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Original Research Article

Comparing Stress Response During Fiberoptic Versus Direct Laryngoscopic Orotracheal Intubation After Dexmedetomidine Premedication

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Abstract:

Background: Endotracheal intubation commonly provokes sympathetic stimulation, leading to transient hypertension and tachycardia. Attenuating these haemodynamic responses is crucial, especially in patients with cardiovascular risk.

Methods: This randomized clinical trial included 80 patients (ASA I–II) undergoing elective surgery under general anaesthesia. Participants were randomly assigned to fibreoptic-guided intubation (Group F) or direct laryngoscopy (Group D). Haemodynamic parameters were recorded at baseline, during, and after intubation, and analyzed using SPSS 18.0.

Results: Group F exhibited significantly lower systolic, diastolic, and mean arterial pressures between 2–5 minutes post-intubation ($p < 0.01$) compared to Group D. Heart rate elevation was transient in both groups but returned to baseline more rapidly in Group F. Beyond 7 minutes, haemodynamic variables stabilized in both groups. Overall, fibreoptic bronchoscopy showed superior attenuation of pressor and tachycardic responses.

Conclusion: Fibreoptic-guided intubation provides better haemodynamic stability than direct laryngoscopy during general anaesthesia.

Keywords: Fibreoptic Intubation, Direct Laryngoscopy, Haemodynamic Response, Dexmedetomidine, General Anaesthesia.

Introduction

Airway management is a critical component of anesthesia practice, and endotracheal intubation is one of the most essential yet physiologically stressful procedures performed in the perioperative setting [1]. The act of laryngoscopy and tracheal intubation triggers a strong sympathetic response distinguished by elevated heart rate, blood pressure, and plasma catecholamine levels. These hemodynamic changes are usually well tolerated in healthy individuals but may be hazardous in patients with cardiovascular or cerebrovascular diseases. Over the years, various techniques and pharmacological agents have been explored to attenuate this pressor response, with dexmedetomidine—a highly selective α2-adrenergic agonist—emerging as a valuable adjunct due to its sedative, analgesic, and sympatholytic properties [2-4].

Among the available airway management techniques, direct laryngoscopy (DL) remains the standard method, while fiberoptic laryngoscopy (FOL) is increasingly used, especially in patients with anticipated difficult airways [5]. The physiological stress response, however, may vary depending on the degree of airway manipulation and visualization technique [6]. While direct laryngoscopy provides a rapid and reliable means of intubation, it involves significant stimulation of the oropharyngeal and laryngeal structures [7]. Fiberoptic intubation, on the other hand, is often considered less stimulating, but its impact on hemodynamic and stress responses—especially when combined with premedication such as dexmedetomidine—remains an area of ongoing clinical interest [8,9]. Comparative evaluation of these two methods can guide anesthesiologists in selecting the optimal approach for patients with varying clinical conditions.

This randomised prospective study was carried out in the Department of Anaesthesiology at SCB Medical College to compare the stress response during fiberoptic versus direct laryngoscopic orotracheal intubation following dexmedetomidine premedication. Through this comparative analysis, the study seeks to identify the safer and more effective intubation technique for minimizing stress responses in patients undergoing general anesthesia.

Methods

Materials and Methods

Study Design and Setting: This randomized clinical trial took place at the Department of Anaesthesiology, SCB Medical College, Cuttack, for two years from September 2018 to October 2020.

Sample Size and Study Population: Eighty patients were recruited and randomly divided into two equal cohorts of forty using computer-generated allocation. Group F underwent intubation via a flexible fiberoptic bronchoscope, while Group D was intubated using conventional direct laryngoscopy. All participants received dexmedetomidine as part of the premedication protocol.

Eligibility Criteria: The study included patients of either sex classified as ASA Physical Status I or II and scheduled for elective surgeries under general anaesthesia. Exclusion criteria involved patient non-consent, existing cardiovascular, respiratory, neurological, renal, or hepatic conditions, pregnancy or lactation, known hypersensitivity to study drugs, psychiatric disorders, or anticipated difficult airway (Mallampati Grade III/IV or thyromental distance below 6.5 cm).

Preoperative Assessment and Premedication: Patients were evaluated one day prior to surgery and instructed to maintain an eight-hour fasting period. Baseline haemodynamic variables were recorded following intravenous cannulation. Standard premedication consisted of intravenous ranitidine (50 mg), glycopyrrolate (200 µg), metoclopramide (10 mg), and dexmedetomidine (0.5 µg/kg) diluted in 10 ml normal saline, infused slowly over 10 minutes.

Anaesthetic Protocol: After three minutes of preoxygenation with 100% oxygen, anaesthesia induction was achieved using butorphanol (10 µg/kg) and propofol (2 mg/kg). Once bag-mask ventilation was confirmed, succinylcholine (1.5 mg/kg) was administered to facilitate tracheal intubation. Anaesthesia maintenance involved 1.5% sevoflurane in oxygen. Haemodynamic measurements were taken before and after induction, during intubation, and post-intubation.

Intubation and Monitoring Procedures: In Group F, intubation was guided by a lubricated, pre-warmed fiberoptic bronchoscope with the endotracheal tube mounted on it. Once the vocal cords and carina were visualized, the tube was advanced, and the bronchoscope was withdrawn. Group D patients were intubated using a Macintosh laryngoscope (blade size 3 or 4 as needed). Endotracheal placement was confirmed by auscultation and end-tidal CO_2 ($EtCO_2$) monitoring. Anaesthesia was maintained with 1–3% sevoflurane in a mixture of 50% nitrous oxide and oxygen at a flow of 3 L/min. Atracurium (0.5 mg/kg) was given as an initial dose, followed by intermittent 0.1 mg/kg boluses for muscle relaxation. Haemodynamic data were recorded five minutes before induction, then every minute for the first five minutes post-intubation, and subsequently every two minutes for the next ten minutes.

Statistical Analysis: Descriptive and inferential statistics were used, with continuous data expressed as mean ± SD and categorical data as frequencies and percentages. Group comparisons were made using Student's t-test, Chi-square/Fisher's Exact test, and non-parametric methods where required, analyzed in SPSS v18.

Results

The demographic characteristics of the study participants were comparable between the two groups. The average age of patients in cohort F was 42.38 ± 4.82 years, while in cohort D it was 39.62 ± 6.47 years, showing a statistically significant difference (Table 1).

Table 1: Demographic profile of Study cohort

Parameter	Cohort F (n=40)	Cohort D (n=40)	Statistical Test	p-Value	Interpretation
Mean Age (years)	42.38 ± 4.82	39.62 ± 6.47	Independent t-test	0.035	Statistically significant difference
Mean Weight (kg)	69.02 ± 13.61	69.25 ± 12.43	Independent t-test	0.939	No significant difference
Gender Distribution	Male: 23 (56.7%) Female: 17 (43.3%)	Male: 19 (46.7%) Female: 21 (53.3%)	Chi-square test	—	Groups comparable

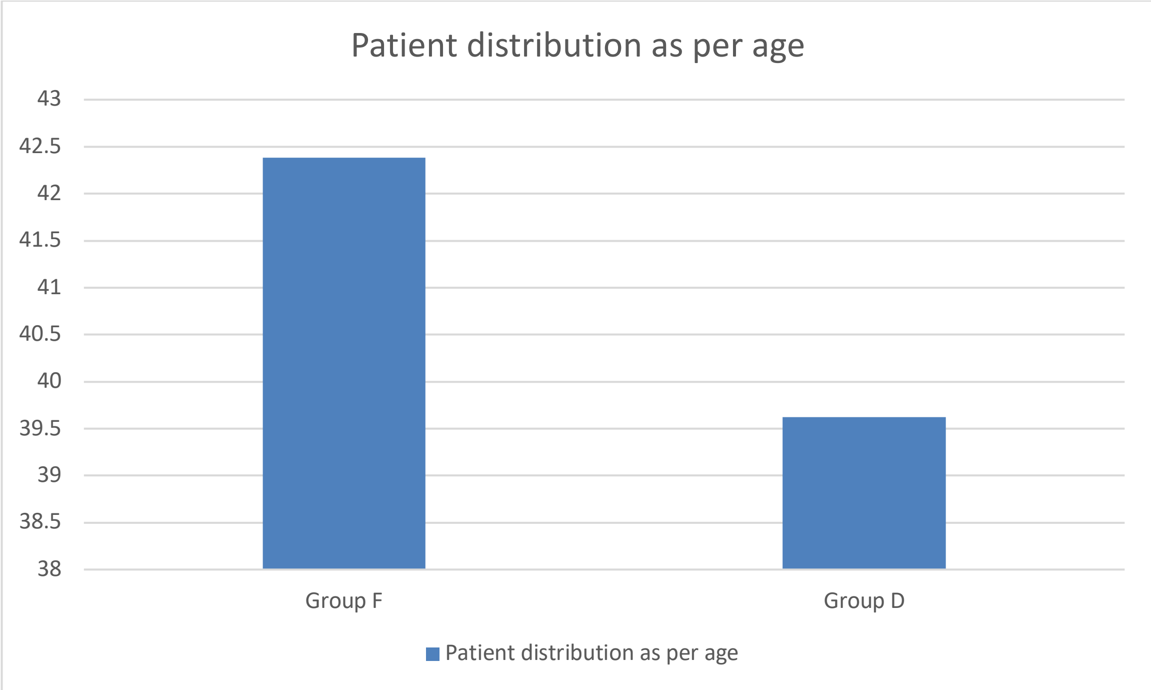

Figure 1: Patient distribution as per age.

Systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressures (MAP) were consistently lower in cohort F, which underwent intubation with a flexible fibreoptic bronchoscope, compared to cohort D intubated via direct laryngoscopy. The most significant differences occurred between 2 and 5 minutes post-intubation ($p < 0.01$), indicating a more stable hemodynamic response in cohort F. Beyond 5 minutes, pressures gradually normalized in both groups, demonstrating effective autonomic recovery and comparable mean values by 15 minutes (Table 2).

Table 2: Comparison of cardiovascular parameters Between Cohort F and cohort D

Parameter	Phase	Cohort F (Mean ± SD)	Cohort D (Mean ± SD)	Interpretation
SBP	Baseline	126.60 ± 4.39	128.80 ± 3.29	Comparable at baseline
	2–5 min	121.30–121.15 mmHg	131.35–127.35 mmHg	Significantly lower in Group F (p < 0.01)
	7–15 min	120.95–121.90 mmHg	116.95–114.05 mmHg	Stabilization observed in both groups
DBP	Baseline	81.70 ± 3.61	84.35 ± 3.86	Slightly lower in Group F (p = 0.002)
	2–5 min	78.75–80.50 mmHg	89.05–85.80 mmHg	Lower in Group F (p < 0.001)
	7–15 min	81.30–79.85 mmHg	81.90–80.40 mmHg	Values converged over time
MAP	Baseline	92.45 ± 3.69	95.00 ± 2.30	Higher in Group D initially (p = 0.0001)
	2–5 min	89.60–88.10 mmHg	100.62–95.15 mmHg	Significantly lower in Group F (p < 0.01)
	7–15 min	91.20–90.45 mmHg	91.15–88.02 mmHg	MAP comparable in both groups

Heart rate response was consistently attenuated in cohort F compared to cohort D from 3 to 11 minutes following intubation ($p < 0.01$). While both groups exhibited transient tachycardia immediately after intubation, cohort F demonstrated quicker stabilization and maintenance of near-baseline heart rate levels, suggesting superior suppression of sympathetic stimulation. This pattern indicates that fibreoptic bronchoscopy induces less hemodynamic stress than direct laryngoscopy, aligning with trends seen in cardiovascular parameters (Table 3).

Table 3: Comparison of Heart Rate Between Cohort F and cohort D

Phase	Cohort F (Mean ± SD)	Cohort D (Mean ± SD)	P value	Observation
Baseline	77.25 ± 4.47	77.90 ± 3.29	0.462	Comparable baseline HR
Induction	75.00 ± 3.89	73.45 ± 3.20	0.058	No significant difference
1 min	86.00 ± 5.30	87.05 ± 3.26	0.289	Transient rise post-induction
2–5 min	83.80–78.90	88.85–87.05	< 0.0001	HR significantly lower in Group F
7–15 min	77.70–77.15	85.05–81.05	< 0.0001	Sustained lower HR in Group F

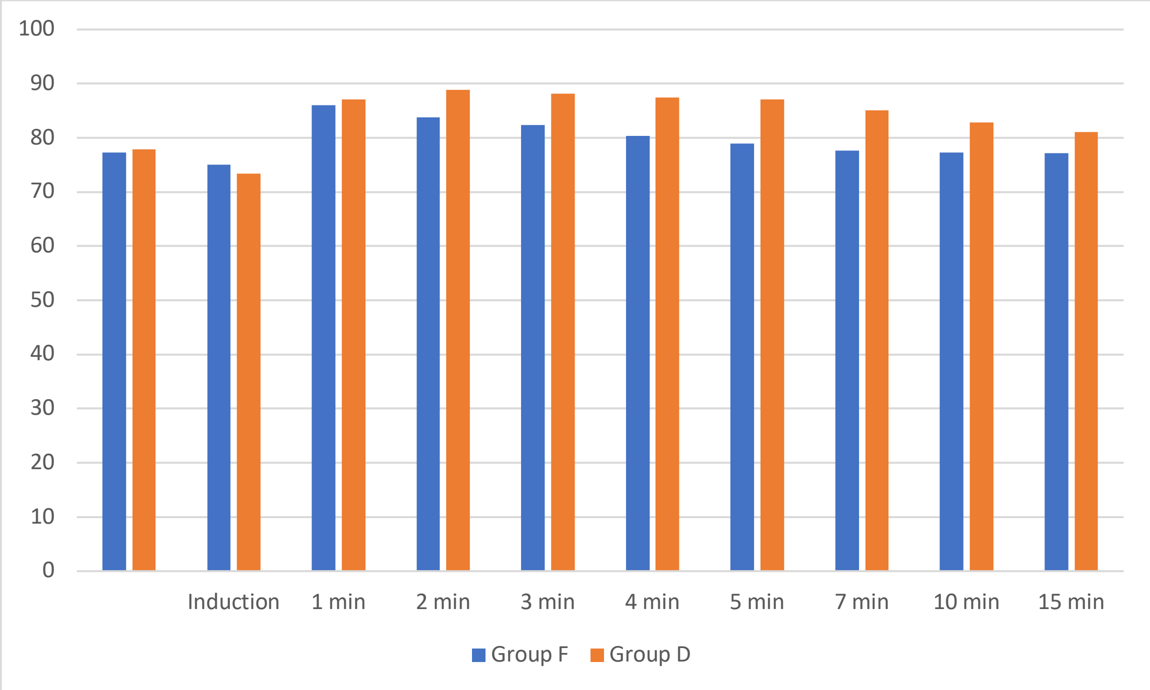

Figure 2: Heart Rate Changes at Different Time Intervals

Discussion

The present randomized clinical trial compared haemodynamic responses during intubation performed with a flexible fibreoptic bronchoscope (Group F) versus direct laryngoscopy (Group D) under general anaesthesia. The results demonstrated that fibreoptic-guided intubation produced significantly lower systolic, diastolic, and mean arterial pressures, along with reduced heart rate elevations, particularly during the first five minutes post-intubation. These findings indicate that fibreoptic intubation provides greater cardiovascular stability, likely due to less mechanical stimulation of the oropharyngeal and laryngeal structures compared with traditional laryngoscopy [10,11]. Several previous studies have consistently reported the haemodynamic blunting effect of dexmedetomidine. Sulaiman et al. [12] and Jain et al. [13] showed that dexmedetomidine in doses of 0.5–1.0 µg/kg administered over 10 minutes before induction effectively suppresses the pressor response to laryngoscopy and intubation. The current study aligns with these findings, demonstrating a notable attenuation of sympathetic parameters such as heart rate and blood pressure following dexmedetomidine premedication, confirming its role in maintaining cardiovascular stability during airway manipulation.

Khudad et al. [14] reported comparable haemodynamic outcomes between fibreoptic bronchoscopy and direct laryngoscopy; however, the present results revealed a comparatively lower stress response in the fibreoptic group. Similarly, Aghdaii et al. [15] found that although intubation time was shorter with direct laryngoscopy, haemodynamic differences between the techniques were not statistically significant. The diminished stress response observed with fibreoptic intubation in the present study may be due to minimal airway irritation and reduced stimulation compared with conventional methods.

Additionally, Jain et al. [13] observed that dexmedetomidine markedly decreased sympathetic responses—including heart rate and blood pressure—compared to fentanyl. In the present trial, premedication with dexmedetomidine 0.5 µg/kg infused over 10 minutes produced similar effects, corroborating the observations of Sulaiman et al. [12] and Gandhi et al. [16]. The incidence of bradycardia or hypotension was minimal, highlighting the haemodynamic safety of this dosage when used as a pre-induction adjunct.

The choice of anaesthetic agents and premedications also influences the cardiovascular response to intubation. While Aghdaii et al. [15] employed lorazepam and morphine, and Khudad et al. [14] used fentanyl, pancuronium, and thiopental, the present study used propofol, butorphanol, and succinylcholine followed by atracurium, with maintenance via sevoflurane and nitrous oxide. Despite these pharmacological differences, dexmedetomidine consistently demonstrated superior suppression of haemodynamic fluctuations, underscoring its efficacy in reducing peri-intubation stress responses.

Conclusion

The present randomized clinical trial demonstrated that intubation performed using a flexible fibreoptic bronchoscope result in significantly greater haemodynamic stability compared to direct laryngoscopy in patients undergoing general anaesthesia with dexmedetomidine premedication. Fibreoptic-guided intubation produced lower systolic, diastolic, and mean arterial pressures, as well as attenuated heart rate responses, particularly during the critical 2–5 minutes following intubation, indicating reduced sympathetic stimulation and smoother airway management. These findings suggest that the fibreoptic technique, by minimizing mechanical stress on the airway, offers a safer alternative for patients at risk of cardiovascular fluctuations, such as those with hypertension or ischemic heart disease. While both methods eventually achieved comparable haemodynamic recovery by 15 minutes, the superior early stability associated with fibreoptic bronchoscopy underscores its clinical advantage in maintaining perioperative cardiovascular control and enhancing patient safety.

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