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Original Research Article

A Prospective Randomised Double-Blind Study to Compare the Effects of Nalbuphine and Fentanyl on Intubating Condition during Awake Fibreoptic Bronchoscopy Guided Intubation

Maina Singh[1], Kuldeep Jonwal[2], Shubham Khandelwal[3], Kuldeep Verma[4]

[1]Professor, Department of Anaesthesiology and Critical Care, Jawahar Lal Nehru Medical College, Ajmer

[2]Assistant professor, Department of Anaesthesiology and Critical Care, Jawahar Lal Nehru Medical College, Ajmer

[3]Associate Professor, Department of Anaesthesiology and Critical Care, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan

[4]Post Graduate student, M.D. Anaesthesia, Department of Anaesthesiology and critical care, Jawahar Lal Nehru medical College Ajmer

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Corresponding author: Dr. Kuldeep Verma

Conflict of interest: Nil

Abstract

Background and Aims: Awake fibreoptic intubation (AFOI) is the gold standard for managing anticipated difficult airways. Optimal intubating conditions require adequate sedation, suppression of airway reflexes, patient comfort, and haemodynamic stability without compromising spontaneous ventilation. This study compared the effects of intravenous nalbuphine and fentanyl on intubating conditions during AFOI.

Methods: In this prospective, randomised, double-blind study, 60 ASA physical status I–II adult patients undergoing elective surgery with anticipated difficult airway were allocated into two groups (n = 30 each). Group N received nalbuphine 0.2 mg/kg IV and Group F received fentanyl 2 µg/kg IV, both infused over 10 min before AFOI. All patients received standard topical anaesthesia and sedation protocol. Intubating conditions were assessed using cough score, patient comfort score, and post-intubation tolerance score. Haemodynamic parameters were recorded at baseline, during, and after intubation.

Results: Fentanyl produced significantly better cough suppression ($p < 0.05$) and higher comfort scores compared to nalbuphine, with improved post-intubation tolerance. Haemodynamic responses were attenuated in both groups, but fentanyl provided greater stability in heart rate and blood pressure. Sedation scores were comparable. No major adverse events occurred in either group.

Conclusion: Both nalbuphine and fentanyl are effective for sedation during AFOI. Fentanyl offers superior cough suppression, patient comfort, and haemodynamic stability, making it a preferred choice in patients without contraindications.

Keywords: Awake Fibreoptic Intubation, Nalbuphine, Fentanyl, Sedation, Difficult Airway.

Introduction

Endotracheal intubation is a fundamental airway management procedure that ensures airway patency, facilitates adequate oxygenation and ventilation, and protects against aspiration in a variety of clinical situations.[1] It is indicated in conditions such as respiratory failure, airway obstruction, altered sensorium, cardiac arrest, major trauma, and during general anaesthesia.[2]

Orotracheal intubation using direct laryngoscopy remains the most commonly employed technique owing to its simplicity and rapidity; however, the laryngoscopy stimulus may cause a marked sympathetic surge, resulting in tachycardia and hypertension, which can be detrimental in patients with cardiovascular or cerebrovascular disease.[3] Alternative approaches, such as nasotracheal intubation, video laryngoscopy, and flexible fibreoptic bronchoscope-guided intubation, are preferred in specific clinical situations and difficult airway scenarios.[4]

Awake fibreoptic intubation (AFOI) is considered the gold standard in anticipated difficult airway, cervical spine instability, restricted mouth opening, maxillofacial trauma, and in situations where airway patency must be preserved during intubation.[5] AFOI allows spontaneous breathing

and minimal airway manipulation but can provoke coughing, discomfort, and haemodynamic fluctuations.[6] Therefore, adequate airway preparation, topical anaesthesia, and conscious sedation are essential to facilitate patient comfort, suppress airway reflexes, and maintain stable haemodynamics without compromising ventilation.[7]

Several pharmacological agents, including benzodiazepines, propofol, α-2 adrenoceptor agonists, and opioids, have been utilised to optimise sedation for AFOI, each with specific advantages and limitations.[8,9] Nalbuphine, a κ-opioid receptor agonist and μ-opioid receptor antagonist, provides analgesia and sedation without significant respiratory depression.[10] Fentanyl, a potent μ-opioid agonist, blunts airway reflexes and haemodynamic responses but may cause respiratory depression and other opioid-related side effects.[11]

Given the distinct pharmacodynamic profiles of these agents, the present prospective, randomised, double-blind study was designed to compare nalbuphine and fentanyl with respect to intubating conditions, patient comfort, tolerance to intubation, haemodynamic responses, sedation levels, and side effects during awake fibreoptic bronchoscopy-guided intubation.

Material and Methods

This prospective, randomised, double-blind controlled study was conducted in the Department of Anaesthesiology, Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer, after obtaining approval from the Institutional Ethics Committee and Research Review Board. Written informed consent was obtained from all participants before enrolment.

Sixty ASA I/II patients of either sex, aged 20–60 years, weighing 30–60 kg, and scheduled for elective surgery under general anaesthesia with endotracheal intubation were included. Exclusion criteria were: refusal to participate, uncooperative patients, history of drug allergy, pre-existing asthma, renal or hepatic dysfunction, morbid obesity, and pregnancy or lactation. Patients were randomly allocated to two groups of 30 each using the sealed-envelope method. Group N received nalbuphine 0.2 mg/kg IV and Group F received fentanyl 2 μg/kg IV, both administered over 10 min. The study drugs were prepared in equal volumes by an independent anaesthesiologist not involved in subsequent study conduct. Both patients and observers were blinded to group allocation.

All patients underwent a pre-anaesthetic evaluation the day prior to surgery, including medical history, physical examination (Mallampati grade, thyromental distance, BMI, vitals), and routine laboratory investigations. Premedication included intravenous ranitidine 50 mg and ondansetron 4 mg, given 30 min before surgery. Patients were kept nil per orally for 8–10 h before the procedure. On arrival in the operating room, standard monitors (ECG, NIBP, SpO_2) were attached and baseline parameters recorded. Glycopyrrolate 0.004 mg/kg IV was given as antisialagogue. The more patent nostril was selected after assessment. Xylometazoline 0.1% nasal drops were instilled in both nostrils, and 2% lignocaine jelly was applied to the fibreoptic bronchoscope and endotracheal tube. Bilateral superior laryngeal nerve blocks were performed with 1.5 ml of 2% lignocaine per side, followed by transtracheal injection of 2 ml 2% lignocaine. Nebulisation with 4 ml of 4% lignocaine was performed over 15 min, and 10% lignocaine spray (20 mg) was applied to the posterior tongue and hypopharynx.

A 5.0-mm flexible fibreoptic bronchoscope (Karl Storz, Germany) pre-loaded with an appropriately sized cuffed endotracheal tube (6.0–6.5 mm females, 6.5–7.0 mm males) was used. The Ramsay Sedation Score (RSS) was recorded after infusion of the study drug; awake fibreoptic intubation was performed when RSS $\geq$ 2. If RSS 2 was not achieved, incremental propofol boluses (20 mg) were given. Intubation was performed via the nasal route, and supplemental oxygen was administered via a nasopharyngeal airway in the opposite nostril. After vocal cord visualisation, aliquots of 2 ml 2% lignocaine were sprayed before advancing the scope to the carina. The tracheal tube was railroaded over the bronchoscope, placement confirmed by capnography, and general anaesthesia was induced as per standard protocol.

Primary outcomes Measures: cough score, intubation comfort score, and post-intubation tolerance score.

Secondary outcomes Measures: haemodynamic parameters (HR, SBP, DBP, MAP, SpO_2) at predefined time intervals, RSS, and adverse effects.

Statistical Analysis: Continuous data were expressed as mean ± SD and compared using Student's t-test. Categorical variables were expressed as numbers (%) and compared using Chi-square or Fisher's exact test. A p value < 0.05 was considered statistically significant. Data were analysed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA).

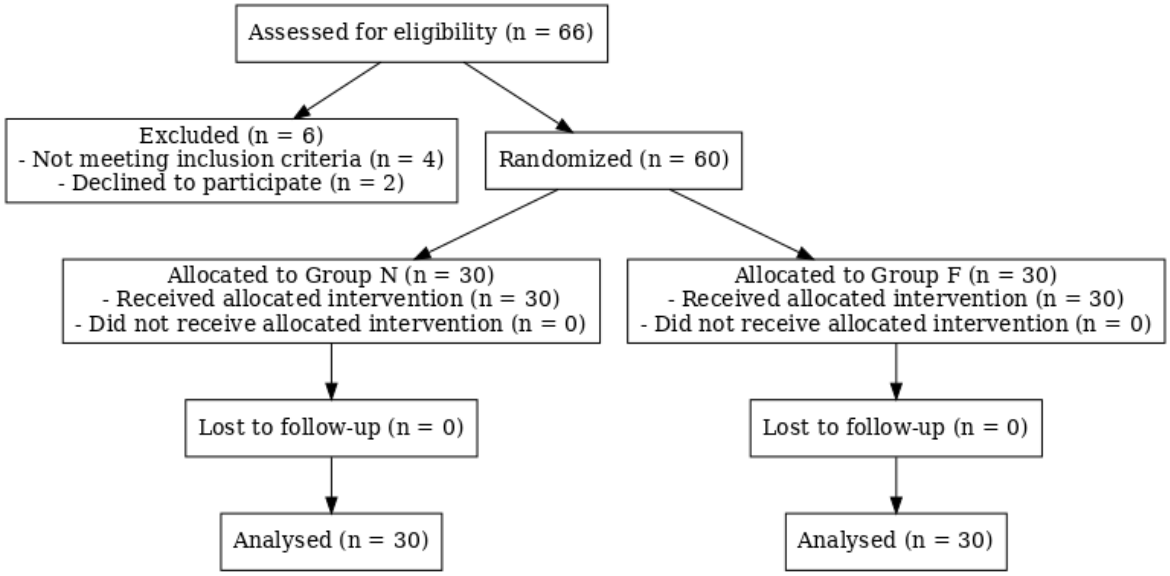


Figure 1:

Results

A total of 66 patients were assessed for eligibility, of which six were excluded (four not meeting inclusion criteria, two declined to participate). Sixty patients were randomised equally into two groups (Group N, n = 30; Group F, n = 30) and all completed the study. The CONSORT flow diagram is shown in Figure 1.

The mean age of patients in Group N was 46.52 ± 10.55 years and in Group F was 48.91 ± 11.25 years. The difference was not statistically significant ($p = 0.399$), indicating that the groups were comparable for age. Gender distribution was also comparable, with females constituting 40% in Group N and 43.33% in Group F ($p = 0.793$). ASA physical status grades I and II were similarly distributed between groups ($p = 0.795$). Mean body weight did not differ significantly between the groups (66.14 ± 7.48 kg vs 65.06 ± 6.68 kg, $p = 0.557$).

Mallampati classification, interincisal gap, and thyromental distance were comparable between the two groups ($p > 0.05$ for all). The mean time for intubation was 95.25 ± 2.15 s in Group N and 94.42 ± 2.24 s in Group F, with no statistically significant difference ($p = 0.148$).

The distribution of cough scores differed significantly between groups ($p = 0.027$), with a higher proportion of patients achieving cough score ≤ 2 in Group F compared to Group N (93.33% vs 66.67%, $p = 0.023$). Similarly, the intubation comfort score was significantly better in Group F, with 93.33% achieving score ≤ 2 compared to 63.33% in Group N ($p = 0.012$).

Post-intubation tolerance score was also significantly better in Group F, with more patients scoring 1 (56.67% vs 26.67%, $p = 0.036$). Ramsay Sedation Score was 2 in all patients in both groups, with no intergroup difference.

Baseline heart rate, systolic BP, diastolic BP, and mean arterial pressure (MAP) were comparable between groups ($p > 0.05$). Just after intubation, Group N showed significantly higher heart rate (78.26 ± 3.99 vs 72.65 ± 2.65 bpm, $p < 0.0001$), systolic BP (128.81 ± 13.95 vs 121.35 ± 13.39 mmHg, $p = 0.038$), diastolic BP (76.15 ± 6.25 vs 72.17 ± 7.27 mmHg, $p = 0.026$), and MAP (89.72 ± 8.05 vs 84.96 ± 8.83 mmHg, $p = 0.033$) compared to Group F.

In intragroup analysis, post-intubation increases in HR, SBP, DBP, and MAP were statistically significant in Group N, whereas Group F did not show significant changes except for a mild, non-significant rise.

No patient in either group developed bradycardia, pruritus, or postoperative nausea/vomiting. Hypotension occurred in two patients in Group N and three patients in Group F.

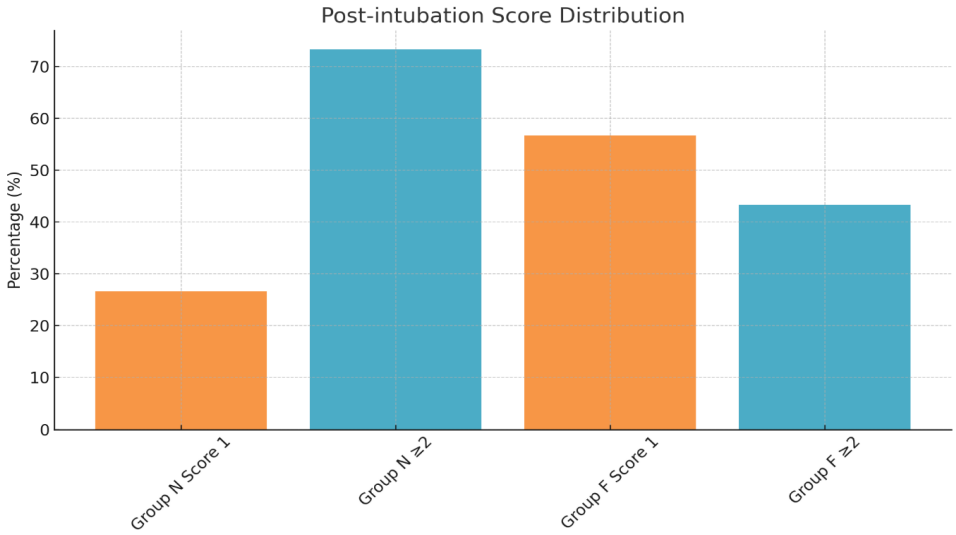
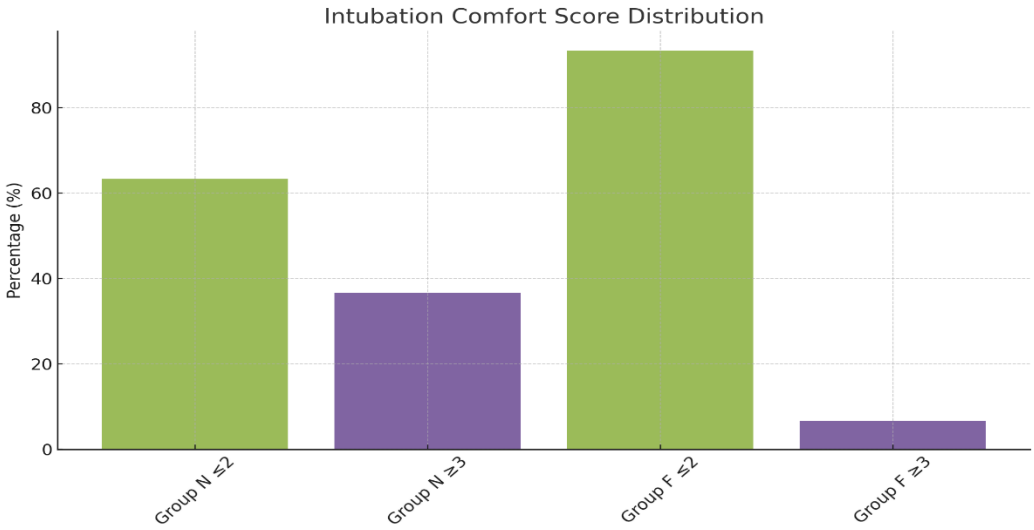


Figure 1:



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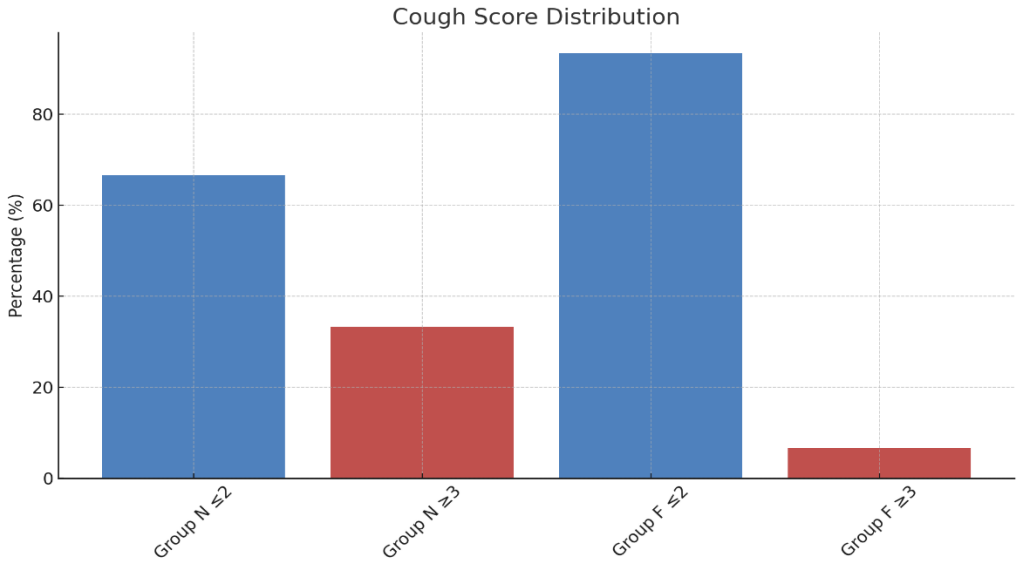

Figure 3:

Discussion

This prospective, randomized, double-blind trial compared nalbuphine and fentanyl for awake fibreoptic bronchoscopy-guided intubation (AFOI). Primary outcomes included cough suppression, intubation comfort, and post-intubation tolerance; secondary outcomes assessed sedation, hemodynamic stability, and adverse events. Demographic characteristics and baseline airway parameters were comparable, minimizing confounding influences.

Intubation time was similar between groups (nalbuphine 95.25 ± 2.15 s, fentanyl 94.42 ± 2.24 s; P = 0.148), consistent with Chaudhary et al. who found procedural duration largely dependent on operator skill and airway preparation rather than drug choice [9]. Cough suppression was superior with fentanyl (score ≤ 2 in 93.3% vs. 66.7%, P = 0.023), likely due to potent μ-opioid receptor agonism blunting airway reflexes [12, 13].

Intubation comfort was also better with fentanyl (93.3% vs. 63.3%, P = 0.012), aligning with findings by Kaur et al. [14]. Post-intubation tolerance was higher with fentanyl (56.7% vs. 26.7%, P = 0.036), reflecting sustained analgesia [12]. Sedation levels (RSS = 2 in all patients) were equivalent, in agreement with Johnston et al., highlighting balanced sedation as essential for AFOI [15].

Hemodynamic responses favoured fentanyl, with significantly lower post-intubation heart rate (P < 0.0001), SBP (P = 0.038), DBP (P = 0.026), and MAP (P = 0.033) compared to nalbuphine, corroborating reports by Khanday et al. [16], Akheela & Chandra [17], and Elsabeeny et al. [18]. Nalbuphine's mixed agonist–antagonist profile may permit greater sympathetic activation.

Adverse events were infrequent and comparable; mild hypotension occurred slightly more often with fentanyl, without significant differences, supporting the safety of both drugs [9].

Overall, fentanyl provided better airway reflex suppression, patient comfort, and hemodynamic control during AFOI, while nalbuphine offered comparable sedation with minimal side effects.

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