THE PLANET

Original Article

Effects of Remifentanil and Propofol on Elective Tracheal Intubation in Laparoscopic Surgery with or without Muscle Relaxant: A Comparative Study

Naushad Khan Shaon[1*], Marfia Arjumand Banu[2], Abdur Razzaque[3], Sheikh Imran Alam[4], Shanjida Kibria[5], Mohammed Shakil Rahman[6], Risul Islam[7], Dilip Kumar Bhowmick[8]

ARTICLE INFO

Received: 9 June 2026
Accepted: 15 June 2026
Published Online: 19 June 2026

DOI: 10.5281/zenodo.20760702

Volume: 9, Number: 4, Page: 110-115

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Background: Endotracheal intubation is routinely required in laparoscopic surgery due to increased aspiration risk and reduced respiratory compliance. This study compares intubating conditions and postoperative myalgia between remifentanil–propofol and remifentanil–propofol with suxamethonium. **Objective:** The aim of the study was to compare the effects of remifentanil and propofol with or without muscle relaxant on intubation and hemodynamic responses in elective laparoscopic surgery. **Methods & Materials:** This quasi-experimental study was conducted in the Reproductive Endocrinology and Infertility operation theatre under the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka (October 2024–September 2025), involving 64 laparoscopic surgery patients equally allocated to Group PR (remifentanil–propofol) and Group PRS (remifentanil–propofol–suxamethonium); intubation was assessed by Steyn's Helbo–Hansen score, hemodynamics at baseline and 1, 5, and 10 minutes, postoperative myalgia at 24 hours, and data analyzed with SPSS v26. **Results:** Baseline demographic and clinical characteristics were comparable between Group PR and Group PRS ($p > 0.05$). Intubating conditions, intubating scores, and hemodynamic parameters at different time intervals showed no statistically significant differences between the groups. However, postoperative myalgia score (0.38 ± 0.49 vs 0.81 ± 0.54; $p = 0.001$) and incidence of myalgia [12 (37.5%) vs 24 (75.0%); $p = 0.007$] were significantly lower in Group PR compared to Group PRS. **Conclusion:** Remifentanil and propofol provide comparable intubating conditions and haemodynamic stability to suxamethonium-containing regimens while reducing postoperative myalgia.

Keywords: *Remifentanil, Propofol, Tracheal Intubation, Laparoscopic Surgery, Suxamethonium.*

1. *Specialist, Anesthesiology, Asgar Ali Hospital, Dhaka, Bangladesh (ORCID: 0009-0003-4703-3395)*
2. *Resident, Department of Biochemistry, Sir Salimullah Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0007-5415-766X)*
3. *Anaesthesiologist, Dhaka Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0000-4511-9695)*
4. *Medical Officer, Directorate General of Health Services, Dhaka, Bangladesh (ORCID: 0009-0007-2449-4518)*
5. *Assistant Professor, Department of Anaesthesiology, Popular Medical College, Dhaka, Bangladesh (ORCID: 0009-0009-4617-8991)*
6. *Medical Officer, Directorate General of Health Services, Dhaka, Bangladesh (ORCID: 0009-0009-1621-6205)*
7. *Specialist, Anesthesiology, Asgar Ali Hospital, Dhaka, Bangladesh (ORCID: 0009-0008-2070-7536)*
8. *Professor, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0000-0002-8258-5000)*

INTRODUCTION

Endotracheal intubation is essential during surgeries that carry a high risk of aspiration, surgeries performed in complex positions, procedures necessitating airway protection, and thoracic or abdominal procedures, among others. Approximately 50% of general anaesthetic procedures require endotracheal intubation [1]. Laparoscopic surgery is a minimally invasive technique in which the abdominal cavity and its contents are accessed by creating a pneumoperitoneum through gas insufflation. This technique, often performed in non-supine positions, increases intra-abdominal pressure, reduces lung compliance, and elevates the risk of aspiration and airway compromise, thereby necessitating endotracheal intubation [2].

A successful endotracheal intubation requires clear visualisation of the glottis and adequate opening of the glottic aperture. Conventionally, tracheal intubation is facilitated by muscle relaxants. Alternatives to muscle relaxants include intubation under deep inhalational or intravenous anaesthesia, supplementation with high-dose opioids, and awake tracheal intubation following topical or regional anaesthesia, guided by a flexible videoscope or videolaryngoscopy [1].

Suxamethonium is the most commonly used muscle relaxant to facilitate endotracheal intubation. However, it may cause postoperative myalgia, hyperkalaemia, increased intraocular, intragastric, and intracranial pressures, anaphylaxis, and in rare cases suxamethonium apnoea and malignant hyperthermia [3,4]. Moreover, suxamethonium is contraindicated in patients with hyperkalaemia, rhabdomyolysis, burns, muscle trauma, acute or chronic renal failure, intraocular or intracranial hypertension, statin use, neuromuscular disease, malignant hyperthermia, spinal cord injury, pseudocholinesterase deficiency, or in bedridden patients [5].

In comparison with suxamethonium, non-depolarising muscle relaxants have fewer adverse effects, but they still have some drawbacks. One significant limitation is the need for an antagonist to rapidly reverse the block in cases where tracheal intubation or mask ventilation is not possible [6,7].

Beyond pharmacological adverse effects, the use of muscle relaxants can cause catastrophe in the event of failed intubation. Although several predictive tests for difficult laryngoscopy exist—such as the Mallampati classification, assessment of mouth opening, cervical spine flexion and extension, the Patil test, and the Savva test—none of them are completely reliable. In fact, about 50% of difficult airways remain unanticipated [1]. Hence, unanticipated difficult intubation continues to represent a major concern.

Spontaneous ventilation carries fewer risks than controlled ventilation in cases of difficult intubation [8]. Consequently, avoiding muscle relaxants during intubation may help preserve spontaneous respiration, thereby reducing the risk of severe complications.

Laryngoscopy stimulates the sympathetic nervous system. Activation of somatic and visceral nociceptive afferents in the vocal cords, hypopharynx, peritracheal region,

and epiglottis leads to increases in both heart rate and blood pressure. These haemodynamic changes are especially detrimental in patients with coronary artery disease and may precipitate myocardial ischaemia, dysrhythmias, or even heart failure. Opioids have been shown to attenuate these cardiovascular responses [9]. Remifentanil is a potent opioid analgesic with a rapid onset and short duration of action. These pharmacokinetic properties make it an excellent choice for anaesthetic management, allowing precise titration and rapid recovery. It is particularly effective when combined with intravenous or volatile hypnotic agents, consistently attenuating haemodynamic, autonomic, and somatic responses to intubation [10].

Propofol is a widely used intravenous induction agent in clinical anaesthesia. It provides rapid onset and short half-life, decreases airway reflexes and muscle tone, and when combined with opioids, further attenuates reflex responses to airway manipulation [11].

The combination of remifentanil and propofol may therefore offer a potential alternative to suxamethonium, avoiding its adverse effects while maintaining haemodynamic stability and attenuating intubation responses. In addition, avoiding muscle relaxants may preserve spontaneous ventilation, which is advantageous in cases of difficult airway management.

Although several studies have evaluated intubating conditions using remifentanil–propofol combinations without muscle relaxants, direct comparison with suxamethonium-based techniques remains limited. Batra et al. [12] assessed intubating conditions in children using remifentanil and propofol without neuromuscular blockade, but without comparison to conventional muscle relaxant use. McNeil, Culbert, and Russell [13] compared remifentanil–propofol with suxamethonium; however, postoperative myalgia, a key outcome associated with suxamethonium, was not assessed.

Therefore, this study aims to compare intubating conditions and postoperative myalgia between remifentanil–propofol induction and remifentanil–propofol with suxamethonium in patients undergoing laparoscopic surgery.

OBJECTIVE

To compare the effects of remifentanil and propofol with or without muscle relaxant on intubation and hemodynamic responses in elective laparoscopic surgery.

METHODS & MATERIALS

This quasi-experimental study was conducted in the Reproductive Endocrinology and Infertility operation theatre under the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University, Dhaka, from October 2024 to September 2025. A total of 64 patients undergoing laparoscopic surgery under general anaesthesia with endotracheal intubation were enrolled based on predefined inclusion and exclusion criteria. Patients were selected by purposive sampling and equally allocated into two groups (n = 32 each): Group PR (remifentanil and propofol) and Group PRS (remifentanil, propofol, and suxamethonium).

Inclusion Criteria

i. Patients undergoing Reproductive Endocrinology and Infertility–related laparoscopic surgery under general anaesthesia with endotracheal intubation
ii. Age 18–64 years
iii. ASA physical status I–II
iv. Mallampati class I–II

Exclusion Criteria

i. BMI ≥ 30 kg/m²
ii. Gastroesophageal reflux disease
iii. History of drug or alcohol abuse
iv. Known hypersensitivity to study drugs
v. Diagnosed connective tissue disease

Preoperative Assessment and Baseline Data

Preoperative baseline data including age, BMI, ASA grade, Mallampati class, comorbidities, heart rate, systolic blood pressure, and diastolic blood pressure were recorded for all patients. Standard intraoperative monitoring was applied, and intravenous access was secured. All patients received glycopyrrolate 0.2 mg intramuscularly as premedication.

Anaesthetic Induction and Drug Administration

All patients were preoxygenated with 100% oxygen for 5 minutes before induction. Anaesthesia was induced with propofol (2 mg/kg IV) followed by remifentanil (3 µg/kg IV) in both groups. In Group PRS, suxamethonium (1.5 mg/kg IV) was administered after induction, while Group PR received no muscle relaxant.

Intubation Procedure and Assessment

Endotracheal intubation was performed 90 seconds after induction using a Macintosh laryngoscope. Intubating conditions were assessed using Steyn's modification of the Helbo–Hansen scoring system by a blinded anaesthesiologist. Correct tracheal tube placement was confirmed by capnography and bilateral chest auscultation.

Maintenance of Anaesthesia and Recovery

Anaesthesia was maintained with 30% oxygen in 70% nitrous oxide, isoflurane at 1 MAC, and vecuronium (0.1 mg/kg IV followed by intermittent doses) in both groups. Neuromuscular blockade was reversed with neostigmine (0.05 mg/kg IV) and atropine (0.02 mg/kg IV). Extubation was performed once standard recovery criteria were met.

Postoperative Monitoring

Hemodynamic parameters (heart rate, systolic blood pressure, and diastolic blood pressure) were recorded at baseline, and at 1, 5, and 10 minutes after intubation. Postoperative myalgia was assessed at 24 hours using a 4-point myalgia scale.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Independent t-test and chi-square or Fisher's exact test were used as appropriate. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Review Board of Bangladesh Medical University. Written informed consent was obtained from all participants in both Bangla and English prior to enrolment.

RESULTS

Table I shows that the mean age was 32.93 ± 10.08 years in Group PR and 29.28 ± 5.61 years in Group PRS (p = 0.08). The mean BMI was 23.38 ± 2.38 kg/m² in Group PR and 23.16 ± 2.93 kg/m² in Group PRS (p = 0.74). ASA I was present in 26 (81.25%) patients in each group, while ASA II was found in 6 (18.75%) patients in each group (p = 1.00). Regarding Mallampati classification, Class I was observed in 28 (87.5%) patients in Group PR and 26 (81.25%) in Group PRS, whereas Class II was seen in 4 (12.5%) and 6 (18.75%) patients respectively (p = 0.78 and 0.52). Comorbidities such as hypertension (2 [6.25%] vs 3 [9.3%]), diabetes mellitus (4 [12.5%] vs 3 [9.3%]), and COPD/BA (1 [3.33%] vs 0 [0%]) were comparable between groups with no statistically significant differences.

Table I
Demographic and baseline clinical characteristics of the study population (*n* = 64).

Characteristics		Group PR (n=32)	Group PRS (n=32)	p value
Age (years)		32.93 ± 10.08	29.28 ± 5.61	0.08
BMI (kgm^{-2})		23.38 ± 2.38	23.16 ± 2.93	0.74
ASA grading	ASA I	26 (81.25%)	26 (81.25%)	1.00
	ASA II	6 (18.75%)	6 (18.75%)	1.00
Mallampati class	Class I	28 (87.5%)	26 (81.25%)	0.78
	Class II	4 (12.5%)	6 (18.75%)	0.52
Co-morbidity	HTN	2 (6.25%)	3 (9.3%)	0.65
	DM	4 (12.5%)	3 (9.3%)	0.71
	COPD/BA	1 (3.33%)	0.00	0.31

Table II shows that laryngoscopy was easy in 23 (71.88%) patients and fair in 9 (28.13%) patients in both groups (p = 1.00). Vocal cords were open in 27 (84.38%) patients in Group PR and 32 (100%) in Group PRS, while moving cords were observed in 5 (15.63%) patients in Group PR and none in Group PRS (p = 0.05). Coughing was absent in 30 (93.75%) vs 32 (100%) patients, while slight coughing occurred in 2 (6.25%) vs 0 (0%) patients (p = 0.49). Jaw relaxation was complete in 25 (78.13%) patients in both groups and slight in 7 (21.88%) patients in both groups (p = 1.00). Limb movement was absent in 30 (93.75%) patients in Group PR and 32 (100%) in Group PRS, while slight movement occurred in 2 (6.25%) vs 0 (0%) patients (p = 0.49).

Table II
Comparison of intubating conditions using Steyn's modification of Helbo-Hansen scoring system (*n* = 64).

Characteristics		Group PR (n=32)	Group PRS (n=32)	p value
Laryngoscopy	Easy	23 (71.88%)	23 (71.88%)	1.00
	Fair	9 (28.13%)	9 (28.13%)	1.00
Vocal cord	Open	27 (84.38%)	32 (100%)	0.05
	Moving	5 (15.63%)	0 (0%)	0.05
Coughing	None	30 (93.75%)	32 (100%)	0.49
	Slight	2 (6.25%)	0 (0%)	0.49
Jaw relaxation	Complete	25 (78.13%)	25 (78.13%)	1.00
	Slight	7 (21.88%)	7 (21.88%)	1.00
Limb movement	None	30 (93.75%)	32 (100%)	0.49
	Slight	2 (6.25%)	0 (0%)	0.49

Table III shows that the mean intubating score was 5.78 ± 0.49 in Group PR and 5.56 ± 0.56 in Group PRS (p = 0.10), with no statistically significant difference between the groups.

Table III
Comparison of overall intubating score between Group PR and Group PRS (*n* = 64).

Characteristics	Group PR (n=32)	Group PRS (n=32)	p value
Intubating score	5.78 (± 0.49)	5.56 (± 0.56)	0.10

Table IV shows that baseline heart rate was 77.6 ± 7.2 beats/min in Group PR and 77.8 ± 7.4 beats/min in Group PRS (p = 0.91). At 1, 5, and 10 minutes after intubation, heart rates were 78.09 ± 6.08 vs 77.4 ± 10.16, 78.91 ± 6.5 vs 78.46 ± 8.77, and 78.5 ± 6.04 vs 78.40 ± 6.47 respectively, with no statistically significant differences at any time point.

Table IV
Comparison of heart rate at different time intervals between Group PR and Group PRS (*n* = 64).

Heart rate (beats/min)	Group PR (n=32)	Group PRS (n=32)	p value
Baseline	77.6 (± 7.2)	77.8 (± 7.4)	0.91
1 min after intubation	78.09 (± 6.08)	77.4 (± 10.16)	0.74
5 min after intubation	78.91 (± 6.5)	78.46 (± 8.77)	0.70
10 min after intubation	78.5 (± 6.04)	78.40 (± 6.47)	0.93

Table V shows that baseline systolic blood pressure was 120.75 ± 7.65 mmHg in Group PR and 120.87 ± 7.01 mmHg in Group PRS (p = 0.95). At 1, 5, and 10 minutes after intubation, values were 121.81 ± 5.74 vs 122.4 ± 5.83, 120.65 ± 5.79 vs 120.06 ± 5.75, and 121.78 ± 5.58 vs 121.4 ± 4.85 respectively, with no significant differences between groups.

Table V
Comparison of systolic blood pressure at different time intervals between Group PR and Group PRS (*n* = 64).

Systolic blood pressure (mm Hg)	Group PR (n=32)	Group PRS (n=32)	p value
Baseline SBP	120.75 (± 7.65)	120.87 (± 7.01)	0.95
1 min after intubation	121.81 (± 5.74)	122.4 (± 5.83)	0.68
5 min after intubation	120.65 (± 5.79)	120.06 (± 5.75)	0.68
10 min after intubation	121.78 (± 5.58)	121.4 (± 4.85)	0.81

Table VI shows that baseline diastolic blood pressure was 74.28 ± 5.61 mmHg in Group PR and 73.81 ± 5.70 mmHg in Group PRS (p = 0.74). At 1, 5, and 10 minutes after intubation, values were 75.43 ± 5.79 vs 74.62 ± 6.84, 72.50 ± 5.32 vs 72.00 ± 5.53, and 74.06 ± 5.90 vs 72.90 ± 8.27 respectively, with no statistically significant differences.

Table VI
Comparison of diastolic blood pressure at different time intervals between Group PR and Group PRS (*n* = 64).

Diastolic blood pressure (mm Hg)	Group PR (n=32)	Group PRS (n=32)	p value
Baseline DBP	74.28 (± 5.61)	73.81 (± 5.70)	0.74
1 min after intubation	75.43 (± 5.79)	74.62 (± 6.84)	0.61
5 min after intubation	72.50 (± 5.32)	72.00 (± 5.53)	0.71
10 min after intubation	74.06 (± 5.9)	72.9 (± 8.27)	0.55

Table VII shows that the mean postoperative myalgia score was 0.38 ± 0.49 in Group PR and 0.81 ± 0.54 in Group PRS (p = 0.001). The incidence of myalgia was 12 (37.5%) in Group PR and 24 (75.0%) in Group PRS (p = 0.007), indicating significantly higher myalgia in the suxamethonium group.

Table VII
Comparison of postoperative myalgia score and incidence at 24 hours between Group PR and Group PRS (*n* = 64).

Postoperative myalgia score	Group PR (n=32)	Group PRS (n=32)	p value
Myalgia scale value	0.38 (± 0.49)	0.81 (± 0.54)	0.001
Incidence of Myalgia	12 (37.5%)	24 (75.0%)	0.007

DISCUSSION

This quasi-experimental study was conducted at Bangladesh Medical University following approval from the Institutional Review Board (IRB) and included sixty-four patients scheduled for laparoscopic surgery. Group PR received remifentanil and propofol, whereas Group PRS received remifentanil, propofol, and suxamethonium for anesthesia induction. The study aimed to assess and compare intubating conditions, hemodynamic responses at different time intervals, and the incidence of postoperative myalgia at 24 hours between patients in Group PR and those in Group PRS.

When comparing the baseline characteristics of this study with previous reports, a clear consistency was observed, supporting the generalizability of the findings. Age distribution showed no significant difference between groups (p = 0.08) and was comparable to earlier studies such as Gulhas et al. [14], where the p-value was 0.39. Similar baseline comparability was also reported by McNeil et al. [13], supporting the homogeneity of study populations in investigations evaluating intubation without muscle relaxants.

ASA physical status was balanced, with 81.25% ASA I and 18.75% ASA II in Group PR versus 81.25% ASA I and 18.75% ASA II in Group PRS (p = 1.0). The matched ASA physical status distribution demonstrates that both groups were similar in terms of perioperative risk. This finding is similar to Gulhas et al. [14] (p = 0.485).

Anthropometric measures showed no significant variation between groups. BMI remained consistent across groups, minimizing the risk of confounding (p = 0.74), which is consistent with Gulhas et al. [14], where the p-values were 0.32 for height and 0.18 for weight, both of which were statistically non-significant.

Regarding Mallampati class, 87.5% of Group PR and 81.25% of Group PRS had Mallampati I (p = 0.78), whereas Mallampati II was observed in 12.5% and 18.75% of patients, respectively (p = 0.52). The similarity in Mallampati classification suggests that both groups had equivalent baseline airway characteristics, increasing the reliability of subsequent comparisons of intubating conditions.

Comorbidities such as hypertension (6.25% vs. 9.3%; p = 0.65), diabetes (12.5% vs. 9.3%; p = 0.71), and COPD/BA (3.33% vs. 0%) were evenly distributed, further supporting comparability between groups.

In this study, intubating condition was evaluated using Steyn's modification of the Helbo-Hansen scoring system. The laryngoscopic view was comparable across groups, with 71.88% of patients in both PR and PRS categorized as "easy" and 28.13% as "fair," while no cases of difficult or impossible laryngoscopy occurred. Vocal cord response was favorable in both groups, with open cords observed in 84.38% of PR patients and in all PRS patients; only 15.63% in PR showed cord movement. Coughing responses were minimal, as neither group demonstrated moderate or severe reactions, and the majority exhibited either no cough or only slight response. Jaw relaxation was complete in 78.13% of patients in both groups and slight in the remainder, with no cases of rigidity. Limb movement was absent in PRS, whereas 6.25% of patients in PR displayed slight movement.

Taken together, these findings indicate that both regimens provided clinically acceptable and favorable intubating conditions. Although the PRS group demonstrated marginal advantages in terms of vocal cord stability and suppression of limb movement, the differences did not reach statistical significance, suggesting that intubation without muscle relaxant using remifentanil and propofol remained clinically effective in most patients. The near-significant difference observed in vocal cord movement (p = 0.052) may indicate a potential benefit of suxamethonium that could become more apparent in studies with larger sample sizes.

The absence of difficult or impossible laryngoscopy in either group may also be

explained by the inclusion of predominantly ASA I–II patients with Mallampati class I and II airways. Therefore, the findings of the present study may not be fully generalizable to patients with anticipated difficult airway anatomy or higher perioperative risk.

These results differ somewhat from those of Gulhas et al. [14], who investigated intubating conditions in microlaryngoscopy using remifentanil and propofol with and without suxamethonium. They reported that coughing was observed in only one patient in each of the two groups. All patients in the remifentanil group remained immobile during intubation. However, extremity movements were observed in two cases in the suxamethonium group. This discrepancy may be due to differences in drug dosing as well as variations in patient characteristics.

Comparison of intubating scores by Steyn's modification of the Helbo-Hansen scoring system between the two groups showed that Group PR had a slightly higher but statistically non-significant score than Group PRS ($p = 0.10$). Despite the absence of muscle relaxant in Group PR, the overall intubating conditions remained clinically satisfactory, indicating that remifentanil combined with propofol can provide acceptable conditions for elective tracheal intubation in appropriately selected patients.

This finding is in line with McNeil et al. [13], who demonstrated that, in healthy adults with normal airway anatomy, a combination of remifentanil and propofol produces intubating conditions similar to those produced with remifentanil, propofol, and suxamethonium ($p > 0.05$). Gulhas et al. [14] found that remifentanil administered without muscle relaxants can offer intubating conditions comparable to those achieved with suxamethonium ($p > 0.05$). Bouvet et al. [15] also found that the optimal dosage of remifentanil with propofol provides excellent intubating conditions.

This effect may be explained by the central depressant action of propofol, which reduces muscle tone and suppresses laryngeal reflexes, together with the potent opioid effect of remifentanil, which attenuates airway and sympathetic reflex responses during laryngoscopy and intubation.

Hemodynamic variables (HR, SBP, and DBP) were recorded and assessed at baseline and at one, five, and ten minutes after intubation. Baseline heart rate was comparable between groups ($p = 0.91$) and remained within the normal physiological range. Comparison of heart rate at one, five, and ten minutes after intubation showed a slightly higher heart rate in Group PR but without statistical significance ($p = 0.74$, 0.70, and 0.93, respectively). Similarly, no statistically significant differences were observed in systolic or diastolic blood pressure between the two groups throughout the study period.

These findings suggest that omission of muscle relaxant did not adversely affect hemodynamic stability during intubation. The stable hemodynamic responses observed in both groups may be attributed to the potent sympatholytic and reflex-suppressing properties of remifentanil combined with the depressant effects of propofol on airway reflexes and cardiovascular responses. Maintenance of stable heart rate and blood pressure during laryngoscopy and intubation is clinically important, particularly in laparoscopic surgery where sympathetic stimulation may otherwise contribute to undesirable cardiovascular fluctuations.

Grant et al. [16] similarly reported no clinically or statistically significant changes in blood pressure from baseline following induction or intubation with propofol and remifentanil, which is consistent with the findings of the present study.

Baseline mean systolic and diastolic blood pressures were comparable between the groups—Group PR: 120.75 mmHg (SBP) and 74.28 mmHg (DBP); Group PRS: 120.87 mmHg (SBP) and 73.81 mmHg (DBP) ($p = 0.95$ and 0.74, respectively)—with no significant differences at one, five, and ten minutes following intubation. These observations indicate that remifentanil and propofol exert effects on SBP and DBP similar to those of remifentanil, propofol, and suxamethonium.

This finding contradicts the result of McNeil et al. [13], where post-induction MAP was significantly lower in the remifentanil-propofol group. The cause of this discrepancy may be due to differences in drug dosing, timing of blood pressure measurement, and patients' intrinsic factors. By contrast, Grant et al. [16] reported no clinically significant changes in blood pressure from baseline following induction or intubation with remifentanil and propofol, which aligns with the findings of the present study.

Postoperative myalgia was assessed using a 4-point myalgia scale. The results demonstrated significantly higher muscle pain scores in Group PRS, with mean scores of 0.38 in Group PR and 0.81 in Group PRS ($p < 0.05$). In Group PR, 37.5% of patients experienced myalgia, whereas in Group PRS the incidence was 75.0% ($p < 0.007$). These findings confirm the well-established association between suxamethonium use and a higher incidence of postoperative myalgia.

Hossain et al. [17] reported that approximately 70% of patients receiving suxamethonium developed postoperative myalgia. Similarly, Nasseri et al. [18] found that about 50% of patients experienced varying degrees of myalgia after succinylcholine administration. Jain et al. [19] also highlighted that the incidence of suxamethonium-induced myalgia can range widely, from 41% to 92%. The results of the present study are therefore consistent with these previous findings, reinforcing the evidence that suxamethonium significantly increases the risk of postoperative myalgia.

Taken together, the findings of this study support the evidence that the combination of remifentanil and propofol provides intubating conditions comparable to those achieved with remifentanil, propofol, and suxamethonium, while maintaining similar hemodynamic stability and reducing the incidence of postoperative myalgia. These findings highlight the potential role of the remifentanil and propofol combination as a safe and effective alternative to suxamethonium for facilitating tracheal intubation.

LIMITATIONS

As this was a quasi-experimental study without randomization, it may have been subject to selection bias and confounding variables, which could limit causal inference.

CONCLUSION

Under the conditions of this study, it is concluded that the combination of remifentanil and propofol provides intubating conditions comparable to those achieved with remifentanil, propofol, and suxamethonium in laparoscopic surgery. Furthermore, this combination offers similar haemodynamic stability while significantly reducing the incidence of postoperative myalgia.

ACKNOWLEDGMENT

I would like to express my sincere gratitude for the invaluable support and cooperation provided by the staff, participants and my co-authors/colleagues who contributed to this study.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Cook T, Simpson T. Airway management. In: Thompson JP, Smith I, Bailey CJ, editors. Smith and Aitkenhead's Textbook of Anaesthesia. London: Elsevier; 2025. p. 464–519.
2. Kelliher L, Kermode A. Anaesthesia for general, gynaecological and genitourinary surgery. In: Thompson J, Moppett I, Wiles M, editors. Smith and Aitkenhead's Textbook of Anaesthesia. London: Elsevier; 2025. p. 709–15.
3. Tila M, Muluken Z, Dadi N, Zewude M, Habtu E, Dendir G, Demissie W. Incidence and severity of suxamethonium induced

fasciculation and post-operative myalgia, and their association with different iv induction agents among adult patients underwent elective surgery at Jimma medical center, a prospective cohort study. Int. J. Anesth. Res. 2021 Apr 30;9(03):624-9.
4. Mazur B, Greguła A, Stachyrak K, Mika D, Kłos A, Turek K, Lambach M, Pawlicki M, Mazurek A, Wilanowska W. Safety and side effects of suxamethonium in clinical practice–literature overview. Journal of Education, Health and Sport. 2024 Jan 11;52:11-24.
5. Mikhail A, Salahu D, Atiku M, Adesope S, Abdurrahman A, Abdullahi MM. Changes associated with facilitation of endotracheal intubation with either fentanyl or suxamethonium in children. Borno Medical Journal. 2022;19(2):86-93.
6. Santpur MU, Kahalekar GM, Kanni P, RSL B. Comparative Study of Rocuronium Bromide and Succinylcholine Chloride for Endotracheal Intubation During General Anesthesia.
7. Scheller MS, Zornow MH, Saidman LJ. Tracheal intubation without the use of muscle relaxants: a technique using propofol and varying doses of alfentanil. Anesthesia & Analgesia. 1992 Nov 1;75(5):788-93.
8. Kojima Y, Endo S, Hirabayashi K, KOJIMA Y. Stress-Free Intubation With Preserved Spontaneous Breathing for Cases With Difficult Airway Management: A Case Series and Retrospective Analysis. Cureus. 2025 Aug 5;17(8):e89393.
9. Bhardwaj N, Thakur A, Sharma A. A review of various methods for prevention of pressor response to intubation. Int J Res Rev. 2020;7(7):360-.
10. Scott LJ, Perry CM. Remifentanil: a review of its use during the induction and maintenance of general anaesthesia. Drugs. 2005 Sep;65(13):1793-823.
11. Thompson J, Moppett I, Wiles M, editors. Smith and aitkenhead's textbook of anaesthesia. 8th ed. London, England: Churchill Livingstone; 2025.
12. Batra YK, Al Qattan AR, Ali SS, Qureshi MI, Kuriakose D, Migahed A. Assessment of tracheal intubating conditions in children using remifentanil and propofol without muscle relaxant. Pediatric Anesthesia. 2004 Jun;14(6):452-6.
13. McNeil IA, Culbert B, Russell I. Comparison of intubating conditions following propofol and succinylcholine with propofol and remifentanil 2 μg kg–1 or 4 μg kg–1. British Journal of Anaesthesia. 2000 Oct 1;85(4):623-5.
14. Gulhas N, Topal S, Kayhan GE, Yucel A, Begec Z, Yologlu S, Durmus MA, Ersoy MO. Remifentanil without muscle relaxants for intubation in microlaryngoscopy: a double blind randomised clinical trial. European Review for Medical & Pharmacological Sciences. 2013 Jul 15;17(14).
15. Bouvet L, Stoian A, Rimmelé T, Allaouchiche B, Chassard D, Boselli E. Optimal remifentanil dosage for providing excellent intubating conditions when co-administered with a single standard dose of propofol. Anaesthesia. 2009 Jul;64(7):719-26.
16. Grant S, Noble S, Woods A, Murdoch J, Davidson A. Assessment of intubating conditions in adults after induction with propofol and varying doses of remifentanil. British Journal of Anaesthesia. 1998 Oct 1;81(4):540-3.
17. Hossain MS, Sanjowal L, Rashid MM, Babu MA, Saha D. Prevention of succinylcholine induced postoperative myalgia by pretreatment with lignocaine: a randomized controlled study. Faridpur Medical College Journal. 2019;14(1):13-5.
18. Nasseri K, Arvien S. Effects of low-dose ketamine on succinylcholine-induced postoperative myalgia in outpatient surgeries: a randomized, double-blind study. Journal of Pain Research. 2016 Jul 6:503-8.
19. Jain P, Bhosale UA, Soundattikar G. A randomized controlled trial to compare preemptive analgesic efficacy and safety of pregabalin and gabapentin for succinylcholine-induced myalgia. Nigerian Medical Journal. 2019 Jan 1;60(1):27-32.