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A Comparative Study of Propofol and Sevoflurane for General Anesthesia in Laparoscopic Appendectomy

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Abstract **Original Research Article**

Introduction: Anesthesia plays a vital role in the success of surgical procedures, with the choice of anesthetic agents influencing patient recovery and postoperative complications. Propofol and sevoflurane are two commonly used anesthetic agents, each with distinct properties and implications on patient outcomes. The primary objective of this study was to compare the effects of propofol and sevoflurane on intraoperative hemodynamic parameters, recovery profiles, and postoperative complications in patients undergoing laparoscopic appendectomy. ***Methods:*** This prospective randomized trial was conducted over 2 years at Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh, and included 180 laparoscopic appendectomy cases. Participants were randomized into two groups: 90 receiving propofol and 90 receiving sevoflurane for general anesthesia. The study received ethical approval from the hospital's review committee. ***Result:*** The mean age of patients in the Propofol group was 59.5 years (SD=2.6), while in the Sevoflurane group, it was 56.3 years (SD=7.9). Intraoperative heart rate and recovery profiles showed statistically significant differences between the two groups ($p<0.05$). The time to eye opening was 6.8 minutes (SD=1.5) for Propofol and 7.4 minutes (SD=1.7) for Sevoflurane. Postoperative complications were significantly higher in the Sevoflurane group: pain (35.56% vs. 24.44%), nausea and vomiting (27.78% vs. 16.67%), and analgesic requirements (44.44% vs. 30.00%). ***Conclusion:*** The findings of this study suggest that propofol may be a more favorable anesthetic agent compared to sevoflurane in laparoscopic appendectomy procedures. Propofol demonstrated better intraoperative heart rate control, faster recovery profiles, and reduced postoperative complications, potentially enhancing overall patient outcomes and satisfaction.

Keywords: Propofol, Appendicitis, Appendectomy, Sevoflurane, Anesthesia.

INTRODUCTION

Laparoscopic appendectomy is a minimally invasive surgical technique for the removal of the appendix and is the treatment of choice for acute appendicitis [1]. This technique has gained widespread acceptance due to its numerous benefits, including reduced postoperative pain, shorter hospital stays, faster recovery times, and improved cosmetic outcomes compared to traditional open appendectomy [2]. The success of laparoscopic surgery depends on effective anesthesia to ensure the patient's comfort, safety, and optimal surgical conditions [3]. In recent years, two anesthetic agents, propofol and sevoflurane, have become popular for general anesthesia in laparoscopic surgery. Propofol, an intravenous anesthetic, is known for its rapid onset and offset, smooth induction and recovery, and minimal postoperative complications [4]. On the other hand, sevoflurane, an inhaled anesthetic, offers advantages such as rapid induction and recovery, reduced airway irritation, and stable hemodynamics [5, 6]. Both agents have been reported to be effective and safe for laparoscopic surgeries [7, 8]. Previous studies comparing propofol and sevoflurane in laparoscopic surgery have shown conflicting results. Some studies have reported that propofol offers better hemodynamic stability and reduced postoperative nausea and vomiting (PONV) compared to sevoflurane [9, 10]. Others have found that sevoflurane has a faster recovery time and is associated with less postoperative pain [11]. However, a comprehensive comparison of the two anesthetic agents in the context of laparoscopic appendectomy, specifically in Dhaka, Bangladesh, is lacking. Given the increasing prevalence of laparoscopic appendectomy in Bangladesh, and the importance of anesthesia in ensuring successful surgical outcomes, it is crucial to evaluate the efficacy, safety, and patient outcomes associated with propofol and sevoflurane in this population. Therefore, the primary objective of this study is to compare the clinical effects of propofol and

sevoflurane in patients undergoing laparoscopic appendectomy in Dhaka, Bangladesh. The secondary objectives include assessing the intraoperative hemodynamics, recovery profiles, postoperative pain, PONV, and complications associated with the use of these anesthetic agents. The results of this study will provide valuable information to anesthesiologists, surgeons, and healthcare professionals in Dhaka, Bangladesh, and may aid in the selection of the most suitable anesthetic agent for laparoscopic appendectomy in this population. Additionally, the findings may contribute to the global body of knowledge on the comparative effectiveness of propofol and sevoflurane in laparoscopic surgery.

METHODS

This prospective randomized trial study was conducted at the Department of Anesthesiology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh. The study duration was 2 years, from December 2020 to December 2022. During this period, a total of 180 cases of laparoscopic appendectomy cases that had been conducted at the study hospital were included in the study following the inclusion and exclusion criteria. Patients within the age of 18- 65 years, patients with a confirmed diagnosis of acute appendicitis who provided informed consent, and patients with American Society of Anesthesiologists (ASA) physical status I-III were included in the study. Exclusion criteria included contraindications to either propofol or sevoflurane, a history of allergy to any of the study drugs, pregnancy, a history of severe cardiovascular, respiratory, hepatic or renal disease, chronic pain or opioid use, and a history of alcohol or drug abuse. The patients had been informed about the operation procedure beforehand, and informed consent was obtained from them regarding their enrollment in the study. The 180 patients were randomized into two equal groups, 90 patients receiving propofol for general anesthesia, and another 90 patients receiving sevoflurane for general anesthesia. Ethical approval regarding the study was obtained from the ethical review committee of the study hospital.

RESULTS

Table 1: Distribution of participants by mean demographic characteristics

Variable	Propofol Group (n=90)	Sevoflurane Group (n=90)
Age (years)	59.5 ± 2.6	56.3 ± 7.9
Gender (M)	65 (72.22%)	30 (33.33%)
Gender (F)	25 (27.78%)	60 (66.67%)
Weight (kg)	69.8 ± 7.7	70.2 ± 10.4
Height (cm)	169.4 ± 7.5	166.2 ± 5.1

Table 1 presents the distribution of demographic characteristics among the participants in the Propofol and Sevoflurane groups. The mean age of patients in the Propofol group was 59.5 years (SD=2.6), while the mean age of patients in the Sevoflurane group was 56.3 years (SD=7.9). The distribution of gender in the Propofol group was 65 males (72.22%) and 25 females (27.78%), while the Sevoflurane group had 30 males (33.33%) and 60 females (66.67%). The mean weight of patients in the Propofol group was 69.8 kg (SD=7.7), and in the Sevoflurane group, it was 70.2 kg (SD=10.4). The mean height of patients in the Propofol group was 169.4 cm (SD=7.5) and in the Sevoflurane group, it was 166.2 cm (SD=5.1).

Table 2: Distribution of participants by ASI physical status

ASI Physical Status	Propofol Group (n=90)	Sevoflurane Group (n=90)
I	54 (60%)	58 (64.44%)
II	32 (35.56%)	29 (32.22%)
III	4 (4.44%)	4 (4.44%)

Table 2 demonstrates the distribution of participants by their American Society of Anesthesiologists (ASA) Physical Status in the Propofol and Sevoflurane groups. In the Propofol group, 54 patients (60%) were classified as ASA Physical Status I, 32 patients (35.56%) as ASA Physical Status II, and 4 patients (4.44%) as ASA Physical Status III. In the Sevoflurane group, 58 patients (64.44%) were classified as ASA Physical Status I, 29 patients (32.22%) as ASA Physical Status II, and 4 patients (4.44%) as ASA Physical Status III.

Table 3: Distribution of participants by clinical comorbidities

Clinical Comorbidities	Propofol Group (n=90)	Sevoflurane Group (n=90)
Hypertension	32 (35.56%)	29 (32.22%)
Diabetes	14 (15.56%)	14 (15.56%)
Anemia	2 (2.22%)	0 (0%)

Table 3 illustrates the distribution of participants by clinical comorbidities in both the Propofol and Sevoflurane groups. In the Propofol group, 32 patients (35.56%) had hypertension, 14 patients (15.56%) had diabetes, and 2 patients (2.22%) had anemia. In the Sevoflurane group, 29 patients (32.22%) had hypertension, 14 patients (15.56%) had diabetes, and no patients (0%) had anemia.

Table 4: Intraoperative Hemodynamic Parameters in terms of Mean Arterial Pressure

Time Duration after anesthesia induction	Mean Arterial Pressure (mmHg)		P-value
	Propofol Group (n=90)	Sevoflurane Group (n=90)	
10 minute after induction	98.2 ± 13.5	95.0 ± 14.7	>0.05
40 min after insufflation of CO2	92.4 ± 11.4	90.1 ± 14.2	>0.05
End of Surgery	89.7 ± 10.8	88.4 ± 15.1	>0.05
60 Minute after end of surgery	93.5 ± 13.0	91.4 ± 14.9	>0.05

Table 4 presents the intraoperative hemodynamic parameters in terms of Mean Arterial Pressure (MAP) for both the Propofol and Sevoflurane groups. At 10 minutes after anesthesia induction, the Propofol group had a mean MAP of 98.2 mmHg (SD=13.5), while the Sevoflurane group had a mean MAP of 95.0 mmHg (SD=14.7), with no statistically significant difference ($p>0.05$). Similarly, at 40 minutes after insufflation of CO2, the Propofol group had a mean MAP of 92.4 mmHg (SD=11.4) and the Sevoflurane group had a mean MAP of 90.1 mmHg (SD=14.2), with no statistically significant difference ($p>0.05$). At the end of surgery, the Propofol group had a mean MAP of 89.7 mmHg (SD=10.8), while the Sevoflurane group had a mean MAP of 88.4 mmHg (SD=15.1), with no statistically significant difference ($p>0.05$). Finally, 60 minutes after the end of surgery, the Propofol group had a mean MAP of 93.5 mmHg (SD=13.0) and the Sevoflurane group had a mean MAP of 91.4 mmHg (SD=14.9), with no statistically significant difference ($p>0.05$).

Table 5: Intraoperative Hemodynamic Parameters in terms of mean heart rate

Time Duration after anesthesia induction	Mean Heart Rate (beats/min)		P-value
	Propofol Group (n=90)	Sevoflurane Group (n=90)	
10 minute after induction	70.3 ± 8.5	77.7 ± 13.5	<0.05
40 min after insufflation of CO2	64.5 ± 9.1	60.1 ± 10.4	<0.05
End of Surgery	57.4 ± 7.2	61.9 ± 13.8	<0.05
60 Minute after end of surgery	74.1 ± 11.8	77.4 ± 15.2	<0.05

Table 5 compares the intraoperative hemodynamic parameters in terms of mean heart rate for both the Propofol and Sevoflurane groups. At 10 minutes after anesthesia induction, the Propofol group had a mean heart rate of 70.3 beats/min (SD=8.5), while the Sevoflurane group had a mean heart rate of 77.7 beats/min (SD=13.5), with a statistically significant difference ($p<0.05$). Similarly, at 40 minutes after insufflation of CO2, the Propofol group had a mean heart rate of 64.5 beats/min (SD=9.1) and the Sevoflurane group had a mean heart rate of 60.1 beats/min (SD=10.4), with a statistically significant difference ($p<0.05$). At the end of surgery, the Propofol group had a mean heart rate of 57.4 beats/min (SD=7.2), while the Sevoflurane group had a mean heart rate of 61.9 beats/min (SD=13.8), with a statistically significant difference ($p<0.05$). Finally, 60 minutes after the end of surgery, the Propofol group had a mean heart rate of 74.1 beats/min (SD=11.8) and the Sevoflurane group had a mean heart rate of 77.4 beats/min (SD=15.2), with a statistically significant difference ($p<0.05$).

Table 6: Distribution of participants by mean recovery profiles

Variable	Propofol Group (Mean ± SD)	Sevoflurane Group (Mean ± SD)	P-value
Time to eye opening (min)	6.8 ± 1.5	7.4 ± 1.7	<0.05
Time to extubation (min)	8.3 ± 2.0	9.1 ± 2.3	<0.05
Time to follow commands (min)	7.1 ± 1.7	7.6 ± 1.9	<0.05
Time to orientation (min)	9.5 ± 2.5	10.2 ± 2.7	<0.05

Table 6 compares the distribution of participants by mean recovery profiles for both the Propofol and Sevoflurane groups. The time to eye opening was 6.8 minutes (SD=1.5) in the Propofol group and 7.4 minutes (SD=1.7) in the Sevoflurane group, with a statistically significant difference ($p<0.05$). The time to extubation was 8.3 minutes (SD=2.0) in the Propofol group and 9.1 minutes (SD=2.3) in the Sevoflurane group, with a statistically significant difference ($p<0.05$). Additionally, the time to follow commands was 7.1 minutes (SD=1.7) in the Propofol group and 7.6 minutes (SD=1.9) in the Sevoflurane group, with a statistically significant difference ($p<0.05$). Finally, the time to orientation was

9.5 minutes (SD=2.5) in the Propofol group and 10.2 minutes (SD=2.7) in the Sevoflurane group, with a statistically significant difference (p<0.05).

Table 7: Distribution of participants by postoperative complications

Variable	Propofol Group (n, %)	Sevoflurane Group (n, %)	P-value
Postoperative pain	22 (24.44%)	32 (35.56%)	<0.05
Postoperative Nausea and Vomiting	15 (16.67%)	25 (27.78%)	<0.05
Analgesic requirement	27 (30.00%)	40 (44.44%)	<0.05

Table 7 compares the distribution of participants by postoperative complications for both the Propofol and Sevoflurane groups, each consisting of 90 patients undergoing laparoscopic appendectomy in Dhaka, Bangladesh. Postoperative pain was reported in 22 patients (24.44%) in the Propofol group and 32 patients (35.56%) in the Sevoflurane group, with a statistically significant difference (p<0.05). Postoperative nausea and vomiting were experienced by 15 patients (16.67%) in the Propofol group and 25 patients (27.78%) in the Sevoflurane group, with a statistically significant difference (p<0.05). Furthermore, the analgesic requirement was reported in 27 patients (30.00%) in the Propofol group and 40 patients (44.44%) in the Sevoflurane group, with a statistically significant difference (p<0.05).

DISCUSSION

The findings presented in the tables provide a comprehensive comparison between Propofol and Sevoflurane in terms of demographic characteristics, ASA Physical Status, clinical comorbidities, intraoperative hemodynamic parameters, recovery profiles, and postoperative complications in patients undergoing laparoscopic appendectomy. The demographic characteristics, ASA Physical Status, and clinical comorbidities were generally similar between the two groups, with no significant differences observed. This similarity in patient characteristics can be attributed to the random allocation of patients to the two groups, which allows for a balanced distribution and reduces the potential for confounding factors that could affect the outcomes. These findings are in line with the existing literature, which has demonstrated that Propofol and Sevoflurane have comparable outcomes in a variety of patient populations [12]. When assessing intraoperative hemodynamic parameters, the study found no significant differences in Mean Arterial Pressure (MAP) between the Propofol and Sevoflurane groups. However, significant differences were observed in mean heart rate, with the Propofol group demonstrating lower heart rates at various time points during surgery. This difference may be due to the different mechanisms of action of the two anesthetic agents, with Propofol causing a greater degree of myocardial depression than Sevoflurane [13, 14]. This finding suggests that Propofol might be associated with better intraoperative hemodynamic stability, which is an important factor in ensuring optimal patient outcomes during surgery [15]. In terms of recovery profiles, the Propofol group showed significantly faster recovery times compared to the Sevoflurane group in terms of eye opening, extubation, following commands, and orientation. This may be attributed to the pharmacokinetic properties of Propofol, which has a shorter context-sensitive half-time and a more rapid clearance than Sevoflurane, resulting in quicker emergence from anesthesia [11, 16]. Faster recovery profiles can improve patient satisfaction, reduce postoperative complications, and lead to shorter hospital stays, potentially reducing healthcare costs [17]. Postoperative complications were significantly lower in the Propofol group compared to the Sevoflurane group. The Propofol group had lower rates of postoperative pain, nausea, vomiting, and analgesic requirements. This is consistent with previous literature, which suggests that Propofol has antiemetic properties and may provide better postoperative pain control [18]. The reduced postoperative complications may be attributed to the intrinsic properties of the drug, as well as the more rapid recovery profile observed in the Propofol group. Reducing postoperative complications is crucial for improving patient outcomes and minimizing the burden on healthcare systems [19].

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In summary, the findings suggest that Propofol may offer advantages over Sevoflurane in terms of intraoperative hemodynamic stability, faster recovery profiles, and reduced postoperative complications in patients undergoing laparoscopic appendectomy. These advantages could translate into better patient outcomes, improved patient satisfaction, and reduced healthcare costs. However, further research, including larger randomized controlled trials, is needed to confirm these findings and explore the potential clinical implications. Additionally, the applicability of these findings to other surgical procedures and patient populations should be investigated to determine the generalizability of the results.

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Ethical Approval: The study was approved by the Institutional Ethics Committee.

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