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Original Article

Anaesthesia Section

Comparison between Combined Spinal and General Anaesthesia versus General Anaesthesia Alone for Laparoscopic Gynaecological Procedures: A Randomised Controlled Study

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ABSTRACT

Introduction: Laparoscopic gynaecological surgery provides less surgical trauma, shorter recovery, and less postoperative pain. Although General Anaesthesia (GA) is widely used, adding Spinal Anaesthesia (SA) to GA can give better haemodynamic stability and better perioperative outcomes. The current study contrasts SA and GA combination (SGA) with GA alone in laparoscopic gynaecological surgery.

Aim: To compare and assess the impact of SGA versus GA alone on intraoperative haemodynamics, Isoflurane and metoprolol needs, recovery time, satisfaction of the surgeon, and postoperative complications.

Materials and Methods: This randomised controlled trial was conducted at Dr. D.Y. Patil Medical College, involving 50 laparoscopic gynaecological surgery patients. Patients were divided randomly into two groups. Group SGA was administered both SA and GA, while group GA was administered GA. Haemodynamic parameters, demand for anaesthetic agents, duration of recovery, and surgeon satisfaction scores (NRS) were measured and examined. Side-effects like hypotension, nausea, and vomiting were also evaluated. The gathered data were compiled, entered into Microsoft Excel, and analysed using Statistical Package for Social Sciences (SPSS) version 27.0 and if data were not normally distributed the Mann-Whitney U test was used. For categorical variables, the Chi-square test or Fisher's-Exact test was used.

Results: Demographics and baseline haemodynamic parameters were similar in both groups. Group GA had significantly more isoflurane requirement (0.728±0.0817) than group SGA (0.36±0.08) ($p<0.0001$). Intraoperative metoprolol was needed in only group GA (3.86±1.35 mg). Recovery time was significantly less for group SGA (3.94±0.14 min) than for group GA (7.35±1.1 min) ($p<0.0001$). Surgeon satisfaction was greater in group SGA (7.2±0.82 vs. 4.28±1.1, $p<0.0001$). Duration of surgery and pneumoperitoneum times were comparable in both groups ($p>0.05$). Side-effects were minimal. Six patients in group GA had nausea and vomiting, while two in group SGA had hypotension.

Conclusion: The use of SA and GA together in laparoscopic gynaecological surgery results in improved intraoperative haemodynamic control, less requirement of anaesthetic drugs, shorter recovery time, and increased surgeon satisfaction without adding side-effects. SGA can be considered a more desirable option than GA alone in selected patients receiving such procedures.

Keywords: Haemodynamic stability, Inhalational requirement, Recovery time, Surgeon satisfaction

INTRODUCTION

Laparoscopic gynaecological procedures have become a core aspect of modern surgical practice. They offer several benefits over traditional open surgeries. Minimally invasive techniques have dramatically transformed the treatment of gynaecological conditions by reducing surgical trauma, postoperative pain and faster recovery time [1]. The procedure can be conducted under SA or GA. The patient's desire for skills of the surgeon and anaesthesiologist generally guides this choice [2].

Pneumoperitoneum, with the often-used Trendelenburg position, results in increased intra-abdominal pressure, thus impairing venous return, increasing Systemic Vascular Resistance (SVR), and decreasing cardiac output. It impacts respiratory mechanics by virtue of upward displacement of the diaphragm, a decrease in lung compliance, and an increase in airway pressures [3]. These alterations can be associated with hypercarbia and respiratory acidosis. Thus, intraoperative management needs to be closely monitored. The traditional reliance on GA addresses some of these challenges through controlled ventilation and titration of anaesthetic depth. However, the unopposed increase in SVR often necessitates a higher dose of anaesthetic agents or vasodilators that may unnecessarily deepen anaesthesia, delay recovery, and cost more [4]. In recent years, there has been increasing interest in combining SA with GA to optimise the outcomes of laparoscopic surgeries. Though the combination of epidural anaesthesia and GA has been established, studies like "Mehta PJ et al., Ghodki PS et al.," regarding the simultaneous use of SA and GA are not as prominent [5,6]. Most studies that were conducted on the combined use of SA and GA such as in Ghodki PS et al., "Combined SA and GA is better than GA alone for laparoscopic hysterectomy" and "Das W et al., in "Comparison between GA and SA in attenuation of stress response in laparoscopic cholecystectomy" [6,7] focused on its usage in shorter procedures of laparoscopic surgeries, like laparoscopic cholecystectomy, where SA benefits the reversal of the haemodynamic effects of pneumoperitoneum [6].

SA, in combination with GA, enables the strengths of both procedures to be harnessed to optimise the management of the physiological challenges and the comfort and efficiency of the surgical process. The procedure involves a complex procedure such as laparoscopic gynaecological procedures, which has both aspects of laparoscopic dissection and open or vaginal dissection. Therefore, its anaesthetic management poses some unique challenges. The physiological

advantages of the combination diminish the cardiovascular stress response and decrease the use of large doses of anaesthetic agents, thus promoting better haemodynamic stability [8]. Additionally, the decrease in the depth of anaesthesia during GA facilitates quicker emergence and recovery. The reduced reliance on systemic opioids for postoperative pain control aligns with the principles of enhanced recovery after surgery, which emphasise multimodal analgesia and early mobilisation to improve postoperative outcomes. Despite its advantages, the use of SA with GA requires careful consideration and expertise [9].

This research sought to compare the impact of combined SGA with GA alone in laparoscopic gynaecological surgery. The primary aim of this study was to evaluate the differences between combined SGA and GA alone in laparoscopic gynaecological surgery, focusing on the following parameters: Haemodynamic changes during surgery including blood pressure and Heart Rate (HR) variability, isoflurane requirement measured as the total volume of isoflurane used intraoperatively, total intraoperative dose of metoprolol to manage intraoperative haemodynamic responses, recovery time at the end of surgery to extubation, surgeon satisfaction score evaluated using a Numerical Rating Scale (NRS), where higher scores indicate greater satisfaction. The secondary outcomes were aimed at assessing postoperative recovery and overall patient experience. These included incidence of Postoperative Nausea and Vomiting (PONV) recorded within the first 24 hours following surgery and incidence of other side-effects such as hypotension, nausea, vomiting.

MATERIALS AND METHODS

This randomised controlled trial was conducted at Dr. D.Y. Patil Medical college and hospital in Pimpri, Pune, India after obtaining ethics committee approval (Protocol No: IESC/PGS/2023/161) and registration with the Clinical Trials Registry of India (CTRI/2024/06/069636), with 50 patients scheduled for elective laparoscopic gynaecological surgery under GA recruited over 1.5 years (22nd December 2023 to April 2025) the sample size was calculated using WINPEPI 11.3 (5% significance level, 95% power), followed by six months of data analysis and reporting after written informed consent was obtained.

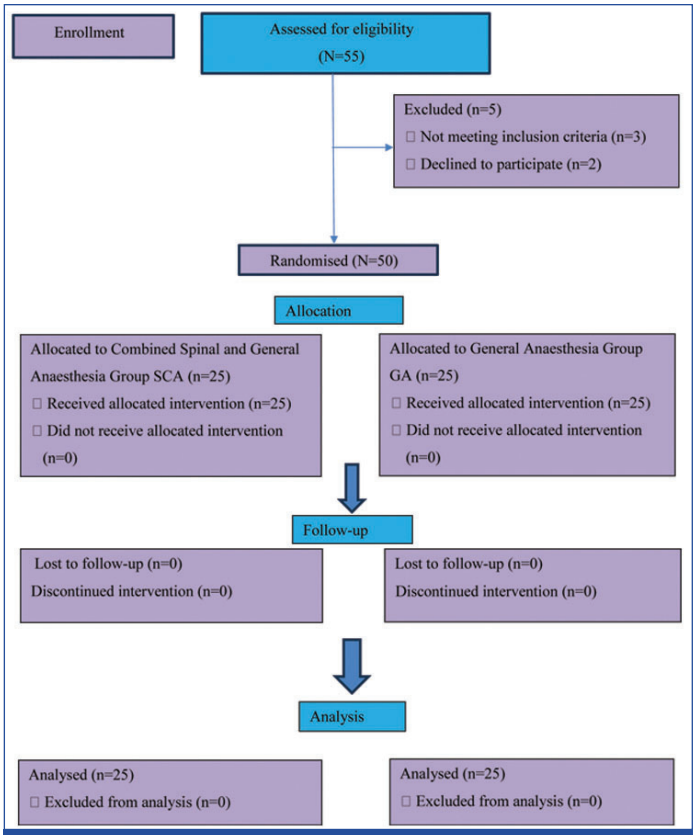
Inclusion and Exclusion criteria: Inclusion criteria were age between 18 and 60 years, ASA physical status (PS) grade I or II willingness to participate in the study and medically fit to undergo elective laparoscopic gynaecological surgery. Exclusion criteria were ASA physical status grade III or higher, Body Mass Index (BMI) greater than 30 kg/m^2, anticipated difficult airway, poor cardiopulmonary reserve, coagulation disorders, known allergy or hypersensitivity to any of the study drugs, high likelihood of conversion from laparoscopy to laparotomy.

Study Procedure

Fifty patients (25 in each group), where group SGA received combined SA and GA with 2.5 mL of hyperbaric bupivacaine 0.5% followed by GA and group GA received GA alone.

Patients were subjected to thorough pre-anaesthetic assessment, such as medical history, past anaesthetic exposure, drug allergies, and family history of anaesthesia-related complications. A physical exam was performed to assess vital signs and anaesthetic risk scores which was normal, airway assessment included oral opening, dentition, neck movement, Mallampati score, and other anatomic features were adequate. Spinal anatomy was assessed for the possibility of neuraxial anaesthesia. Routine investigations were complete blood count, renal function tests, liver function tests, coagulation, serum electrolytes, blood glucose, chest X-ray, and Electrocardiography (ECG) was within normal limits. Patients were kept nil per oral for at least six hours before surgery.

Fifty patients were randomly assigned to two groups of twenty-five patients each, using a computer-generated random number table [Table/Fig-1]. Combined SGA was given to group SGA, and GA was given alone to group GA. Sample size calculation was based on data obtained from previous work by Ghodki PS et al., utilising mean recovery durations of 7.15±3.36 min for GA and 4.12±1.81 min for SGA [6]. The power of 95% and 5% levels of significance was used.



[Table/Fig-1]: CONSORT flow diagram.

The sample size was calculated to be a minimum of forty-two. Fifty patients were recruited due to the expected dropouts.

In the operating room, all patients were connected to standard monitoring devices like ECG, non-invasive blood pressure, pulse oximeter, and capnograph. A 20G i.v. cannula was placed, and Ringer's lactate was administered at 10-15 mL/kg over 15-20 minutes. Baseline vital parameters of HR, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), and Oxygen Saturation (SpO_2) were recorded.

In group SGA, SA was administered under stringent aseptic precautions in the sitting position in the interspace of L3-L4 using a 26G Quincke spinal needle. Following the free flow of cerebrospinal fluid, 2.5 mL of 0.5% hyperbaric bupivacaine was injected gradually over 10-15 seconds. Patients were placed in the supine position, and the degree of sensory block was assessed with a pinprick test until the level of the T6 dermatome was obtained. On attainment of the required spinal block, GA was administered.

In group GA, the initiation of GA commenced with preoxygenation for three minutes using 100% oxygen with a face mask. Premedication was administered with glycopyrrolate 0.004 mg/kg i.v., midazolam 0.02 mg/kg i.v., and fentanyl 2 mcg/kg i.v.. Anaesthesia induction was with propofol 2 mg/kg i.v. titrated to eyelash reflex loss. After successful ventilation had been ensured, vecuronium bromide 0.1 mg/kg i.v. was administered to facilitate endotracheal intubation. Intubation was performed using a 7.0-7.5 mm internal diameter cuffed PVC endotracheal tube. The tube position was confirmed by bilateral chest auscultation, visible chest rise, and capnography. A Ryle's tube of appropriate size was inserted and secured in all patients.

Anaesthesia in both groups was maintained with isoflurane in a 50:50 mixture of oxygen and air. Intermittent vecuronium was

given as required. Pneumoperitoneum was instituted with Carbon Dioxide (CO_2), and intra-abdominal pressure was maintained at 12-15 mmHg. Continuous intraoperative monitoring was employed in both groups. HR, SBP, DBP, MAP, and SpO_2 were recorded. These were observed at baseline, after SA administration, after induction of GA, during CO_2 insufflation, and subsequently at various time intervals. Notable haemodynamic change (e.g., MAP or HR change of >20% from baseline) was managed with titrated metoprolol 0.1 mg/kg i.v. doses. The total intraoperative usage of metoprolol and isoflurane was quantified.

Removal of Ryle's tube was performed at the end of the procedure. Neuromuscular blockade was reversed with neostigmine 0.05 mg/kg i.v. and glycopyrrolate 0.008 mg/kg i.v.. Patients were extubated after ensuring adequate spontaneous ventilation and responsiveness. Postoperatively, the patients were monitored closely.

The following parameters were observed during the study. MAP was monitored during the creation of pneumoperitoneum and subsequently every 15 minutes until the end of the surgery to assess haemodynamic stability. The requirement of inspiratory isoflurane was recorded in both groups to evaluate anaesthetic consumption. The total dose of metoprolol administered intraoperatively was noted. Recovery time was measured from the end of surgery to extubation to assess the duration of emergence from anaesthesia. Surgeon's satisfaction was assessed using a Numerical Rating Scale (NRS), which is an 11-point ordinal scale ranging from 0 to 10, where 0 indicates complete dissatisfaction and 10 indicates complete satisfaction; higher scores reflect greater satisfaction with the surgical conditions [6]. Any postoperative complications such as PONV, hypotension, or bradycardia were also recorded in both groups.

STATISTICAL ANALYSIS

The data collected were tabulated in Microsoft Excel and analysed with SPSS version 27.0. Baseline demographic and clinical variables were analysed using descriptive statistics, presented as mean and Standard Deviation (SD) for continuous data and frequency (percentage) for categorical data. An independent sample t-test was employed to compare normally distributed continuous variables. If data were not normally distributed, the Mann-Whitney U test was used. For categorical variables, the Chi-square test or Fisher's-Exact test was used. Repeated measures ANOVA were used to compare changes in haemodynamic parameters over time. The p-value <0.05 was regarded as statistically significant.

RESULTS

Demographic parameters such as age, height, weight, and BMI were similar in both groups and did not show any statistically significant differences (p>0.05), as seen in [Table/Fig-2]. ASA physical status classification was also comparable (p=0.75).

Parameters	Group SGA (Mean±SD)	Group GA (Mean±SD)	t-value/ χ^2	p-value
Age (years)	39.44±11.63	36.92±11.92	0.75	0.45
Height (cm)	162.2±6.16	163.32±6.44	0.62	0.53
Weight (kg)	63.28±12.63	65.8±10.61	0.76	0.44
Body Mass Index (BMI) (kg/m^2)	24.2±5.41	24.76±4.28	0.40	0.68
ASA Grade I/II	15/10	14/11	0.09	0.75

[Table/Fig-2]: Comparison of demographic parameters.

[Table/Fig-3] indicates that baseline pulse rates were comparable in both groups, with no statistical difference (p=0.92). Heart rate decreased in the SGA group during SA, whereas no such data were available for the GA group. During induction, pneumoperitoneum, intraoperative, and postoperative phases, pulse rates were similar between groups with no statistically significant differences.

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
Preoperative	75.48±9.92	75.72±7.44	0.92
SA administration	71.32±6.36	-	-
5 min after SA	71.04±5.22	-	-
15 min after SA	70.34±5.33	-	-
GA administration	72.64±3.67	74.88±6.91	0.158
Pneumoperitoneum creation	78.16±4.33	76.84±6.33	0.39
Gas insufflation	72.12±4.52	73.64±3.74	0.20
10 min intraoperative	70.12±4.51	71.12±2.99	0.36
15 min intraoperative	70.08±4.86	71.56±2.29	0.174
30 min intraoperative	70.56±4.1	71.96±2.59	0.15
60 min intraoperative	70.8±31.5	72±2.61	0.16
90 min intraoperative	71.6±43.5	73.44±3.84	0.08
120 min intraoperative	76.08±2.41	77.32±5.21	0.065
15 min postoperative	73.76±3.06	72.96±4.46	0.46
30 min postoperative	75.16±6.24	73.36±4	0.23
60 min postoperative	75.16±3.63	75.36±3.36	0.27
90 min postoperative	73.64±2.76	73.96±2.76	0.67
120 min postoperative	73.56±2.66	73.92±2.66	0.61

[Table/Fig-3]: Heart rate distribution in two groups at different intervals of time.

[Table/Fig-4] contrasts SBP between the groups. Preoperative and postoperative SBP measures, as well as intraoperative measures, were similar and failed to demonstrate significant differences statistically (p>0.05).

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
Preoperative	121.92±12.64	126.16±6.65	0.14
SA administration	112.64±6.88	-	-
5 mins after SA	112.84±4.39	-	-
15 mins after SA	110.8±5.64	-	-
GA administration	121.16±8	123.28±8.88	0.37
Pneumoperitoneum creation	129.2±9.26	132.4±5.5	0.14
Gas insufflation	131.68±9.97	130.36±6	0.57
10 min intraoperative	123.52±5.68	124.88±6.16	0.42
15 min intraoperative	123.54±4.1	125.48±6.86	0.22
30 min intraoperative	126.08±4.5	127.4±5.78	0.37
60 min intraoperative	125.36±4.03	127.64±4.71	0.07
90 min intraoperative	125.6±4.7	127.72±6.13	0.17
120 min intraoperative	133.2±4.1	132.36±6.4	0.17
15 min postoperative	123.12±4.01	125±7.11	0.25
30 min postoperative	124.08±5.73	126.48±6.7	0.17
60 min postoperative	122.28±3.54	124.16±9.24	0.34
90 min postoperative	123.2±4.34	123.76±8.83	0.77
120 min postoperative	120.48±3.61	121.56±7.79	0.53

[Table/Fig-4]: Systolic blood pressure distribution in two groups at different intervals of time.

[Table/Fig-5] shows the comparison of DBP in the two groups. No significant difference was noted in DBP between the SGA and GA groups preoperatively. Intraoperatively, DBP was similar in both groups at all points in time, including with SA administration, pneumoperitoneum, and gas insufflation (all p>0.05). Postoperative DBP levels were not significantly different between groups (p>0.05).

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
Preoperative	77.77±8.35	78.16±3.12	0.98
SA administration	67.88±3.14	-	-

5 min after SA	68.72±3.21	-	-
15 min after SA	67.42±3.01	-	-
GA administration	76.12±9.1	78.52±2.65	0.05
Pneumoperitoneum creation	74.04±4.5	75.92±6.03	0.06
Gas insufflation	79.52±3.38	78.88±2.65	0.15
10 min intraoperative	75.4±2.74	75.56±5	0.91
15 min intraoperative	78.56±3.76	79.56±2.57	0.99
30 min intraoperative	76.36±3.16	77.92±3.13	0.0006
60 min intraoperative	75.56±2.57	76.44±2.24	0.09
90 min intraoperative	75.92±2.12	76.96±2.84	0.03
120 min intraoperative	75.72±1.99	76.76±5.5	0.87
15 min postoperative	75.88±1.86	76.24±5.4	0.75
30 min postoperative	79.08±5.42	79.32±3.2	0.74
60 min postoperative	76.24±1.64	76.8±3.98	0.96
90 min postoperative	79.48±6.66	80.8±2.43	0.09
120 min postoperative	75.48±1.87	74.68±6.38	0.60

[Table/Fig-5]: Diastolic Blood Pressure (DBP) distribution in two groups at different intervals of time.

[Table/Fig-6] presents the MAP in the two groups. Preoperative MAP was the same in both groups, with no difference (p=0.1982). During surgery, including after SA administration and during GA administration, MAP levels were the same in the two groups at all-time points observed (p>0.05). At pneumoperitoneum and gas insufflation, MAP was also not significantly different between the groups (p=0.1429 and p=0.4503). Postoperative MAP was also consistent in the two groups at all times (p>0.05).

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
Preoperative	92.49±8.7	94.164.21	0.19
SA administration	82.8±3.26	-	-
5 min after SA	83.43±3.51	-	-
15 min after SA	81.76±3.22	-	-
GA administration	91.3±7.5	93.443.88	0.17
Pneumoperitoneum creation	92.43±6.03	94.75±4.98	0.14
Gas insufflation	96.91±4.36	96.04±3.7	0.45
10 min intraoperative	91.44±3.4	92±4.38	0.61
15 min intraoperative	93.55±2.97	94.87±3.4	0.15
30 min intraoperative	92.93±2.91	94.41±3.99	0.14
60 min intraoperative	92.16±2.7	93.51±2.48	0.07
90 min intraoperative	92.48±2.52	93.88±3.4	0.10
120 min intraoperative	91.55±2.64	92.96±4.55	0.18
15 min postoperative	91.63±2.55	92.49±3.54	0.32
30 min postoperative	94.08±4.73	95.04±3.43	0.41
60 min postoperative	91.59±2.24	92.59±3.8	0.26
90 min postoperative	94.05±0.65	95.12±2.9	0.29
120 min postoperative	90.48	90.31±5.17	0.88

[Table/Fig-6]: Mean arterial pressure distribution in two groups at different intervals of time.

[Table/Fig-7] presents a comparison of SpO_2 between the two groups. Preoperatively, SpO_2 levels were comparable in both groups (p=0.1583). Throughout the procedure, including during SA and GA administration, SpO_2 was maintained stable in both groups with no difference (p>0.05). At different intraoperative time points, including pneumoperitoneum and gas insufflation, SpO_2 levels were similar between the groups (p>0.05). Postoperatively, SpO_2 values at every observed time were found to be similar between the two groups.

[Table/Fig-8] shows that group SGA demonstrated significantly better perioperative outcomes than group GA, with lower isoflurane requirements, no need for metoprolol, faster recovery times, and higher surgeon satisfaction, while surgery and pneumoperitoneum durations were comparable between the groups. The mean time to reach the T6 sensory level was 4.2±1.1 minutes. Motor block was evaluated using the Modified Bromage Scale, and a complete motor block (Bromage score of 3) was achieved at a mean time of 6.8±1.4 minutes following administration of 2.5 mL of 0.5% hyperbaric bupivacaine.

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
Preoperative	98.44±1	98.08±0.76	0.15
SA administration	97.36±3.72	-	-
5 min after SA	98±0.96	-	-
15 min after SA	97.651.21	-	-
GA administration	97.88±0.83	98.16±0.8	0.23
Pneumoperitoneum creation	97.88±0.73	98.04±0.73	0.44
Gas insufflation	97.72±0.54	98±0.76	0.13
10 min intraoperative	97.92±0.7	98.08±0.7	0.42
15 min intraoperative	97.6±0.5	97.84±0.69	0.16
30 min intraoperative	98±0.65	98.12±0.6	0.50
60 min intraoperative	98.08±0.7	98.4±0.58	0.08
90 min intraoperative	98.09±0.76	98.09±0.76	0.16
120 min intraoperative	98.16±0.75	98.36±0.64	0.05
15 min postoperative	98.28±0.74	98.52±0.51	0.18
30 min postoperative	98.28±0.79	98.28±0.79	0.39
60 min postoperative	98.36±0.7	98.68±0.48	0.06
90 min postoperative	98.44±0.65	98.52±0.51	0.63
120 min postoperative	98.4±0.71	98.6±0.5	0.25

[Table/Fig-7]: SpO_2 Distribution in two groups at different intervals of time.

Time	Group SGA Mean±SD	Group GA Mean±SD	p-value
The average inspiratory concentration of isoflurane	0.36±0.08	0.728±0.081	<0.0001
The total dose of metoprolol used (mg)	-	3.86±1.35	-
Recovery time (min)	3.94±0.14	7.35±1.11	<0.0001
Surgeon satisfaction by NRS	7.2±0.82	4.28±1.1	<0.0001
Duration of surgery	107.76±7.69	108.28±8.33	0.81
Duration of pneumoperitoneum (min)	96.6±7.77	96.4±8.55	0.93

[Table/Fig-8]: Comparison of other parameters.

[Table/Fig-9] illustrates the prevalence of side-effects among the two groups. No patients in group SGA developed nausea and vomiting, while in group GA, six patients developed nausea and vomiting, and they were treated with 4 mg of intravenous ondansetron. Two instances of hypotension were noted in group SGA and treated with 6 mg of intravenous mephentermine.

Side-effects	Group SGA	Group GA
Nausea and vomiting	-	6
Hypotension	2	-

[Table/Fig-9]: Comparison of side-effects.

DISCUSSION

The study groups were also well-matched in age, gender, height, weight, BMI, and ASA classification to ensure that these variables did not affect the outcomes.

Demographic and baseline characteristics: In the present study, both group SGA (combined SA and GA) and group GA were comparable in terms of demographic parameters such as age, gender, height, weight, BMI, and ASA classification. The statistical analysis revealed no significant differences between the groups, ensuring that these baseline characteristics did not influence the outcomes. This

finding is in line with earlier studies by Zdravkovic M et al., carried out a prospective, randomised controlled trial comparing SGA with GA alone in 99 patients undergoing laparoscopic gynaecological surgery. They reported no significant differences in age, weight, or height between the groups, which is consistent with the findings of the current study [10]. Imbelloni LE et al., (2011) conducted a study on 68 patients undergoing laparoscopic cholecystectomy to evaluate the safety and cost-effectiveness of SA compared to GA [11]. Their findings showed no statistically significant difference between the two groups in terms of demographic parameters, which aligns with the results of the present study. Furthermore, Hwang JH and Kim BW studied 90 patients undergoing laparoscopic gynaecological surgery to compare outcomes between GA and combined spinal and epidural anaesthesia. Their study concluded that there were no significant differences in age, BMI, weight, or height across the groups, further supporting the demographic similarities observed in the present research [12].

Haemodynamic parameters: Both groups were monitored for HR, SBP and DBP, MAP, and SpO_2 throughout the surgery. Although minor variations were noted at certain time intervals, these differences were neither statistically nor clinically significant, indicating comparable intraoperative haemodynamic stability. Similar findings have been reported in studies by Segal D et al., Das W et al., where no significant haemodynamic differences were observed between SA and GA techniques during laparoscopic surgeries [7,13]. Phulkar S et al., also reported equivalent intraoperative cardiovascular stability in both groups [14].

Anaesthetic requirements and use of metoprolol: The mean inspiratory concentration of isoflurane was significantly higher in the GA group, and metoprolol was required solely in this group for HR control. In contrast, the SGA group showed reduced anaesthetic requirements and greater haemodynamic stability without pharmacologic intervention. These results correspond with those from Ghodki PS et al., and Gupta N et al., both of which demonstrated lower isoflurane use and decreased reliance on metoprolol in patients receiving CSGA, supporting the findings of the present study [6,15].

Duration of surgery, recovery time, and satisfaction: The total duration of surgery and pneumoperitoneum was nearly identical in both groups, with no significant statistical difference. However, group SGA showed a shorter recovery time and received higher satisfaction scores from surgeons, likely due to better intraoperative conditions and fewer interventions. These results align with those reported by Phulkar S et al., who found no differences in surgical duration between the two anaesthesia types. Similarly, Reddy SD et al., and Paneerselvam R et al., noted faster recovery and improved surgeon satisfaction with CSGA, consistent with our findings [14,16,17].

Postoperative side-effects: Postoperative complications were minimal in both groups. Nausea and vomiting occurred in six patients from the GA group, while two patients in the SGA group experienced hypotension. These side-effects were not statistically significant and were self-limiting. The safety profile observed in this study is consistent with previous findings by Turkstani A et al., and Mehta PJ et al., who also reported no significant differences in the incidence of side-effects between SA and GA in laparoscopic surgeries [5,18].

Laparoscopic gynaecological surgery has tremendously progressed patient care by reducing surgical trauma, minimising postoperative pain, and allowing for faster recovery. The preference for anaesthesia, however, continues to be a primary influencer for intraoperative conditions as well as postoperative results. Although GA was the gold standard in the past, increasing interest lies in the simultaneous performance of SA in addition to GA. This combination can provide improved haemodynamic stability and assist in reducing the physiological effects involved with pneumoperitoneum. The results of this study validate the benefits of a combined anaesthetic method, highlighting the value in individualising anaesthesia methods to improve patient safety and surgical effectiveness in minimally invasive surgery [2,19].

Limitation(s)

Our study had the limitation because it is a single-centre design. The investigation was specific to elective laparoscopic gynaecologic operations, excluding generalisability to other interventions. Long-term outcomes and some confounding variables, such as comorbidities, were not evaluated.

CONCLUSION(S)

The combination of SGA in laparoscopic gynaecological procedures has a number of clinical benefits compared to GA alone. SGA provides better intraoperative haemodynamic stability, probably because of the sympathetic blockade induced by SA. SGA also decreases the demand for inhalational and intravenous anaesthetic agents significantly, possibly leading to faster recovery from anaesthesia and reduced recovery times. The surgeon's satisfaction is also significantly greater with SGA, most probably because of better operating conditions and more stable intraoperative parameters. Significantly, these advantages are obtained without increasing perioperative complications or side-effects. Thus, SGA proves to be a safe and effective option, especially in well-selected patients who are undergoing laparoscopic gynaecological surgery.

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