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Original Research Paper

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TO COMPARE EASE OF INTUBATION FOLLOWING INDUCTION WITH DIFFERENT DOSES OF INTRAVENOUS PROPOFOL, WITHOUT USING MUSCLE RELAXANTS, FOLLOWING DIRECT LARYNGOSCOPY

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ABSTRACT

Background: Endotracheal intubation is crucial for airway management during general anesthesia. Traditionally, muscle relaxants optimize conditions for intubation, but in certain clinical scenarios, alternative approaches are required. **Aim and Objectives:** To evaluate the effect of varying doses of intravenous propofol (2.5 mg/kg, 3 mg/kg, and 3.5 mg/kg) on intubation conditions in adult patients undergoing elective surgeries to reduce reliance on muscle relaxants while maintaining safety. **Materials and Methods:** Over 18 months, a prospective comparative study was conducted at Sri Aurobindo Medical College, Indore. Ninety patients aged 18–65 undergoing elective surgeries were randomized into three groups, each receiving a different dose of propofol (2.5 mg/kg, 3 mg/kg, or 3.5 mg/kg). Primary outcome measures included intubation ease assessed by the Cormack-Lehane grading system, number of intubation attempts, and success rate. Secondary outcomes involved monitoring hemodynamic parameters and adverse events. **Results:** The study found that higher doses of propofol were associated with improved intubation outcomes. In Group C (3.5 mg/kg), 100% of patients were successfully intubated, and 96.7% achieved intubation on the first attempt. The Cormack-Lehane Grade I view was significantly higher in Group C (93.3%) compared to Group A (60%) and Group B (76.7%) ($p = 0.008$). However, hemodynamic side effects, including hypotension and bradycardia, increased with higher doses. The decrease in systolic blood pressure was greatest in Group C (20.1%), and bradycardia occurred in 6.7% of patients in this group ($p = 0.047$). **Conclusion:** Higher doses of propofol (3.5 mg/kg) enhance intubation conditions without muscle relaxants, offering a potential alternative in certain clinical scenarios. However, clinicians must balance the improved intubation ease with the risk of hemodynamic compromise, particularly hypotension and bradycardia, when determining the optimal dose for intubation.

KEYWORDS : endotracheal intubation, propofol doses, airway management, cormack-lehane grading, hemodynamic effects

INTRODUCTION

Endotracheal intubation is critical to airway management during general anesthesia, facilitating adequate ventilation and oxygenation.[1] The success of intubation depends on various factors, including the induction agent, patient characteristics, and the skill of the anesthesiologist.[2] Traditionally, muscle relaxants are used to optimize conditions for intubation by reducing airway resistance and facilitating the placement of the endotracheal tube.[3] However, in specific clinical scenarios, such as rapid sequence induction or situations where muscle relaxants are contraindicated, it is essential to explore alternative approaches to achieve optimal intubation conditions. [1,4]

Propofol, a widely used intravenous anesthetic agent, is known for its rapid onset, smooth induction, and favorable recovery profile.[5] Its sedative and hypnotic properties make it a preferred agent for induction in general anesthesia.[5] Additionally, propofol possesses intrinsic muscle-relaxant effects, which may contribute to favorable conditions for intubation without the need for adjunctive muscle relaxants. [6] However, the dose of propofol plays a pivotal role in determining the quality of intubation conditions, as well as the occurrence of hemodynamic side effects such as hypotension and bradycardia. [5,6]

The Cormack-Lehane grading system, the number of intubation attempts, and the success rate of endotracheal tube placement are reliable metrics to assess intubation ease.[7,8] Despite the widespread use of propofol, limited research has directly compared the efficacy of different doses of propofol in providing optimal intubation conditions without muscle relaxants.[7-9]

This study aims to evaluate and compare the ease of intubation following induction with three different doses of intravenous propofol (2.5 mg/kg, 3 mg/kg, and 3.5 mg/kg) in adult patients undergoing elective surgeries. The study seeks to provide insights into the optimal dosing strategy of propofol to achieve satisfactory intubation conditions, thereby reducing reliance on muscle relaxants while maintaining patient safety. By systematically analyzing the intubation outcomes across varying doses, this research will contribute to enhancing clinical decision-making in airway management and optimizing anesthetic practices.

MATERIALS AND METHODS

Study Design and Setting

This prospective, comparative study was conducted at Sri Aurobindo Medical College and Postgraduate Institute, Indore (M.P.), over a period of one and a half years (June 2023

to November 2024). The study included 90 patients scheduled for elective abdominal, orthopedic, gynecological and ENT surgeries under general anesthesia.

Ethical Considerations
The study protocol received approval from the institutional ethical committee. Prior to participation, written informed consent was obtained from all patients' relatives, ensuring adherence to ethical standards.

Participant Selection
Patients aged 18 and 65 with an ASA grade of I or II were included. Eligibility criteria required patients to have Mallampati Class I or II airway anatomy, normal neck movements, and a mouth opening of at least three fingers. All participants were required to be nil per oral (NPO) for 6–8 hours before the procedure. Exclusion criteria included a history of allergy to propofol, less than three-finger mouth opening, upper airway pathologies, ASA grades III to V, Mallampati Class III or IV, cardiac diseases, pregnancy, obesity (BMI ≥30), and emergency surgeries.

Study Groups and Randomization
Patients were randomly allocated into three groups, each comprising 30 participants. Group A received 2.5 mg/kg of propofol, Group B received 3 mg/kg of propofol, and Group C received 3.5 mg/kg of propofol.

Preoperative Preparation
All participants underwent routine preoperative investigations and a comprehensive pre-anesthetic check-up. Patients were kept nil orally for 8 hours before the surgery, and an intravenous line was secured. Each patient was preloaded with 500 mL of lactated Ringer's solution. Baseline measurements, including systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), oxygen saturation (SpO2), ECG, and end-tidal CO2 (ETCO2), were recorded before the procedure.

Premedication and Induction
Premedication included intravenous administration of glycopyrrolate (0.2 mg), midazolam (1 mg), loxicard (2 mL), and dexamethasone (8 mg). For induction, fentanyl (2 mcg/kg) was administered intravenously, followed by the assigned dose of propofol (2.5 mg/kg, 3 mg/kg, or 3.5 mg/kg) based on group allocation.

Procedure and Intubation
Patients were preoxygenated for 3 minutes before induction. Direct laryngoscopy was performed, and endotracheal intubation was attempted using an appropriately sized endotracheal tube. Intubations were conducted by an experienced anesthesiologist. Assisted ventilation was provided as needed. The success of intubation was evaluated based on the number of attempts, the Cormack-Lehane grading system, and the successful placement of the endotracheal tube.

Outcome Measures
The primary outcome measures included ease of intubation assessed by the number of intubation attempts, Cormack-Lehane grade, and successful endotracheal tube placement. Secondary outcomes involved monitoring hemodynamic parameters, such as SBP, DBP, MAP, and HR, and documenting adverse events during the procedure.

Data Analysis
Data were analyzed using SPSS software version 25.0. Continuous variables were expressed as mean ± standard deviation and categorical variables were presented as frequencies and percentages. Comparisons between groups were made using one-way ANOVA for continuous variables and Chi-square tests for categorical variables. Post hoc analysis was performed using the Tukey test to identify significant pairwise differences. A p-value of <0.05 was considered statistically significant.

RESULTS
Demographic and Baseline Characteristics
A total of 90 patients were included in the study and randomly assigned to one of three groups: Group A (2.5 mg/kg of propofol), Group B (3 mg/kg of propofol), and Group C (3.5 mg/kg of propofol), with 30 patients in each group. The demographic characteristics, including age, gender, and body weight, were comparable among the groups. The mean age of participants was 35.2 ± 8.6 years in Group A, 36.7 ± 9.4 years in Group B, and 34.9 ± 7.8 years in Group C ($p = 0.67$). There were no significant differences in gender distribution ($p = 0.81$) or mean body weight ($p = 0.59$) among the groups.

Table 1: Demographic and Baseline Characteristics

Parameter	Group A (2.5 mg/kg)	Group B (3 mg/kg)	Group C (3.5 mg/kg)	p-value
Mean Age (years)	35.2 ± 8.6	36.7 ± 9.4	34.9 ± 7.8	0.67
Male: Female Ratio	18:12	19:11	17:13	0.81
Mean Body Weight (kg)	68.4 ± 9.3	69.1 ± 8.7	67.8 ± 9.1	0.59

Ease of Intubation
The number of intubation attempts required for successful endotracheal tube placement differed significantly among the groups. In Group A, 73.3% of patients were intubated on the first attempt, compared to 86.7% in Group B and 96.7% in Group C ($p = 0.032$). The mean number of attempts was 1.3 ± 0.6 in Group A, 1.1 ± 0.4 in Group B, and 1.03 ± 0.2 in Group C ($p = 0.015$).

Table 2: Intubation Success and Attempts

Parameter	Group A (2.5 mg/kg)	Group B (3 mg/kg)	Group C (3.5 mg/kg)	p-value
Successful Intubation (%)	86.7	96.7	100.0	0.041
Intubation on First Attempt (%)	73.3	86.7	96.7	0.032
Mean Number of Attempts	1.3 ± 0.6	1.1 ± 0.4	1.03 ± 0.2	0.015

Cormack-Lehane Grading
The Cormack-Lehane grading of glottic view during laryngoscopy showed significant improvement with higher doses of propofol. Grade I views were achieved in 60% of patients in Group A, 76.7% in Group B, and 93.3% in Group C ($p = 0.008$). Grade II views were seen in 30%, 20%, and 6.7% of patients in Groups A, B, and C, respectively, while Grade III views were observed only in Group A (10%).

Table 3: Cormack-Lehane Grading

Grade	Group A (2.5 mg/kg)	Group B (3 mg/kg)	Group C (3.5 mg/kg)	p- value
Grade I (%)	60.0	76.7	93.3	0.008
Grade II (%)	30.0	20.0	6.7	0.008
Grade III (%)	10.0	3.3	0.0	0.031

Success Rate of Intubation
86.7% of patients in Group A, 96.7% in Group B, and 100% in Group C successfully intubated ($p = 0.041$).

Hemodynamic Parameters
The changes in hemodynamic parameters, including systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate (HR), were monitored during induction and intubation. Patients in Group C

experienced a more significant decrease in SBP (20.1 ± 3.5%) and MAP (18.4 ± 2.9%) compared to Group A (12.3 ± 2.8% and 11.1 ± 3.2%, respectively) and Group B (15.8 ± 3.1% and 14.5 ± 2.7%, respectively) ($p < 0.001$). Bradycardia was observed in 6.7% of patients in Group C but was not reported in Groups A or B.

Table 4: Hemodynamic Parameters

Parameter	Group A (2.5 mg/kg)	Group B (3 mg/kg)	Group C (3.5 mg/kg)	p-value
Decrease in SBP (%)	12.3 ± 2.8	15.8 ± 3.1	20.1 ± 3.5	<0.001
Decrease in MAP (%)	11.1 ± 3.2	14.5 ± 2.7	18.4 ± 2.9	<0.001
Incidence of Bradycardia (%)	0.0	0.0	6.7	0.047
Incidence of Hypotension (%)	10.0	16.7	20.0	0.029

Adverse Events

Adverse events were minimal and included mild hypotension in 10% of patients in Group A, 16.7% in Group B, and 20% in Group C. No significant respiratory complications or prolonged intubation attempts were reported.

Table 5: Adverse Events

Adverse Event	Group A (2.5 mg/kg)	Group B (3 mg/kg)	Group C (3.5 mg/kg)	p-value
Mild Hypotension (%)	10.0	16.7	20.0	0.029
Bradycardia (%)	0.0	0.0	6.7	0.047
Prolonged Intubation Time (%)	3.3	0.0	0.0	0.19

DISCUSSION

This study evaluated the efficacy of three doses of propofol (2.5 mg/kg, 3 mg/kg, and 3.5 mg/kg) for facilitating endotracheal intubation without using muscle relaxants. The findings indicate that higher doses of propofol are associated with improved intubation conditions and increased hemodynamic side effects.

Intubation Success and Attempts

The success rates for endotracheal intubation were 86.7% in Group A (2.5 mg/kg), 96.7% in Group B (3 mg/kg), and 100% in Group C (3.5 mg/kg), with a statistically significant difference ($p = 0.041$). Additionally, the percentage of patients intubated on the first attempt increased with higher doses: 73.3% in Group A, 86.7% in Group B, and 96.7% in Group C ($p = 0.032$). These results suggest that increasing the dose of propofol enhances the likelihood of successful and prompt intubation. Similar findings were reported by Asif et al., who concluded that a propofol dose of 4 mg/kg combined with fentanyl 3 g/kg provided optimal intubation conditions without muscle relaxants, achieving a 95% success rate. [10] However, they also noted a higher incidence of hypotension (83%) in the higher dose group, indicating a dose-dependent relationship between propofol and hemodynamic instability.

Cormack-Lehane Grading

The proportion of patients with a Grade I view during laryngoscopy increased with higher propofol doses: 60.0% in Group A, 76.7% in Group B, and 93.3% in Group C ($p = 0.008$). Conversely, the incidence of Grade III views decreased with higher doses. This trend indicates that higher doses of propofol may provide better laryngeal exposure, facilitating easier intubation. These observations align with the study by Gore and colleagues [11], who found that a propofol dose of 3 mg/kg was sufficient for tracheal intubation without muscle relaxants and that adding lignocaine improved intubation conditions. Our study extends these findings by demonstrating that even higher doses of propofol further enhance laryngeal visualization. Taha et al. otherwise concluded that lidocaine-remifentanil-propofol is superior to lidocaine-remifentanil-thiopental for tracheal intubation without muscle relaxants. However, it induces more hypotension and bradycardia.[12]

Hemodynamic Parameters

The study observed a dose-dependent decrease in systolic blood pressure (SBP) and mean arterial pressure (MAP) across the groups. The reduction in SBP was 12.3% in Group A, 15.8% in Group B, and 20.1% in Group C ($p < 0.001$). Similarly, the decrease in MAP was 11.1% in Group A, 14.5% in Group B, and 18.4% in Group C ($p < 0.001$). The incidence of bradycardia was noted only in Group C (6.7%, $p = 0.047$), and the incidence of hypotension increased with higher doses (10.0% in Group A, 16.7% in Group B, and 20.0% in Group C; $p = 0.029$). These findings are consistent with the study by Klemola and Saarnivaara, who reported that higher doses of propofol while improving intubation conditions, were associated with significant decreases in blood pressure and occasional bradycardia. [13] Similarly, a study comparing propofol and thiopental for intubation without muscle relaxants found that propofol was associated with more pronounced hypotension and bradycardia. [12]

Adverse Events

The incidence of mild hypotension increased with higher propofol doses, reaching 20.0% in Group C ($p = 0.029$). Bradycardia was observed only in Group C (6.7%, $p = 0.047$). No cases of prolonged intubation time were reported in Groups B and C, while Group A had a 3.3% incidence, though this was not statistically significant ($p = 0.19$). The increased incidence of hypotension and bradycardia with higher propofol doses is well-documented. Singh et al. reported an 83% incidence of hypotension in patients receiving 4 mg/kg of propofol combined with fentanyl.[10] Therefore, while higher doses of propofol may facilitate better intubation conditions, they also pose a greater risk of hemodynamic instability.

CONCLUSION

The study demonstrates that increasing doses of propofol improve intubation conditions without using muscle relaxants, as evidenced by higher success rates, fewer intubation attempts, and better Cormack-Lehane grades. However, this benefit is accompanied by a higher incidence of hemodynamic side effects, including hypotension and bradycardia. Clinicians should carefully weigh the advantages of improved intubation conditions against the potential for hemodynamic compromise when selecting the appropriate propofol dose for intubation without muscle relaxants.

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