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Comparative Study of Efficacy of Two Doses of Intravenous (i.v.) Fentanyl on Hemodynamic Response to Laryngoscopy and Intubation.

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ABSTRACT

Intubation-induced hemodynamic responses can precipitate cardiovascular complications. This study aimed to compare the efficacy of two doses of intravenous (i.v.) fentanyl in mitigating these responses. A prospective randomized study was conducted involving 40 patients undergoing elective surgery under general anesthesia. Patients were randomized into two groups (Group A: 2 µg/kg intravenous (i.v.) fentanyl, Group B: 4 µg/kg intravenous (i.v.) fentanyl). Heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded pre-induction, at intubation, and at intervals of 1, 3, and 5 minutes post-intubation. Group B (4 µg/kg intravenous (i.v.) fentanyl) showed significantly less increase in heart rate and systolic blood pressure compared to Group A (2 µg/kg intravenous (i.v.) fentanyl). No significant adverse events were observed in either group. A higher dose of intravenous (i.v.) fentanyl (4 µg/kg) was more effective in controlling hemodynamic responses during intubation without significant side effects.

Keywords: Intravenous (i.v.) Fentanyl, Laryngoscopy, Hemodynamic response

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INTRODUCTION

Endotracheal intubation frequently triggers hemodynamic instability characterized by hypertension and tachycardia [1, 2]. Various pharmacological interventions have been studied to minimize this response. Intravenous (i.v.) Fentanyl, a potent synthetic opioid, is commonly used to mitigate these effects, yet optimal dosing remains unclear. This study evaluates the comparative efficacy of two different doses of intravenous (i.v.) fentanyl in attenuating the hemodynamic response during laryngoscopy and intubation, aiming to establish an effective dosage regimen that minimizes adverse cardiovascular events [3-5].

Study Methodology

This prospective, randomized controlled study was conducted over a period of one year at a tertiary care hospital. A total of 40 patients scheduled for elective surgical procedures under general anesthesia were enrolled after obtaining informed written consent and ethical approval from the institutional review board. Patients aged between 18 and 60 years, classified as American Society of Anesthesiologists (ASA) grade I and II, were included, while patients with cardiovascular diseases, respiratory illnesses, or allergies to intravenous (i.v.) fentanyl were excluded.

Patients were randomly allocated into two groups using a computer-generated randomization technique. Group A received intravenous (i.v.) fentanyl at a dose of 2 µg/kg, whereas Group B received intravenous (i.v.) fentanyl at 4 µg/kg intravenously prior to induction of anesthesia. Standard monitoring including electrocardiography, non-invasive blood pressure, and pulse oximetry was established. General anesthesia was induced using i.v propofol and i.v succinylcholine and intubated with appropriate sized oral cuffed endotracheal tube and maintained with i.v non-depolarizing muscle relaxant, isoflurane, nitrous oxide and oxygen mixture.

Heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded at baseline (pre-induction), immediately at intubation, and at 1, 3, and 5 minutes post-intubation. All hemodynamic parameters were documented by an independent observer blinded to group allocation, ensuring objectivity. Statistical analysis was performed using SPSS software, and significance was defined at a p-value of <0.05.

Anesthesia Technique

Premedication

i.v. Glycopyrrolate 4 µg/kg
i.v. Ondansetron 0.1 mg/kg

Preoxygenation

100% O_2 for 5 minutes.

Induction Agent

i.v. Propofol 2 mg/kg
i.v. Succinylcholine 2 mg/kg

Intubated

With appropriately sized, oral cuffed endotracheal tube.

Maintained

With O_2 + N_2O + Isoflurane + non-depolarizing muscle relaxant

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RESULTS

Table 1: Demographic Profile

Parameters	Group A (n=20)	Group B (n=20)
Age (years)	35.4 ± 9.2	34.8 ± 8.5
Gender (M/F)	12/8	11/9
BMI (kg/m^2)	23.5 ± 3.6	36.1 ± 4.2

Graph 1: Demographic Profile

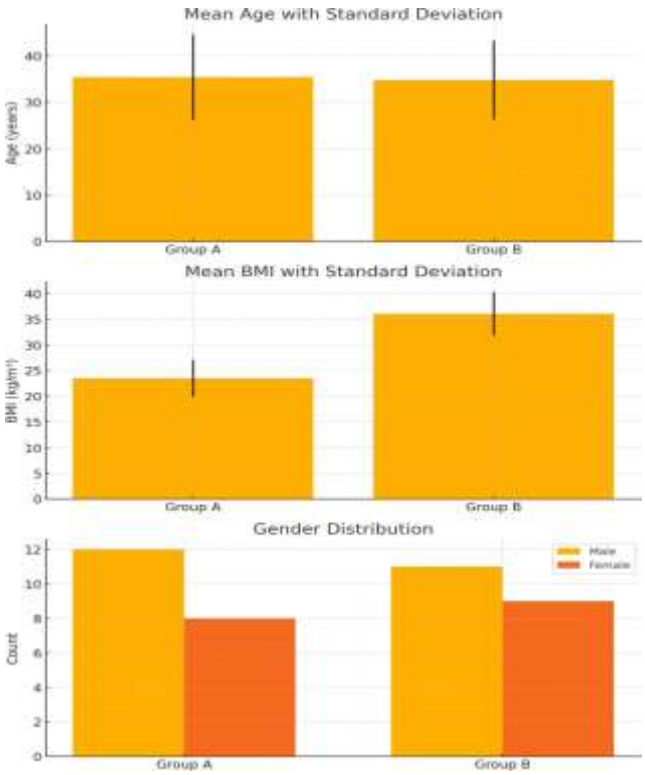
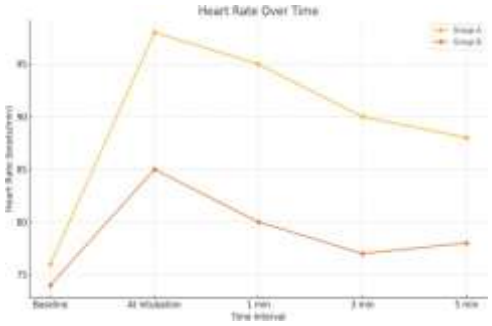


Table 2: Heart Rate (beats/min)

Time	Group A	Group B
Baseline	76 ± 5	74 ± 6
At intubation	98 ± 7	85 ± 5*
1 min	95 ± 6	80 ± 4*
3 min	90 ± 5	77 ± 4*
5 min	88 ± 4	78 ± 5*
(*p<0.05)		



Graph 2: Heart Rate (beats/min)

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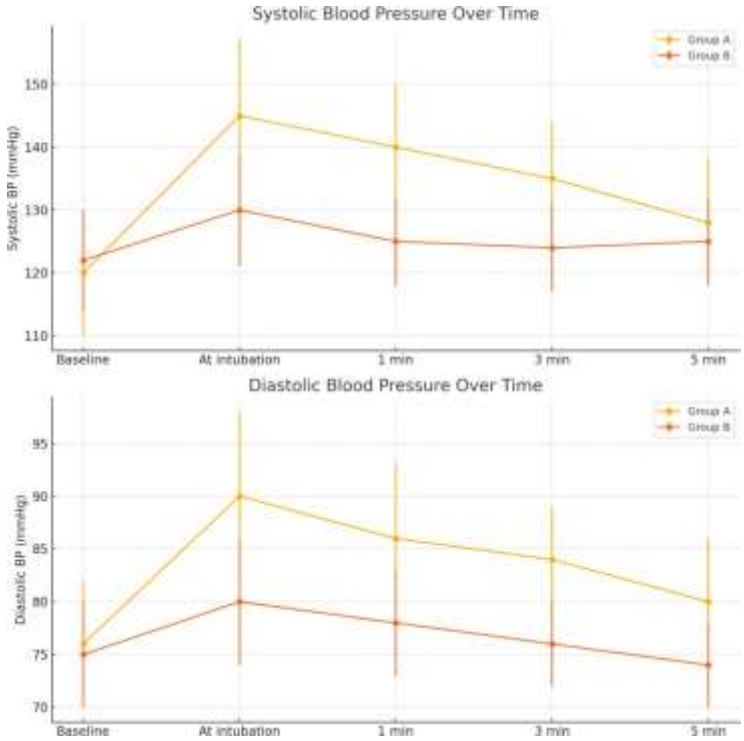
Table 3: Systolic Blood Pressure (mmHg)

Time Interval	Group A	Group B
Baseline	120 ± 10	122 ± 8
At intubation	145 ± 12	130 ± 9*
1 min	140 ± 10	125 ± 7*
3 min	135 ± 9	124 ± 7*
5 min	128 ± 10	125 ± 7*

Table 4: Diastolic Blood Pressure (mmHg)

Time Interval	Group A	Group B
Baseline	76 ± 6	75 ± 5
At intubation	90 ± 8	80 ± 6*
1 min	86 ± 7	78 ± 5*
3 min	84 ± 6	76 ± 4*
5 min	80 ± 5	74 ± 4*



Graph 3& 4: Systolic and diastolic blood pressure

Table 5: Mean Arterial Pressure (MAP)

Time Interval	Group A	Group B
Baseline	90 ± 6	89 ± 5
At intubation	110 ± 7	95 ± 6*
1 min	102 ± 5	92 ± 4*
3 min	98 ± 4	90 ± 4*
5 min	95 ± 5	88 ± 5*

$p<0.05$ significant difference

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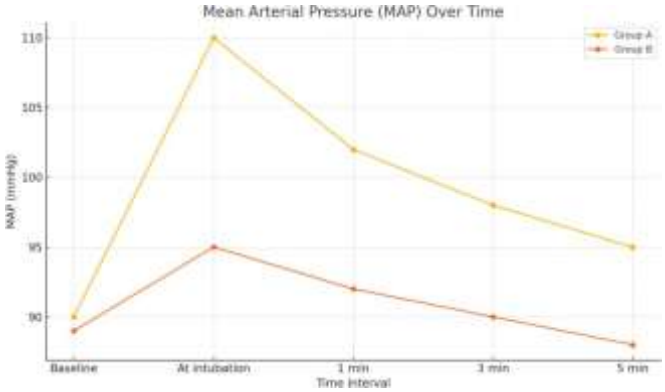

Graph 5: Mean Arterial Pressure (MAP)

DISCUSSION

This study evaluated the comparative efficacy of two doses of intravenous (i.v.) fentanyl in controlling hemodynamic changes induced by laryngoscopy and intubation. The stress response, characterized by tachycardia and hypertension, can significantly increase cardiovascular risk, especially in vulnerable patients. Our results showed a clear benefit of using a higher dose of intravenous (i.v.) fentanyl (4 μg/kg), as evidenced by significant attenuation of both heart rate and blood pressure compared to a lower dose (2 μg/kg). These findings align with earlier research suggesting dose-dependent suppression of cardiovascular reflexes during laryngoscopy [6, 7].

Interestingly, the heart rate at intubation increased by only 11 beats/minute in Group B compared to 22 beats/minute in Group A, highlighting the enhanced efficacy of higher intravenous (i.v.) fentanyl dosing. Similar findings were observed by earlier studies, reinforcing that higher intravenous (i.v.) fentanyl doses produce greater analgesic depth and suppression of sympathetic stimulation. This implies that patients with pre-existing cardiovascular conditions could particularly benefit from optimized intravenous (i.v.) fentanyl dosing [8-10].

In terms of blood pressure management, systolic, diastolic, and mean arterial pressures remained significantly lower in the higher-dose intravenous (i.v.) fentanyl group during intubation and the immediate post-intubation period. Such reductions can reduce perioperative cardiovascular events, improve patient stability, and potentially enhance postoperative recovery and outcomes. These findings corroborate previous studies that reported improved hemodynamic stability with increased opioid dosing [11-15].

Notably, the absence of significant adverse events, such as severe hypotension or respiratory depression, in either group highlights intravenous (i.v.) fentanyl's safety profile at these studied doses. However, further studies involving larger samples and higher-risk populations are essential to confirm the broad applicability of these results.

CONCLUSION

This study contributes valuable evidence supporting higher intravenous (i.v.) fentanyl dosing during induction of anesthesia, potentially redefining clinical practice guidelines for anesthesia management. Clinicians should consider balancing the efficacy and safety of intravenous (i.v.) fentanyl, selecting the optimal dosage tailored to individual patient profiles and surgical requirements.

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