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Nebulised Versus Intravenous Dexmedetomidine for Awake Fibreoptic Bronchoscope-Guided Intubation in Head and Neck Surgery: A Prospective, Double-Blind, Randomised Clinical Trial

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Abstract

Introduction: Awake fibreoptic intubation (AFOI) is gold standard for anticipated difficult airway management and allows for airway instrumentation while maintaining patient's respiratory drive through right sedative regimen. Nebulisation with dexmedetomidine offers a needle-free, patient-friendly approach and reduced systemic side effects. The aim of study was to compare sedative effect of IV dexmedetomidine with nebulised dexmedetomidine by obtaining 5-point intubation comfort score for AFOI in patients undergoing head and neck surgery. The secondary objective was to record haemodynamic variables, intubation time, coughing response, Ramsay Sedation Score (RSS), incidence of postoperative sore throat, and. future willingness.

Methods: This prospective, double-blind, randomised trial was conducted in 128 patients undergoing head and neck surgery under general anaesthesia. Patients were randomly allocated into two groups (n=64 each) and nebulised preoperatively: Group I received IV dexmedetomidine 1 µg/kg diluted in 50 mL of normal saline (NS), infused using a syringe pump, along with nebulised 4% lignocaine (2.5 mL) diluted with NS to a total volume of 5 mL. Group N received 50 mL of IV NS infused intravenously through a syringe pump and nebulised dexmedetomidine 1 µg/kg combined with 4% lignocaine (2.5 mL), diluted with NS to a total volume of 5 mL. Dexmedetomidine was administered as a fixed single dose in both groups, without subsequent doses. Intraoperative haemodynamic parameters were monitored. Intubation response was assessed by coughing and 5-point intubation comfort score. RSS was also assessed. Statistical analysis was done using chi-square test and student t-test, p-value <0.05 was considered significant.

Results: Both groups were demographically comparable in terms of age, gender, and weight. Group N showed better 5-point intubation comfort score (Group N: No reaction - 22, slight grimacing - 32, heavy grimacing - 6, while in Group I, it was exhibited by 6, 38, and 12 patients, respectively) and the difference was statistically significant (p = 0.008), and lesser coughing (Group N: no coughing - 37, slight- 23, moderate to severe - 4, while in Group I, it was exhibited by 8, 33, and 23 patients, respectively) and RSS demonstrated deeper sedation in Group I as compared to Group N (lower sedation scores were predominantly seen in Group N (26.6% and 67.2%), whereas higher scores were more frequent in Group I (54.7% and 26.6%) . Postoperative sore throat was absent in 58 (90.6%) patients in Group N compared to only 16 (25.0%) in Group I. Sore throat was reported in 6 patients in Group N and 48 patients in Group I and the difference was highly significant (p < .001).

Conclusion: Results of this study support nebulised dexmedetomidine due to its ease of administration and stable haemodynamic effects as a noninvasive alternative to IV administration for sedation during awake fibreoptic nasotracheal intubation (AFONI).

Categories: Anesthesiology
Keywords: airway management, awake fibreoptic intubation, dexmedetomidine, intravenous vs nebulization, nebulization and airway

Introduction

Airway management is a cornerstone of safe anaesthetic practice. Awake fibreoptic intubation (AFOI) stands out as one of the most reliable and versatile approaches and is considered the gold standard for managing difficult airways, while preserving spontaneous ventilation [1]. This is especially crucial in scenarios where the risk of "cannot intubate, cannot ventilate" is high [2].

It is primarily indicated in anticipated difficult airways and in patients with severe cardiorespiratory compromise where induction of general anaesthesia may pose significant risk. [3]. Airway anaesthesia is

commonly achieved using nebulised local anaesthetics because they are simple, noninvasive, and provide widespread mucosal coverage. However, nebulisation alone may not consistently produce satisfactory intubating conditions, and supplemental airway blocks or the "spray-as-you-go" (SAYGO) technique via the bronchoscope channel may be required [4]. In addition, sedation is also often required.

Dexmedetomidine is well suited for AFOI because it provides cooperative sedation with minimal respiratory depression and can be administered intravenously, intranasally, or by nebulisation [5]. The IV route has traditionally been the standard method of administration for dexmedetomidine in clinical settings, offering predictable pharmacokinetics and rapid onset. However, IV administration can lead to haemodynamic fluctuations such as bradycardia and hypotension. Additionally, IV access may be cumbersome or contraindicated in certain clinical situations, prompting the need for alternative routes of administration [6].

In recent years, the nebulised route has gained attention as a noninvasive, needle-free, and patient-friendly approach for dexmedetomidine administration [7]. Nebulised dexmedetomidine suppresses airway reflexes through local α_2-adrenergic receptor activation and, following systemic absorption, produces cooperative sedation by acting on the locus coeruleus [8]. Previous studies have demonstrated its efficacy in attenuating the haemodynamic response to laryngoscopy and reducing postoperative sore throat, indicating effective airway mucosal deposition [9,10]. Furthermore, dexmedetomidine has consistently enhanced the efficacy of local anaesthetics when used as an adjuvant in peripheral nerve blocks, neuraxial anaesthesia, and local infiltration. These findings raise the possibility that nebulised dexmedetomidine may similarly augment airway topical anaesthesia when combined with nebulised local anaesthetic during AFOI. However, this potential benefit, particularly in comparison with IV dexmedetomidine, remains largely unexplored.

Although both IV and nebulised dexmedetomidine have been used to facilitate AFOI, direct comparisons between these two routes remain limited. We hypothesised that adding dexmedetomidine to nebulised local anaesthetic would improve airway topicalisation and suppress airway reflexes, resulting in better patient comfort during intubation. We also postulated that nebulised dexmedetomidine would provide adequate sedation through mucosal absorption while avoiding the deeper systemic sedation associated with IV administration. Therefore, this study compared dexmedetomidine mixed with a local anaesthetic and administered via nebulisation with IV dexmedetomidine administered alongside a local anaesthetic via nebulisation. The primary outcome was patient comfort during intubation, while secondary outcomes included sedation, intubation characteristics, haemodynamic responses, and willingness to undergo the procedure again if required.

Materials And Methods

This prospective, randomised, double-blind, single-centre study was conducted after obtaining approval from the Institutional Ethics Committee (IEC) letter no.55 (ECR/769/INST/JH/2015/RR-21) dated January 27, 2025, and registration with the Clinical Trials Registry-India (CTRI/2025/03/083229). Written informed consent was obtained from the patients for the participation in study. The study was carried out according to the principles of the Declaration of Helsinki (2013) and good clinical practices.

Patients were included and excluded as per study protocol (Table *1*).

Inclusion criteria	Exclusion criteria
The patient giving written and informed consent for study.	Patients with severe renal or hepatic impairment.
Patient posted for elective head and neck surgeries requiring elective nasal intubation.	Patient having any intra oral mass or having any predisposition to intra oral bleeding.
All those patients having anticipated difficult airway.	Patients with history of alcohol or drug addiction.
Patients with ASA grade I and II.	Patients having allergy to the study drugs or with cognitive impairment or communication problem.
Male and female patients aged between 18-70 years	All pregnant and lactating females

TABLE 1: Inclusion and exclusion criteria for patients as per study protocol

ASA: American Society of Anesthesiologists

Randomisation was performed using computer-generated random numbers. The medication for nebulisation was prepared by an anaesthesiologist, who was not associated with study. To ensure double blinding, the patient and the anaesthesiologist recording the data were not aware of the group allocation. Allocation

concealment was done using sequentially numbered opaque sealed envelopes that were opened in the operating room by the anaesthesiologist who prepared the drug. 128 patients were assessed for the eligibility criteria and selected. They were randomly assigned into two groups of 64 patients each, irrespective of age and sex. Random distribution of patients into two groups was done by computer-generated number. Fibreoptic intubation was carried out by a senior anaesthesiologist well trained for it.

Adequate nil per os protocols were followed according to American Society of Anesthesiologists (ASA) guidelines (2 hours - clear liquid, 6 hours - light meal, and 8 hours - heavy meal). After taking the patient on the operation table, monitors (noninvasive blood pressure, oxygen saturation (SpO_2), ECG, end tidal carbon dioxide ($EtCO_2$)) were attached. Two 18G IV access was taken on right and left forearm with approximately 200 mL Ringer's lactate bolus on flow. Simultaneously, baseline parameters of all the patients including heart rate (HR), systolic blood pressure, diastolic blood pressure, and SpO_2 was noted. Patients were premedicated with inj. glycopyrrolate 5 µg/kg IV and inj. ondansetron 0.1 mg/kg IV. Two drops of oxymetazoline 0.05% nasal drops and lidocaine jelly were applied to each nostril. Subsequently, on both nostrils, an adequate size of nasal airway was used to check patency of the nostrils. Oxygenation via nasal cannula with oxygen flow of 2-4 L/min was administered.

The bilateral superior laryngeal nerve was blocked at level of greater cornu of hyoid bone with 2 ml 2% lignocaine and recurrent laryngeal nerve was blocked by transtracheal approach at cricothyroid membrane using a 22G needle attached to a 5 ml syringe. After piercing the membrane, the free air aspiration was confirmed, and 4 ml of 2% lignocaine was injected.

The light cord and functional suction catheter were attached, and fibreoptic bronchoscope was prepared for intubation simultaneously. Before insertion, an oxygen source was connected, and a lubricated appropriate size (6.5 for females and 7 for males) endotracheal tube was threaded over fiberscope.

An anaesthesiologist who was not part of the study prepared the drug, opened the sequentially numbered opaque sealed envelopes in the operating room, and subsequently administered the drug intravenously or by nebulisation. Both the study groups were given nebulisation and I.V 50 ml NS infusion.

Group I (n = 64) received IV dexmedetomidine 1 µg/kg in volume of 50 ml NS + (nebulisation with 4% lignocaine 2.5 ml + normal saline (NS) made up to 5 ml)

Group N (n = 64) received IV NS 50 ml + (nebulisation with dexmedetomidine 1 µg/kg + 4% lignocaine 2.5 ml made up to 5 ml)

HR and mean arterial pressure (MAP) was noted at baseline, after drug loading dose at 2, 4, 6, 8, and 10 minutes, prior to fibreoptic intubation and then at 2,4,6,8, and 10 minutes following fibreoptic intubation.

Endotracheal tube placement was confirmed by fibreoptic scope and recording of $EtCO_2$, and then the tube was fixed.

After this, general anaesthesia was given, using inj. propofol 2 mg/kg IV followed by inj. vecuronium 0.1 mg/kg. For maintenance, O_2 + N_2O with sevoflurane and inj. vecuronium 0.02 mg/kg were used. Analgesia was achieved with inj. fentanyl 1.5 mcg/kg loading dose and maintained with inj. fentanyl 0.5 mcg/kg every 40 minutes.

N_2O and anaesthetic agents were terminated 10 minutes before completion of surgery and 100% oxygen was used for ventilation.

On resumption of spontaneous breathing, remaining neuromuscular blockade was reversed by inj. neostigmine 50 µg/kg and inj. glycopyrrolate 6 µg/kg. Patient was ventilated with 100% oxygen at a fresh gas flow of 4-6 L per minute and extubated after spontaneous breathing pattern was established. Patient was subsequently transferred to postanaesthesia care unit.

The primary outcome measure was 5-point fibreoptic intubation comfort score to assess patient tolerance (score 1 = no reaction; score 2 = slight grimacing; score 3 = heavy grimacing; score 4 = verbal objection; score 5 = defensive movements of head and hands) [11]. Ramsay Sedation Score (RSS) was used to evaluate sedation at the start of airway manipulation [12]. Time from insertion of fibreoptic bronchoscope to appearance of first $EtCO_2$ graph was noted as intubation time. Required SAYGO boluses were also noted down. In addition, coughing (1 = none, 2 = slight, 3 = moderate, 4 = severe); Vocal cord movement (1 = closed, 2 = moving, 3 = open) during intubation was also noted. The duration of surgery was also noted [13].

At postoperative day 1 patient were asked a questionnaire regarding complain of sore throat and future willingness for AFOI.

Statistical analysis

Sample size was based on the clinical assumption that the nebulised administration formula of drug may have the better outcome in 5-point fibreoptic intubation comfort score for 25% better in the nebulised group compared to IV group. Keeping these parameters with 80% power and 5% alpha, the sample size was calculated as 64 per group (total sample size 128) based on the formula: $n = \frac{16p(100-p)}{d^2}$ [14].

Data were entered into MS Excel and analysed using the Statistical Product and Service Solutions (IBM SPSS, version 22.0, NY) which is a licensed statistical software and access was obtained through an individual license. Continuous quantitative variables were analyzed using Mann-Whitney U test and are presented as mean, SD, and 95% confidence interval. Categorical data were assessed using the chi-square test. Statistical significance was set at $p < 0.05$.

Results

The present study was conducted on 128 patients aged between 18-70 years, scheduled for head and neck surgery requiring AFOI. Patients were randomly allocated into groups and all patients who were enrolled in the study completed it (Figure 1).

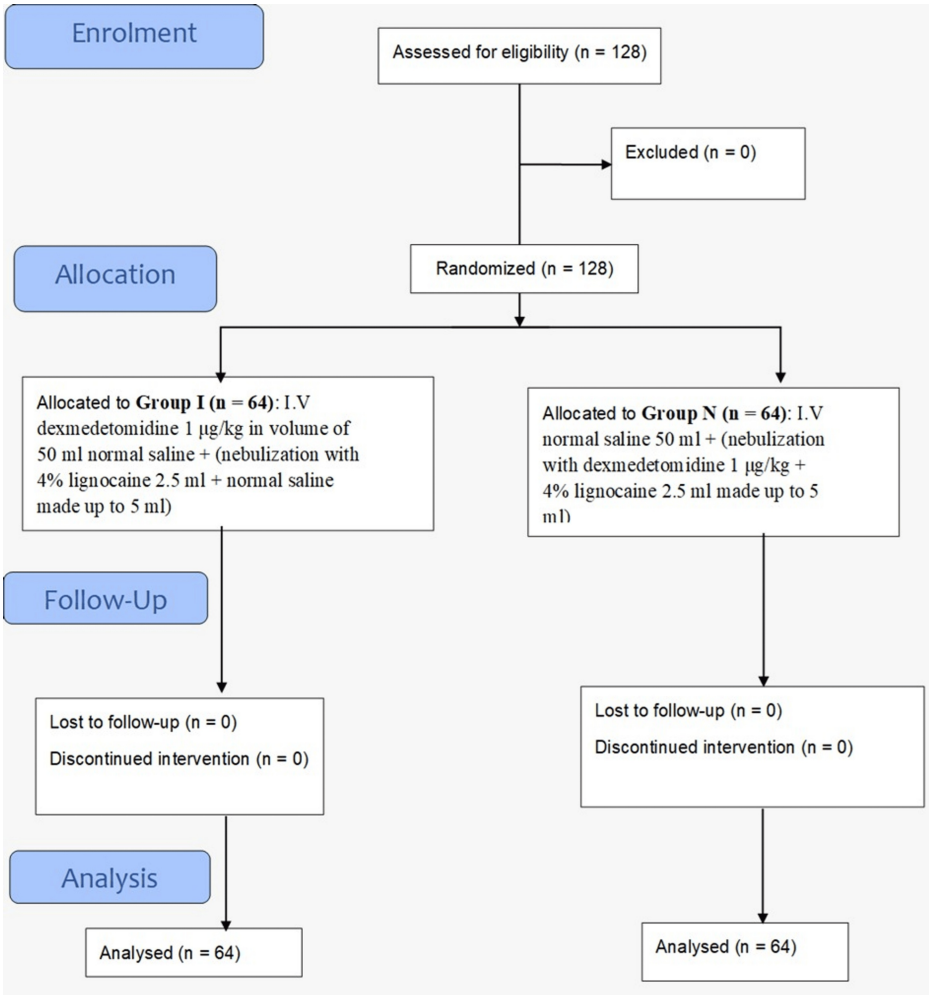


FIGURE 1: Consolidated Standards of Reporting Trials flow chart showing participants in the study

Demographic characteristics

Baseline demographic parameters were comparable between the groups, with no statistically significant differences in age, weight, sex, duration of surgery, or ASA physical status (Table 2).

Variables	Group N (n=64)	Group I (n=64)	Test Statistics	p-value
Age (years)	39.61 ± 15.10	42.22 ± 15.01	U = 1832; Z = -1.03	0.303
Weight (kg)	54.23 ± 9.99	54.81 ± 9.94	U = 2021.5; Z = -0.126	0.899
Sex (F/M)	16/48	20/44	χ^2 = 0.618; df = 1	0.432
Duration of surgery (minutes)	125.00 ± 31.29	126.48 ± 22.81	U = 1969; Z = -0.378	0.705
ASA physical status I/II	31/33	30/34	χ^2 = 0.016; df = 1	0.898

TABLE 2: Demographic profile of study groups

Mann-Whitney U-Test was applied for continuous variables (age, weight, and duration of surgery) and chi-square test for categorical variables (sex, ASA status). $p < 0.05$ was considered statistically significant.

Group N: Nebulisation group; Group I: IV group; ASA: American Society of Anesthesiologists; n: Frequency; F: Female; M: Male; U: Mann-Whitney U statistic; Z: Standardised U statistics; χ^2: Chi-square statistic; df: Degree of freedom

Sedation and intubation outcomes

Statistically significant difference ($p < 0.05$) was observed in 5-point fibreoptic intubation comfort scores with Group N having more patients who had no reaction on fibreoptic intubation. Similarly, Group N had more patients with open vocal cords than Group I ($p = 0.002$). SAYGO boluses were required more in Group I as compared to Group N ($p = 0.033$). Group N had lower incidence of coughing as compared to Group I which was statistically significant ($p < 0.001$). RSS was found to be higher (more than 3) in patients in Group I than Group N which had lower scores (Table *3*).

Variable	Category	Group N n (%)	Group I n (%)	χ^2 value	df	p-value
5-Point Fibreoptic Intubation Comfort Score	No reaction	22 (34.4)	6 (9.4)	13.157	4	0.008
	Slight grimacing	32 (50.0)	38 (59.4)			
	Heavy grimacing	6 (9.4)	12 (18.8)			
	Defensive movements	3 (4.7)	5 (7.8)			
	Verbal objection	1 (1.6)	3 (4.7)			
Vocal Movement	Closed	0 (0.0)	1 (1.6)	12.510	2	0.002
	Moving	5 (7.8)	20 (31.3)			
	Open	59 (92.2)	43 (67.2)			
SAYGO Boluses	No	51(79.7%)	39(60.9%)	5.389	1	0.033
	Yes	13(20.3%)	25(39.1%)			
Coughing	None	37 (57.8)	8 (12.5)	34.141	3	<0.001
	Slight	23 (35.9)	33 (51.6)			
	Moderate	4 (6.3)	20 (31.3)			
	Severe	0 (0.0)	3 (4.7)			
RSS	1	17 (26.6)	3 (4.7)	73.305	3	<0.001
	2	43 (67.2)	9 (14.1)			
	3	2 (3.1)	35 (54.7)			
	4	2 (3.1)	17 (26.6)			

TABLE 3: Comparison of 5-point fibreoptic intubation comfort score, vocal movement, SAYGO boluses, coughing, and RSS between two study groups

Chi-square test was applied for analysis of 5-point fibreoptic intubation comfort score, vocal movement, SAYGO boluses, coughing and RSS.

SAYGO: Spray-as-you-go; RSS: Ramsay Sedation Score; Group N: Nebulisation group; Group I: IV group; χ^2: Chi-square; df: Degree of freedom

Intubation time was found to be comparable between the two study groups with p-value being 0.245 (Table *4*).

Variable	Group N (Mean ± SD)	Group I (Mean ± SD)	U	Z	P-value
Intubation Time (seconds)	162.41 ± 32.71	171.83 ± 41.77	1804.5	-1.162	0.245

TABLE 4: Comparison of intubation time (in seconds) between the two study groups

Mann-Whitney U test was applied for analysis of intubation time.

U: Mann-Whitney U test characteristic; Z: Standardised test statistics

More patients in Group N showed future willingness for AFOI than in Group I (p <0.001), and Group N also had lesser incidence of postop sore throat (Table *5*).

Variables	Category	Group N n (%)	Group I n (%)	χ^2	df	p-value
Future Willingness for AFOI	Yes	53 (82.8)	14 (21.9)	47.636	1	<0.001
	No	11 (17.2)	50 (78.1)			
Postop Sore Throat	No	58 (90.6)	16 (25.0)	56.505	1	<0.001
	Yes	6 (9.4)	48 (75.0)			

TABLE 5: Comparison of future willingness for AFOI and incidence of postop sore throat between the two study groups

Chi-square test was applied for analysis of future willingness for AFOI and incidence of postoperative sore throat.

Group N: Nebulisation group; Group I: IV group; AFOI: Awake fibreoptic intubation, χ^2: Chi-square statistic; df: Degree of freedom

Haemodynamic outcomes

Haemodynamic parameters (HR and MAP) at baseline were comparable in both groups, indicating comparable preintervention status. However, HR was significantly lower after 4 mins in Group I, which persisted at 6, 8, and 10 minutes after drug administration (Figure 2).

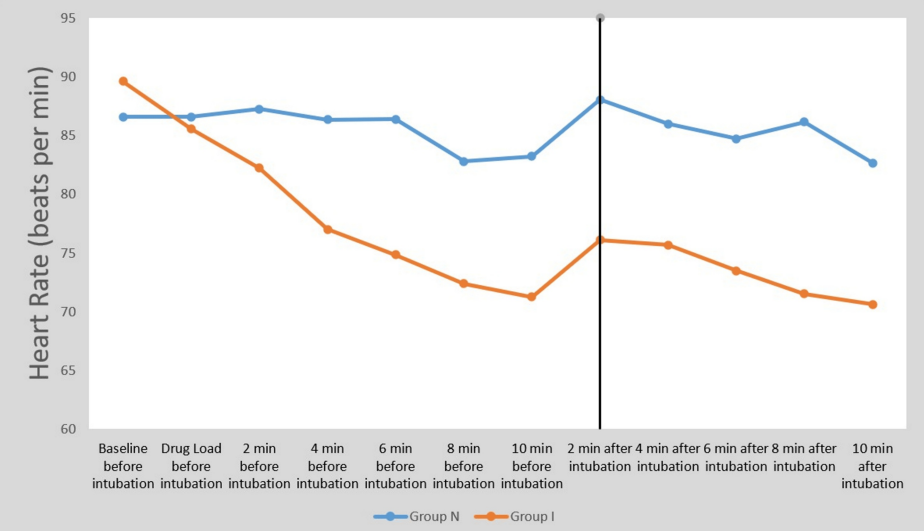


FIGURE 2: Graph showing comparison of HR between the two study groups before and after fibreoptic intubation

Data was analyzed by Mann-Whitney U-test. Vertical black line represents point fibreoptic intubation.

Blue line: Group N (nebulisation group); Orange line: Group I (IV group); HR: Heart rate

Similarly, MAP was also significantly lower at 6, 8, and 10 minutes in Group I. This clearly shows Group N had better haemodynamic stability (Figure 3).

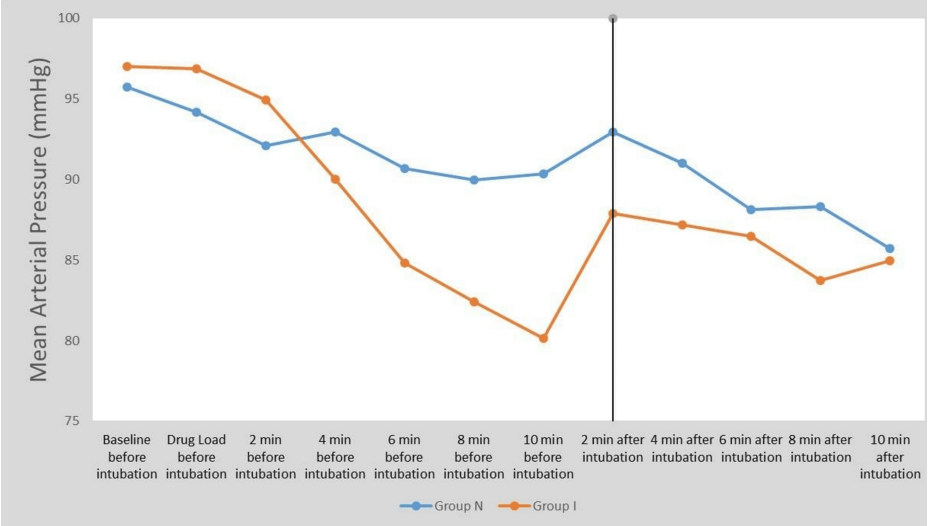


FIGURE 3: Graph showing comparison of MAP between the two study groups before and after fibreoptic intubation

Data was analyzed using Mann-Whitney U-test. Black vertical line in the graph shows point of intubation.

Blue line: Group N (nebulisation group); Orange line: Group I (IV group); MAP: Mean arterial pressure

Discussion

In the present study, patients receiving nebulised dexmedetomidine demonstrated improved, tolerance to fibreoptic bronchoscopy compared with the IV group. This may be attributed to the combined systemic and topical effects of the drug on airway mucosa [8]. Nebulised dexmedetomidine may reduce airway irritation and suppress cough reflex more effectively, facilitating smoother bronchoscope passage [15].

The study conducted by Arora et al. evaluated different doses of dexmedetomidine for awake fibreoptic nasotracheal intubation (AFONI) in patients undergoing oro-maxillofacial and oral malignancy surgeries [13]. Three groups (Group D1, D2, D3) were given IV dexmedetomidine in dose of 0.5 mcg/kg, 1 mcg/kg, and 1.5 mcg/kg respectively. The primary outcome measure was the airway obstruction score, and secondary outcome measures were intubation scores (including vocal movement, coughing, and limb movements) and a 5-point fibreoptic intubation comfort score. Sedation was assessed using the RSS. The airway obstruction score was comparable between the groups ($p = 0.78$). Similarly, vocal movement ($p = 0.15$), coughing ($p = 0.31$), limb movement ($p = 0.51$), and 5-point fibreoptic intubation comfort score ($p = 0.49$) did not differ between the groups. The mean RSS was significantly greater in Group D3 than in Groups D1 and D2 ($p = 0.001$) [13]. However, in the present study, the cough score was lower in nebulised group, and 5-point fibreoptic intubation comfort score showed a significant difference between the two groups.

A study by Grover et al. evaluated the efficacy of nebulised dexmedetomidine in reducing cough during flexible bronchoscopy [15]. The main findings showed a significant reduction in procedural cough episodes, improved patient tolerance, and better bronchoscopist satisfaction in the dexmedetomidine group. Similarly, in our study, we observed lower incidence of coughing during procedure and improved patient tolerance in the nebulised group as compared to IV group. Our study also shows remarkable significance in difference of routes, i.e., IV vs nebulised dexmedetomidine, RSS, SAYGO bolus administration, and postoperative sore throat in the two groups, concluding that nebulised group had more advantages over IV group.

The study conducted by Bhalotra et al. on comparative evaluation of nebulised versus IV dexmedetomidine on intubating conditions during AFONI had the primary outcome measure as the cough score, which was significantly lower in nebulised group (2.43 ± 0.992 vs 3.52 ± 1.082), with $p = 0.001$ [16]. RSS, number of SAYGO boluses required, and the postintubation score were also significantly lower in nebulised group [16]. However, in the present study, the primary outcome was 5-point intubation score which was observed to show better tolerance in Group N as coughing response was significantly greater in Group I. Similarly, the comparison of SAYGO boluses requirement was lower in nebulised group ($p = 0.033$).

An observational cross-sectional study by Yadav et al. evaluated the efficacy of nebulised dexmedetomidine-lidocaine for awake nasotracheal intubation [17]. Primary outcome of cough and gag reflex was assessed on basis of 4-point intubation condition assessment score, which demonstrated superior efficacy of dexmedetomidine-lidocaine nebulisation in providing optimal intubating conditions for AFOI [17].

Similarly, in the present study, 5-point fibreoptic intubation tolerance score showed better patient tolerance in nebulised group along with lower incidence of coughing and vocal cord movement, and better patient satisfaction in Group N as compared to Group I. However, apart from these, our study also evaluated the requirement of SAYGO boluses, which was lower in nebulised group as compared to IV group, proving better efficacy of nebulised dexmedetomidine than IV administration.

Kumar et al. did a prospective randomised study, with the primary goal to evaluate the effects of dexmedetomidine nebulisation in blunting the stress response to laryngoscopy and intubation. It concluded that nebulised dexmedetomidine effectively blunts the stress response to laryngoscopy and intubation with no adverse effects [18]. The present study also observed that no coughing was seen in 37 (57.8%) patients in Group N compared to only eight (12.5%) in Group I. In our study, absence of limb movement was noted in 47 (73.4%) participants in Group N compared to 21 (32.8%) in Group I. Slight and moderate limb movements were more frequent in Group I (51.6% and 15.6%) than in Group N (21.9% and 4.7%). Thus, the study concluded that the patients in nebulisation group experienced lesser stress, as evident from lesser incidence of coughing and absence of limb movements in more patients as compared to Group I.

The randomised, double blind, placebo-controlled study conducted by Niyogi et al. on efficacy of IV dexmedetomidine on patient's satisfaction, comfort, and sedation during AFOI in patients with cervical spondylosis myelopathy posted for elective cervical fixation [19]. Patient's alertness, sedation, and cardiorespiratory changes during the procedure were assessed by the Observer Assessment Awareness and Sedation (OAA/S) scale. On the first postoperative day, patients' comfort during AFOI was assessed by visual analogue scale (VAS). Patients of Group D had an acceptable level of sedation (OAA/S score: 20 to 17 with greater comfort and satisfaction (VAS: 40-60), compared to control group (VAS: 50-90, $P < 0.001$.). Moreover, haemodynamic parameters were less significantly altered in the dexmedetomidine group during AFOI. IV dexmedetomidine infusion during AFOI improved patient's tolerances with an acceptable level of sedation without significant haemodynamic instability and respiratory depression [19]. In the present study, 5-point fibreoptic intubation comfort score was used to assess the patient, which showed better tolerance in Group N as compared to Group I. Also, Group N had lower sedation levels.

Thus, the primary conclusion of the study is that the 5-point fibreoptic intubation comfort score, which was better in Group N, showed that patients being nebulised with dexmedetomidine had better tolerance for awake nasal intubation. Also, Group N had lower sedation score, lower incidence of postoperative sore throat, lesser requirement of SAYGO boluses, lower sedation levels as assessed by RSS score, and thus had overall better patient satisfaction score as compared to Group I. Overall, patients in Group N also showed better acceptance and future willingness for awake intubation than Group I.

Limitations

Despite these encouraging findings, certain limitations of the present study should be acknowledged. The sample size was relatively small, and the study was conducted in a single centre, which may limit generalisability. Additionally, plasma concentrations of dexmedetomidine were not measured, and therefore, the pharmacokinetic differences between the two routes could not be fully evaluated. Other limitations were the sample population of only head and neck surgery and individual variations in airway anatomy. Future studies with larger sample sizes and pharmacokinetic analysis may provide further insight into the optimal dosing and timing of nebulised dexmedetomidine.

Conclusions

Based on the findings of this study, both nebulised and IV dexmedetomidine were effective in providing sedation during AFONI. While IV dexmedetomidine demonstrated a slightly faster onset and marginally better sedation quality, nebulised dexmedetomidine offered the benefits of a noninvasive route of administration and greater haemodynamic stability. Therefore, nebulised dexmedetomidine may represent a safe and effective alternative to IV administration for airway preparation in AFONI.

Thus, the results of this study add to the growing body of evidence supporting nebulised dexmedetomidine as a promising noninvasive alternative to IV administration for sedative effect during AFONI. Its favourable safety profile, ease of administration, and stable haemodynamic effects make it a valuable option in the management of anticipated difficult airways.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mukesh Kumar, Nitesh Sinha, Shio Priye

Critical review of the manuscript for important intellectual content: Mukesh Kumar, Nitesh Sinha,

Shio Priye

Supervision: Mukesh Kumar, Nitesh Sinha, Shio Priye

Acquisition, analysis, or interpretation of data: Kumar Anand, Karuna Mayee

Drafting of the manuscript: Kumar Anand, Karuna Mayee

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. INSTITUTIONAL ETHICS COMMITTEE, RIMS, RANCHI issued approval 55. With reference to your Synopsis Submission no - S/153/24, Titled "A comparison of intravenous Dexmedetomidine vs. Nebulized Dexmedetomidine for awake fiberoptic bronchoscope guided intubation in head and neck surgery: A prospective, double blind, randomized trial" after detailed discussion, the Institutional Ethics Committee accords the final approval. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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