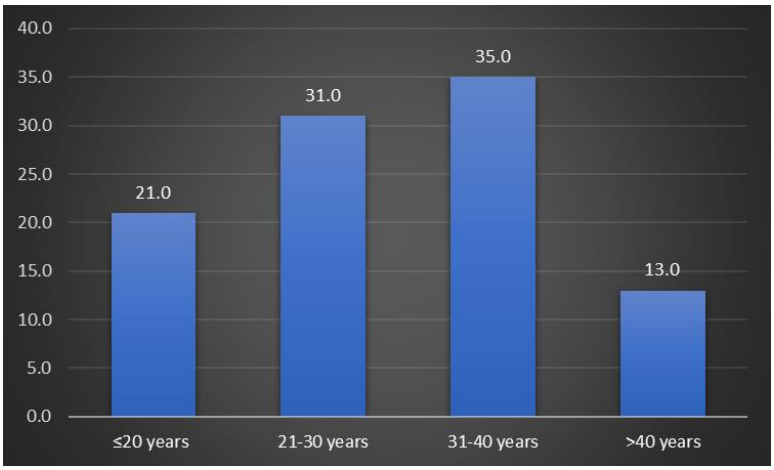

Figure 1: Age distribution of the study subjects (n=100)

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Figure 1 shows that most (35%) of our patients were in the 31-40 age group, followed by 31% aged 21-30, and 21% and 13% of patients were in the ≤20 & >40 age group, respectively.

Table 1: Baseline characteristics of the study subjects (n=100)

Baseline characteristics	**Group A**		**Group B**		**P-value**
	N=50	P(%)	N=50	P(%)	
Mean age (years)	29.32±8.02		28.12±9.94		0.508
BMI (kg/m^2)	24.85±3.18		24.04±5.24		0.352
Weight (kg)	69.6±11.3		72.8±12.1		0.175
Height (cm)	152.4±5.9		155.7±3.6		0.001
Parity					
1-2	26	52	27	54	
3-4	24	48	23	46	
ASA Status					
I	28	56	30	60	
II	22	44	20	40	
Operative time (minutes)	43.24±14.94		44.33±16.46		0.729
Anesthesia time (minutes)	52.12±8.30		54.30±19.81		0.475
Indications for laparoscopy					
Diagnostic	7	14	8	16	
Operative	8	16	6	12	
Infertility	23	46	24	48	
Others	12	24	12	24	
Co-morbidities					
DM	26	52	28	56	
HTN	12	24	9	18	
Anemia	18	36	17	34	

Group A =Regional Anesthesia, Group B =General Anesthesia, ASA =American Society of Anesthesiologists, DM= Diabetes Mellitus, HTN= Hypertension

Table 1 presents the baseline characteristics of study participants. The mean age of participants in Group A was 29.32 ± 8.02 years, compared to 28.12 ± 9.94 years in Group B (p = 0.508). The mean BMI was slightly higher in Group A (24.85 ± 3.18 kg/m²) compared to Group B (24.04 ± 5.24 kg/m²), but the difference was not statistically significant (p = 0.352). Most patients (52% in Group A and 54% in Group B) had a parity of 1–2. Similarly, ASA status showed no significant difference, with 56% of Group A and 60% of Group B categorized

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as ASA I, and 44% of Group A and 40% of Group B as ASA II. The operative and anesthesia times were also similar between the groups, with no significant differences (p = 0.729 and p = 0.475, respectively). The most common indication was infertility in groups A and B (46% vs 48%). Prevalence of DM, HTN & anemia was comparable between groups, with no significant differences observed.

Table 2: Hemodynamic changes at per-operative and postoperative period

Hemodynamic changes	Group A	Group B	P-value
Heart rate (per minute)			
0 min	91.13±8.53	90.40±2.64	
10 min	82.5±13.7	85.64±7.24	
Postoperative	70.21±9.90	74.83±10.05	0.061
Systolic BP (mmHg)			
0 min	112.69±11.41	121.58±2.95	
10 min	95.30±8.68	127.85±4.15	
Postoperative	109.30±5.57	120.52±2.81	0.001
Diastolic BP (mmHg)			
0 min	74.15±5.24	77.10±3.68	
10 min	61.85±8.78	83.50±4.58	
Postoperative	70.41±3.62	81.21±1.47	0.001
MAP in mmHg			
0 min	90.10±10.32	87.33±19.44	
10 min	80.91±8.42	91.44±9.87	
Postoperative	90.04±8.36	99.37±8.62	0.041

Group A =Regional Anesthesia, Group B =General Anesthesia, MAP: Mean arterial pressure

Table 2 shows that postoperative heart rate was slightly lower in Group A (70.21 ± 9.90 bpm) compared to Group B (74.83 ± 10.05 bpm), but this difference was not statistically significant (p = 0.061). Both systolic and diastolic blood pressures were consistently higher in Group B at all time points. Statistically significant differences were observed in postoperative measurements for both systolic (p = 0.001) and diastolic blood pressure (p = 0.001). Group B had a higher postoperative MAP (99.37 ± 8.62 mmHg) than Group A (90.04 ± 8.36 mmHg), and this difference was significant (p = 0.041).

Table 3: SpO_2 and $ETCO_2$ changes at per-operative and postoperative period

Oxygen saturation (SpO_2) %	Group A	Group B	P-value
0 min	98.6±0.83	97.93±1.87	
10 min	99.50±0.86	99.83±0.46	

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Postoperative	99.5±4.55	99.53±1.87	0.964
End-tidal Carbon Dioxide ($ETCO_2$) in mm of Hg			
0 min	32.77±4.55	31.73±5.36	
10 min	33.90±3.64	34.07±3.02	
Postoperative	32.9±2.6	33.3±5.9	0.662

Group A =Regional Anesthesia, Group B =General Anesthesia

Table 3 shows the comparison of oxygen saturation (SpO_2) and end-tidal carbon dioxide ($ETCO_2$) levels between Group A and Group B during the perioperative and postoperative periods. Both SpO_2 (0.964) and $ETCO_2$ (0.662) showed no significant differences between the groups.

Table 4: Distribution of our study subjects by post-operative complications (n=100)

Complications	**Group A**		**Group B**	
	N=50	P(%)	N=50	P(%)
No complications	31	62	28	56
Nausea	19	38	22	44
Vomiting	18	36	23	46
Abdominal discomfort	11	22	19	38
Anxiety	4	8	7	14
Hypotension	8	16	6	12

Group A =Regional Anesthesia, Group B =General Anesthesia

Table 4 shows that a higher percentage of participants in Group A (62%) reported no complications compared to Group B (56%). Nausea was reported in 38% of participants in Group A and 44% in Group B. Similarly, vomiting was more frequent in Group B (46%) compared to Group A (36%). Abdominal discomfort and anxiety were less common in Group A (22% vs 38%) compared to Group B (8% vs 14%), except for hypotension (16% vs 12%), respectively.

Table 5: Comparison of pain scores, recovery scores, recovery time, and hospital stay between groups

Pain score	**Group A**	**Group B**	**P-value**
Preoperative VAS score	5.27±3.46	6.47±2.97	0.065
Postoperative VAS score			
After 2h	4.07±3.4	5.18±3.66	0.119
After 8h	2.17±1.97	3.93±1.53	0.002
After 24 h	1.13±1.96	1.93±3.15	0.130

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Modified Aldrete Score			
Pre-operative	3.61 ±1.6	3.59 ± 1.2	0.943
Postoperative	8.04 ±1.7	7.25 ± 1.8	0.026
Mean Recovery Time (minutes)	16.91± 6.29	20.51± 5.42	0.002
Hospital stays (days)	4.56 ± 0.6	5.06 ± 1.1	0.005

Group A =Regional Anesthesia, Group B =General Anesthesia

Table 5 shows the comparison of pain scores, Modified Aldrete scores, mean recovery time, and duration of hospital stay between Group A and Group B. Pain was assessed using the Visual Analogue Scale (VAS). Postoperatively, VAS scores showed no significant difference at 2 hours (p = 0.119) but were significantly lower in Group A (2.17 ± 1.97) compared to Group B (3.93 ± 1.53) at 8 hours (p = 0.002). No significant difference was observed at 24 hours. Postoperative Modified Aldrete scores and mean recovery time were also significantly different between the groups (p = 0.026 and p = 0.002, respectively), with Group A demonstrating faster recovery. Additionally, patients in Group A had a shorter mean hospital stay (4.5 ± 0.6 days) compared to Group B (5.0 ± 1.1 days), and there was a significant difference (p = 0.005).

Discussion

Although general anesthesia (GA) has been regarded as a suitable anesthetic technique for laparoscopic surgery owing to the various effects of pneumoperitoneum, there are various complications associated with GA. [5] Regional anesthesia (RA) has been reported as equally favorable in laparoscopic gynecological surgeries. RA is advantageous over GA in terms of shorter postoperative stay, lesser postoperative pain, absence of airway manipulation, and overall safety. [9] It leads to a faster recovery in immediate postoperative settings. Therefore, this study was done to evaluate the postoperative pain outcomes of general and regional anesthesia in laparoscopic gynecological surgeries.

In the present study, the patients who received regional anesthesia (SAB) were considered as cases, and patients who received general anesthesia were considered as the control group. We found the mean age of the RA and GA groups was 29.32 and 28.12 years, respectively. Hwang et al found that the overall mean age was 41.4 and 42.6 years in the CSEA and GA group, respectively. [11] In this study, the most common indication was infertility (46% vs 48%) in the RA & GA groups, respectively. Kaya Ugur et al. included patients who were scheduled to undergo diagnostic laparoscopy combined with hysteroscopy for unexplained infertility. [15] Asgari et al. and Zirak et al. similarly included patients with only infertility issues. [3,16] Raimondo et al. have detailed the surgical procedure performed (cystectomy or adnexectomy). [17]

Postoperative heart rate was slightly lower in the RA group (70.21 ± 9.90 bpm) compared to the GA group (74.83 ± 10.05 bpm), but this difference was not statistically significant (p = 0.061) in this study. Zirak et al. also found the difference between the 2 groups was not statistically significant. [3] Similar results were obtained by Kaya Ugur et al. [15]

In our study, the GA (control) group had a higher postoperative MAP (99.37 ± 8.62 mmHg) than the RA (case) group (90.04 ± 8.36 mmHg), and this difference was significant (p = 0.041). During postoperative observation, Zirak et al. had a lower MAP in cases than in controls. [3] Similar results were reported in a study done by Kaya Ugur et al. (80.87 ± 5.58 vs. 91.23 ± 17.12, p = 0.005), respectively. [15]

In the current study, post-operative SpO_2 showed no significant differences between the groups. Zirak et al. and Kaya Ugur et al. found that SpO_2 in the postoperative phase (98.5 ± 1.55 vs. 98.53 ± 4.87, p = 0.220 and 100 ± 0 vs. 99.86 ± 0.38, p = 0.593, respectively) had no significant difference between the groups. [3, 15] Raimondo et al. similarly registered no significant differences. [17]

$ETCO_2$ had no significant differences between the groups during the postoperative phase. Zirak et al. found that cases had an ETCO2 higher than controls (29.73 ±

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6.36 vs. 27.27 ± 3.10, p = 0.188) before Inflation. [3] Kaya Ugur et al. recorded ETCO2 only for controls in the postoperative period, and the evaluation was 33.71 ± 3.35. [15] Raimondo et al. registered no significant differences in post-peritoneum ETCO2 (after pneumoperitoneum: 33.3 ± 5.9 vs. 32.9 ± 2.6, p = 0.813). [17]

Postoperative pain was considered the main outcome in the studies reported in our analysis, as well as in the ones evaluating laparoscopic surgery in RA. [18,19] In the present study, pain outcomes, as assessed by VAS scores, showed no significant difference at 2 hours (p = 0.119) postoperatively. However, at 8 hours, VAS scores were significantly lower in Group A (2.17 ± 1.97) compared to Group B (3.93 ± 1.53) at 8 hours (p = 0.002), indicating better intermediate-term pain control with regional anesthesia. No significant differences were observed at 24 hours. Similarly to our results, a study by Hwang et al found that RA is responsible for less pain, especially in the first postoperative hours.[11] Asgary et al. found that there were no statistical differences in terms of pain among the 3 groups (GA, SA, and SA with lidocaine). [20] Raimondo et al. found that at 1, 8, 12, 24, and 48 h after surgery, pain was significantly lower in the SA arm (p < 0.05). Pain assessed through the Verbal Numerical Rating Scale was lower in the SA arm than the GA arm. [17] On the contrary, Zirak et al. reported an opposite result: after 2 h, SA had the most intense pain than GA (5.27 ± 2.46 vs. 2.47 ± 2.97, p = 0.009). This trend was maintained after 8 h (3.93 ± 1.53 vs. 1.93 ± 3.15, p = 0.035) and 24 h (3.53 ± 2.80 vs. 1.13 ± 1.96, p = 0.011). [3]

In the present study, the Modified Aldrete Score, used to assess postoperative recovery, showed no significant difference preoperatively (p = 0.943), but Group A had a significantly higher postoperative score (8.04 ± 1.7 vs. 7.25 ± 1.8; p = 0.026), indicating faster recovery. Correspondingly, the mean recovery time was significantly shorter in Group A (16.91 ± 6.29 minutes) compared to Group B (20.51 ± 5.42 minutes; p = 0.002). A study by Banerjee et al. found the recovery time from general anaesthesia was 14.8 ± 3.8 and 13.0 ± 3.5 minutes, in Modified Aldrete Score (MAS) and the Fast-Track Criteria (FTC) groups, respectively. The mean recovery time difference was 1.75 minutes. [21]

In this study, hospital stay was significantly shorter for patients in Group A (4.5 ± 0.6 days) compared to Group B (3.93 ± 1.53), with a p-value of 0.005, highlighting a potential advantage of regional anesthesia in promoting earlier discharge. Shorter hospital stays are beneficial both for patient recovery and for reducing healthcare costs.

In this study, a higher percentage of participants in the RA group (62%) reported no complications compared to the GA group. (56%). Nausea and vomiting were reported in 38% and 36% of participants in the RA group and 44% & 46% in the GA group, respectively. These findings emphasize that while regional anesthesia may have a slightly higher risk of hypotension, it may be associated with a lower incidence of postoperative nausea, vomiting, and discomfort compared to general anesthesia. Zirak et al. reported more frequent cases of nausea in the GA group during recovery, with a significant difference. [3] Similarly, Kaya Ugur et al. reported a lower incidence of nausea in the SA group compared to the GA one (13.33% vs. 46.6%). [15] In Raimondo et al., nausea and vomiting were reported in 3/15 (20%) women receiving GA and in 1 patient (8.3%) who underwent SA (p = 0.400). [17]

Overall, our findings show that regional anesthesia may offer certain advantages over general anesthesia in laparoscopic gynecological surgeries, particularly in terms of pain control at 8 hours postoperatively, shorter hospital stays, and faster recovery.

Limitations of the study

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

Conclusion and recommendations

In our study, we found that there are significant differences between general anesthesia and regional anesthesia in patients' recovery and pain outcomes. Patients undergoing surgery with RA experienced better postoperative recovery, characterized by shorter hospital stays, lower pain scores at 8 hours postoperatively, and fewer overall complications compared to those who received GA. Although GA was associated with slightly

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higher postoperative mean arterial pressure, it also had a higher incidence of nausea, vomiting, and abdominal discomfort. These findings suggest that RA may provide superior postoperative outcomes, especially in terms of pain management and recovery time, making it a favorable option for laparoscopic gynecological procedures.

However, further study with a prospective and longitudinal study design, including a larger sample size, needs to be done to validate the findings of our study.

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Conflict of interest: None declared

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