Research Article

Comparison Between Dexmedetomidine and Fentanyl on Intubation Condition During Awake Fibreoptic Bronchoscopic Intubation

Dr Manisha Mund[1], Dr Ambika Prasad Panda[2], Dr Chinmayee Priyadarshini[3], Dr Kamala Kanta Swain [4*], Dr Arpita Jena[5]

[1,2,4,5]Assistant Professor, Department of Anesthesiology. SCB Medical College. Cuttack, India.

[3]Assistant Professor. Department of Pharmacology. SCB Medical College. Cuttack, India.

***Corresponding author's E-mail:** nandasikata2021@gmail.com

Received: 16-04-2024; **Revised:** 28-06-2024; **Accepted:** 10-07-2024; **Published on:** 15-07-2024.

ABSTRACT

Background: Awake fibreoptic intubation is the mainstay for anticipated difficult airway management. Different pharmacological agents have been used for providing conscious sedation for this but each one having own demerits.

Objectives: The aim of this study was to compare the efficacy between dexmedetomidine and fentanyl for conscious sedation in Awake fiberoptic intubation. (AFOI)

Materials and Methods: This prospective randomized double-blind study was done in 60 patients with anticipated difficult airway posted for surgery. Group F received fentanyl 2 mcg/kg infusion over 10 min. Group D received dexmedetomidine 1 mcg/kg infusion over 10 min. AFOI was done in both groups when patients achieved Ramsay sedation score of two. The primary objectives were to assess the endoscopy time and secondary objectives were intubation time, cough score, postintubation score and the hemodynamic responses between the groups receiving the two drugs.

Results: We found that endoscopy time and intubation time were shorter with dexmedetomidine than with fentanyl. Cough score, Ramsay sedation score and post intubation score was low in group D compared to group F. The first ETCO2was significantly higher in group F compared to group D, indicating that fentanyl may have produced more respiratory depression than dexmedetomidine

Conclusion: Dexmedetomidine can be a better alternative to fentanyl to achieve adequate sedation for AFOI.

Keywords: Difficult airway, awake, dexmedetomidine, fentanyl, fiberoptic, intubation.

INTRODUCTION

Awake fibreoptic intubation (AFOI) is the method of choice for definitive airway management in patients with a difficult airway when undergoing surgeries under general anesthesia.[1] Preparing patients for AFOI is an important step that includes anxiolysis, amnesia induction, attenuation of airway reflexes, minimal sedation, and maintaining patent airway and adequate ventilation. The drug used should be safe and easy to titrate with minimal adverse effects.[2] Benzodiazepines (diazepam and midazolam), opioids (morphine, fentanyl, and remifentanil), intravenous induction agents (ketamine and propofol), and alpha-2 agonists (clonidine and dexmedetomidine) have been used alone or in combination to achieve appropriate intubation conditions for AFOI.[3] However, these drugs have certain advantages and disadvantages. Although commonly used midazolam offers minimal sedation with anxiolysis and amnesia, its dose requirement varies and has no effect on the airway reflexes. Fentanyl reduces the discomfort during the passage of the bronchoscope through the vocal cords, maintaining cardiovascular stability; however, fentanyl induces dose-dependent respiratory depression.[4] Propofol exhibits prompt onset and offset of action with intense amnesia but is associated with respiratory depression and increased incidence of hypoxemia when used alone or in combination with another drug. Moreover, at high doses, it causes loss of upper airway tone, causing difficulty in negotiation of the bronchoscope beyond the epiglottis, as well as apnea.[5] Dexmedetomidine is the agent of choice for manyanesthesiologist to achieve sedation in AFOI because of its advantages over the other drugs. It produces profound sedation with easy arousability, without respiratory depression.[6] Furthermore, it has the added advantage of having anxiolytic and analgesic properties. It decreases the salivary secretions, thereby allowing better visualization through the fiberscope. However, it can result in cardiovascular depression causing bradycardia and hypotension. These effects are generally temporary and can be successfully treated with atropine or ephedrine and volume infusions. Hence, our study aimed to find an ideal agent and its appropriate dose for conscious sedation. Our goal was to achieve quick endoscopy and intubation with spontaneous ventilation with stable hemodynamics.

MATERIALS AND METHODS

This was a prospective randomized double-blind trial conducted in a tertiary care hospital in Odisha from Aug 2021 to Aug 2022. The study was approved by the Institutional Ethical Committee. Written informed consent was obtained from all patients. Patients aged 18–65 years with American Society of Anesthesiologists grades 1 and 2 undergoing oral or dental surgeries with anticipated difficult airway (mallampati III/IV) due to limited mouth opening (< two fingers), restriction of neck mobility, or lack of space for laryngoscopy were included. The exclusion

criteria were pregnancy, alcohol/drug use, allergy to the drugs used in this study, cardiovascular abnormalities, severe neurological, hepatic, renal, or pulmonary diseases, and bleeding disorders. All patients were subjected to a pre-anesthetic checkup. Glycopyrrolate 5 µg/kg were administered intravenously (IV) 30 min before the procedure. Lidocaine 4% (4 ml) nebulization was administered for 10 min. In the operation theater, the baseline hemodynamic parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), oxygen saturation, and electrocardiogram findings were recorded. The patients were randomly divided to two groups of 30 each. The study drug was prepared by an anesthetist not involved in the study. Randomization was performed by using computer-generated random numbers, and the group allocation was concealed in an opaque envelope that was opened by the anesthetist in the operating room. Group D received an IV infusion of dexmedetomidine 1 µg/kg diluted in normal saline to a total volume of 50 ml. Group F received an IV infusion of fentanyl 2 µg/kg diluted in normal saline to a total volume of 50 ml. All patients received the drug solutions as IV infusion for 10 min. Xylometazoline (0.05%) nasal drops were administered in both the nostrils. A nasal pack soaked in lidocaine (2%) and adrenaline (1:200,000) was placed in the patent nostril. Endoscopy was started immediately after achievement of sedation score 2. A lubricated flexo-metallic endotracheal tube, as appropriate for each patient, was loaded in the fiberoptic endoscope. Fiberoptic intubation was performed using the "spray as you go" technique with 2% lidocaine with adrenaline (1:200,000) through the working channel. The scope was manipulated to visualize the vocal cords, and 2 ml of 2% lidocaine was sprayed. The scope was directed towards the vocal cords and then crossed beyond them. The carina of the trachea was identified to spray 2 ml of 2% lidocaine beyond it. The tube was then advanced over the scope to stay approximately 2 cm above the carina. After confirmation of the proper position of the tube using capnography, the cuff was inflated, and the endotracheal tube was secured in place. The primary outcome evaluated was endoscopy time. The secondary outcome measurements were the intubation time, cough score, post intubation score, Ramsay sedation score (RSS) and hemodynamics. Endoscopy time was defined as time from the insertion of fiberscope into the nostril to the visualization of carina. Intubation time was defined as time from the insertion of endotracheal tube into the nose to confirmation of intubation with capnography. Cough score[7] was evaluated as: 1 = no cough, 2 = slight cough (no more than two cough in sequence), 3 = moderate cough (3-5 cough in sequence), 4 = severe cough (>5 cough in sequence). Tolerance to intubation was evaluated by post-intubation score after placement of tube in the trachea.

1 = Co-operative,

2 = minimal resistance,

3 = severe resistance.

Any adverse events of oxygen desaturation (< 90%), bradycardia (HR < 60 beats/min), or hypotension (SBP < 100 mmHg, DBP < 60 mmHg, and MAP < 65 mmHg) were recorded. Episodes of bradycardia were treated by administering atropine 0.6 mg IV. Hypotensive episodes were managed by crystalloid infusion and IV ephedrine 6 mg. Hypoxia was managed by oxygen insufflation through the oxygen port of the scope. If it persisted, then the endoscope was temporarily removed, followed by bag and mask ventilation with 100% oxygen. Sample size calculation based on the previous literature[8], taking a minimum difference of endoscopy time of 1 min, with power of 80% and error of 0.05 for this study, the minimum sample size was calculated to be 25 per group. 30 patients were included in each group to meet the dropouts. The data were analyzed using Statistical Product and Service Solutions statistic software (version 23) and Microsoft Office Excel 2019. The demographic data are expressed as means and standard deviations. Parametric data between the two groups were compared using an independent t-test and non-parametric data using Mann–Whitney U test. Categorical data were compared using chi-square test or Fisher's exact test. All analyses were two-tailed; P-values ≤ 0.05 were considered statistically significant.

RESULTS

In total, 60 patients completed the study (Fig. 1). No statistically significant differences were observed in the baseline data between the two groups. A total number of 60 patients belonging to ASA I and II were chosen and were divided into two groups. Group D was received Dexmedetomidine of dose 1 mcg/kg infusions for 10 min and Groups F was received Fentanyl of dose 2 mcg/kg infusions for 10 min.

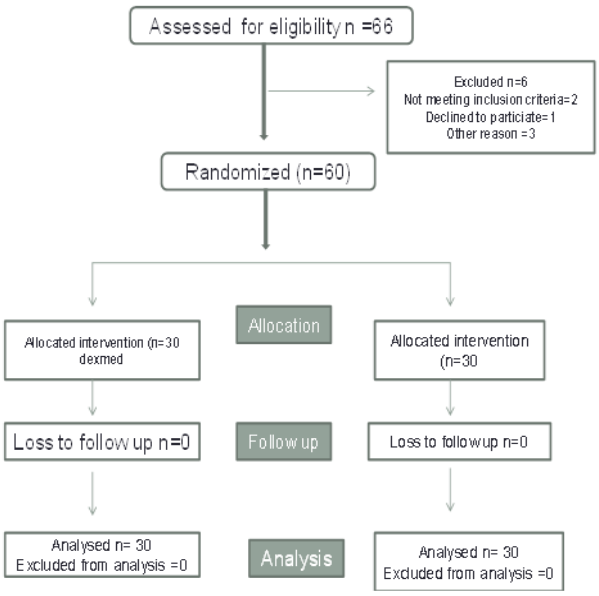

Figure 1: Consort flow diagram

There was no significant difference in both groups regarding demographic parameters like age, gender, weight and ASA status. (table 1)

Table 1: Demographic data

Parameters	Group F	Group D	P value
Age (Years)	40.97 (14.8)	39.93 (15.9)	0.268
Gender M/F	13/17	8/22	0.176
Weight (kg)	60.3 (6.3)	60 (6.4)	0.668
ASA class (I/II)	26/4	28/2	0.238

Table 2: Intubation parameters

AFOI parameters	Group F	Group D	P value
Endoscopy time (minutes)	3.5(1.1)	2.7(0.8)	0.032
Intubation time (seconds)	39.2(10.5)	35.0(11.2)	0.041
First $ETCO_2$ after intubation	41.2(4.3)	39.3(2.7)	0.15

Table 3: Sedation score, cough score and postintubation score

	Group	N	Mean	SD	P value
Ramsay sedation score	D	30	2.87	0.43	0.021
	F	30	2.13	0.35	
Cough score	D	30	2.10	0.40	0.018
	F	30	2.97	0.41	
Post intubation score	D	30	1.27	0.45	0.037
	F	30	1.90	0.31	

Table 4: Heart rate at different time interval

HR	Group	N	Mean	SD	P Value
Baseline	D	30	80.03	5.81	0.942
	F	30	80.13	4.74	
5 Min	D	30	76.73	5.51	0.185
	F	30	78.57	5.04	
10 Min	D	30	73.63	5.99	0.234
	F	30	76.93	5.11	
Intubation	D	30	76.37	8.11	0.004
	F	30	102.30	4.21	
5Min post intubation	D	30	75.03	7.94	0.007
	F	30	99.37	4.02	

Endoscopy and intubation time was less in group D compared to group F which was statistically significant. The first $ETCO_2$ was significantly higher in group F compared to group D, indicating that fentanyl associated may produce more respiratory depression than dexmedetomidine. (table 2)

There was statistical difference in sedation score, cough score and post intubation score in both groups. (table 3) There was significant statistical difference in the mean heart rate and MAP at intubation and post intubation. Though fall in SpO_2 was less in D group compared to F group, the difference was not significant. (table 4)

DISCUSSION

Awake fibreoptic bronchoscope guided intubation is one of the best methods in securing airway in a case of difficult airway.[8] For AFOI, many drugs has been used for producing sedation while preserving spontaneous respiration. We have compared dexmedetomidine and fentanyl for conscious sedation for awake fibreoptic intubation. The first ETCO2 was significantly higher in group F compared to group D, indicating that fentanyl may produce more respiratory depression than dexmedetomidine. Endoscopy and intubation time was less in the dexmedetomidine group due to better patient cooperation and the

antisialagogue effect of dexmedetomidine. Changes in the HR were significantly higher in patients receiving fentanyl as compared to dexmedetomidine group. Dexmedetomidine results in stable hemodynamic parameters because of its inhibition of noradrenline thereby reducing the sympathetic response to intubation. Dexmedetomidine infusion can cause bradycardia, hypotension ,atrial fibrillation and hypertension particularly in high doses.[9] However in our study there was no incidence of bradycardia because of glycopyrrolate administration Acharys et al[10] has compared intubating condition and hemodynamic changes during AFOI using Fentanyl vs dexmedetomidine .They found dexmedetomidine provided better intubating conditions. Dexmedetomidine acts primarily on the locus ceruleus, a pontine nucleus, to inhibit the norepinephrine production in response to anxiety and stress. Hence, it induces efficient sedation with arousable and cooperative patients without any airway obstruction.[10] Cabrini et al. analyzed different drugs used in AFOI in difficult intubation cases and found that dexmedetomidine showed fewer desaturation episodes when compared to opioids such as propofol or midazolam.[11] Yadav et al. compared the combination of dexmedetomidine (1 µg/kg) and midazolam with that of fentanyl (2 µg/kg) and midazolam and reported that the former provides better intubation conditions with more stable hemodynamic parameters.[12] The study done by Mondal et al.[13] showed that RSS was better with dexmedetomidine group (RSS 3 ± 0.37) compared with fentanyl group (RSS 2.07 ± 0.254). They compared RSS score between two groups rather than time to sedation. This finding was in agreement with our study. A study by Liu et al.[14] showed that the time to intubate patients with dexmedetomidine was 673.1 s ± 8.3 SD. This is similar to the findings in our study. The study conducted by Cattano et al.[15] showed that the number of intubation attempts was more in the dexmedetomidine group compared to remifentanyl group. This was different from our study. This could be due to the lower dose of dexmedetomidine they used for loading (0.4 mcg/kg over 10 min). We used 1 mcg/kg dexmedetomidine for infusion over 10 min which might have provided better sedation which, in turn, reduced our intubation attempts. The skill of the endoscopist and the heterogeneity of the study groups would also have influenced the findings.

The study conducted by Mondal et al.[13] showed that 93.3% patients in dexmedetomidine group had cough score ≤2 and 90% of patients in fentanyl group had cough score ≥3. This difference from our study might be because of the pattern of anesthetizing the airway. Baiju et al., compared a low dose of fentanyl (1 µg/kg) with the standard dose of dexmedetomidine (1 µg/kg) and found a better tolerance to intubation with dexmedetomidine.[16] Though all above studies were in agreement with our study, we suggest further large-scale studies to validate our study findings.

CONCLUSION

Endoscopy time and intubation time was less with dexmedetomidine as it achieved target sedation faster compared to fentanyl enabling early intubation. without any respiratory depression and hemodynamic disturbance.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Johnston KD, Rai MR. Conscious sedation for awake fibreoptic intubation: a review of the literature. Can J Anaesth. 2013;60:584–599.
2. Alfieri A, Passavanti MB, Di Franco S, Sansone P, Vosa P, Coppolino F, et al. Dexmedetomidine in the Management of Awake Fiberoptic Intubation. Open Anesth J. 2019;13:1–5.
3. Agrawal A, Jadon A, Parida SS, Chakraborty S, Sinha N, Chandra O. Comparative evaluation of dexmedetomidine and fentanyl – Midazolam combination as sedative adjunct to fibreoptic intubation under topical anaesthesia. Am J Adv Med Sci. 2014;2:29–37..
4. Chu KS, Wang FY, Hsu HT, Lu IC, Wang HM, Tsai CJ. The effectiveness of dexmedetomidine infusion for sedating oral cancer patients undergoing awake fibreoptic nasal intubation. Eur J Anaesthesiol. 2010;27:36–40. -
5. Sharma J, Purohit S, Bhatia S, Kalra P, Sharma M, Meena R. Awake orotracheal fibre-optic intubation: comparison of two different doses of dexmedetomidine on intubation conditions in patients undergoing cervical spine surgery. Indian J Anaesth. 2017;61:811–817.
6. Sharma J. Nebulisation versus spray-as-you-go airway topical anaesthesia in patients with temporomandibular joint ankylosis using 2% lignocaine. J Maxillofac Oral Surg. 2015;14:398–402.
7. Xue FS, Liu HP, He N, Xu YC, Yang QY, Liao X, et al. Spray-as-you-go airway topical anesthesia in patients with a difficult airway: a randomized, double-blind comparison of 2% and 4% lidocaine. Anesth Analg. 2009;108:536–543.
8. Hassan ME, Mahran E. Evaluation of different doses of dexmedetomidine alone versus the combination of dexmedetomidine and fentanyl in sedation during awake fiberoptic intubation in oral cancer surgery patients: a prospective, randomized, double-blind clinical trial. Saudi J Anaesth. 2017;11:196–202.
9. Yousuf A, Ahad B, Mir AH, Mir AW, Wani JG, Hussain SQ. Evaluation of Effectiveness of Dexmedetomidine and Fentanyl-midazolam Combination on Sedation and Safety during Awake Fiberoptic Intubation: A Randomized Comparative Study. Anesth Essays Res. 2017 Oct-Dec;11(4):998-1003.
10. Acharya R, Sriramka B, KoushikJ P.Comparison of dexmedetomidine alone with dexmedetomidine and fentanyl during awake fiberoptic intubation in patients with

difficult airway: a randomized clinical trialDent Anesth Pain Med 2022;22(5):349-356

11. Cabrini L, Baiardo Redaelli M, Ball L, Filippini M, Fominskiy E, Pintaudi M, et al. Awake fiberoptic intubation protocols in the operating room for anticipated difficult airway: a systematic review and meta-analysis of randomized controlled trials. Anesth Analg. 2019;128:971–980.
12. Yadav U, Yadav JBS, Srivastava D, Srivastava S. A Randomized Controlled Study Comparing Dexmedetomidine-Midazolam with Fentanyl-Midazolam for Sedation during awake Fiberoptic Intubation in Anticipated Difficult Airway. Anesth Essays Res. 2020 Apr-Jun;14(2):271-276.
13. Mondal S, Ghosh S, Bhattacharya S, Choudhury B, Mallick S, Prasad A. Comparison between dexmedetomidine and fentanyl on intubation conditions during awake fiberoptic bronchoscopy: a randomized double-blind prospective study. J Anaesthesiol Clin Pharmacol. 2015;31:212–216.
14. Liu HH, Zhou T, Wei JQ, Ma WH. Comparison between remifentanil and dexmedetomidine for sedation during modified awake fiberoptic intubation. Exp Ther Med 2015;9:1259-64.
15. Cattano D, Lam NC, Ferrario L, Seitan C, Vahdat K, Wilcox DW, et al. Dexmedetomidine versus remifentanil for sedation during awake fiberoptic intubation. Anesthesiol ResPract 2012:753107
16. Baiju B, Gopakumar G, Prathibha VK, Antony J, Jayaprakash R. A prospective randomized controlled study to assess the efficacy of fentanyl and dexmedetomidine for conscious sedation in awake fiberoptic intubation. Natl J Physiol Pharm Pharmacol 2020;10(09):813-820.