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Original Research Article

Comparative Evaluation of Ease and Efficacy of Three Drug Combinations- Dexmedetomidine and Propofol, Fentanyl and Propofol, Fentanyl and Midazolam for Fiber-Optic Intubation

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Abstract

Background: Awake nasal or oral fiberoptic intubation (AFOI) is the technique of choice in airway management of known or unknown, anticipated or unanticipated difficult airway, unstable cervical fracture, severe cervical stenosis, severe facial burn, limited mouth opening due to diseases of temporomandibular joint, mandibular-maxillary fixation, vertebral artery insufficiency. Various drugs have been used to aid in fiberoptic intubation for optimal intubating conditions and sedation.

Aims: To observe the efficacy and ease of intubating condition during fiberoptic intubation using drug combinations of Dexmedetomidine and Propofol, Fentanyl and Propofol, and Fentanyl and Midazolam.

Materials and Method: An observational, prospective clinical study was carried out on 90 patients aged between 20-60 years of both sex of ASA grade I and II, undergoing elective surgeries under general anaesthesia. Patients were divided into three groups containing 30 patients in each group to facilitate fiberoptic intubation, Group D (n=30)- received Dexmedetomidine and Propofol, Group F (n=30)- received Fentanyl and Propofol, Group M(n=30)- received Fentanyl and Midazolam. Intubation conditions, post intubation score, depth of sedation, intra-op vitals and post-op complications were documented.

Results: Satisfying intubation condition was observed in more patients in group D as compared to group F and M. The vocal cord movement was grade 1 (open) in 28 cases of group D, 27 cases of group F and 21 cases of group M. Whereas, cough score was >/=2 in 1, 5 and 9 cases of group D, F and M, respectively. Limb movement grade was 2 or more in 2 cases of group D, 4 cases of group F and 10 cases of group M. only 1 attempt was taken for awake fiberoptic intubation in 29 cases of group D, 27 cases of group F and 21 cases of group M. Whereas, 2 or more attempts were taken in 1 case of group D, 3 cases of group F and 9 cases of group M. Remarkable increase in the heart rate was found in group M than group D and F. Similarly, the increase in the heart rate was higher in group F than group D. Desired Ramsay sedation score of 3 i.e., 26 participants of group D, 25 of group F and 15 of group M. The occurrence of post-op complications related with fibreoptic intubation were significantly less in Dexmedetomidine and Propofol, and Fentanyl and Propofol group than midazolam with fentanyl.

Introduction

Airway management is a major skill. of an anaesthesiologist. The morbidity and mortality associated with anaesthesia are significantly contributed by difficulties with tracheal intubation. Fiber-optic intubation becomes a definitive and impeccable technique to manage the patient's airway.

Fiber-optic intubation (FOI) is the technique of choice in airway management of known or unknown, anticipated or unanticipated difficult airway, unstable cervical fracture, severe cervical stenosis, severe facial burn, limited mouth opening due to diseases of temporomandibular joint, mandibular maxillary fixation, vertebral artery insufficiency.

Patient preparation is necessary prior to fiber-optic intubation which comprise of anxiolysis, adequate sedation, obtundation of airway reflexes, with preservation of a patent airway and adequate ventilation [1].

In most of the cases, benzodiazepines, propofol and opioids are being used as a sole agent or in combination for sedation during fiber-optic intubation [2].

Midazolam is an imidazole benzodiazepine derivative. It is a short acting drug and provides anxiolysis, sedation and anterograde amnesia and helps in calming the patient [3].

Propofol provides sedative-hypnotic effect with fast onset and offset of action. In high doses, propofol causes marked apnea and loss of upper airway tone which makes the negotiation of fiberoptic bronchoscope beyond epiglottis more demanding. [4]

Fentanyl, a phenylpiperidine derivative of synthetic opioid, is helpful by suppressing the nociceptive stimuli and blunt the circulatory responses caused by endotracheal intubation. It ensures mild sedation and analgesia with stable hemodynamics. But it has some major side effects like respiratory depression, nausea, vomiting and chest wall rigidity [5].

Although these drugs, alone or in combination, may render better intubating conditions, but all of these drugs cause respiratory depression, therefore are associated with high incidence of hypoxemia and apnea [3,4,5] which can be fatal in difficult airway with can't intubate can't ventilate situations.

Therefore, an ideal agent for conscious sedation is required which can assure spontaneous ventilation along with a patent airway, optimal intubating conditions, adequate cooperation from the patient and stable hemodynamics without respiratory depression.

Dexmedetomidine is a highly selective, centrally acting alpha-2 agonist. Within CNS, alpha-2 receptors are primarily located within pons and medulla of brainstem.

The beneficial effects produced by dexmedetomidine are anxiolysis, analgesia, sedation, amnesia, anti-sialogogue and sympatholysis.

The sedative effect is mediated by the pre-synaptic alpha-2 receptors in the locus ceruleus and modulates the endogenous sleep pathways. The sedation produced by dexmedetomidine is similar to natural sleep. Patients are sedated but easily arousable with stimuli, and are able to follow commands with minimal respiratory depression as compared to other agents.

The arousable sedation, preservation of spontaneous breathing, sympatholysis and analgesia of dexmedetomidine makes it a much better alternative for many other drugs for fiber-optic intubation. [6]

The aim of the study was to observe the drug combinations of Dexmedetomidine and Propofol, Fentanyl and Propofol, and

Fentanyl and Midazolam for efficacy and ease during fiber-optic intubation. In this study, we included adult patients undergoing elective surgery under General Anaesthesia.

Materials and Method

The present observational, hospital-based study was conducted after obtaining approval from institutional ethical committee. As per the discretion of anaesthesiologist, the anaesthetic procedure, and the patient profile, 90 patients aged between 20-60 years of both sex of ASA grade I and II, undergoing elective surgeries under general anaesthesia were chosen and divided into three groups containing 30 patients in each group to facilitate fiberoptic intubation: Group D (n=30)- received Dexmedetomidine and Propofol, Group F (n=30)- received Fentanyl and Propofol, Group M(n=30)- received Fentanyl and Midazolam.

Dose of the study drug was calculatedand diluted with normal saline to make equal volumeof 50ml each. A single anaesthesiologist performed fiber-optic intubation in all patients. A written consent was taken from each patient. All the patients were kept fasting for at least 6 hours prior to the surgery. All the patients received inj. Glycopyrrolate 0.01mg/kg IV and inj.Ondansetron 0.1mg/kg IV 30 minutes before the procedure.

In operation theatre, multiparameter monitors were attached to record pulse rate, non-invasive BP, respiratory rate, SpO2 and ECG.

For the procedure, the nostril with better patency was chosen after testing both nostrils. Cotton wool-tipped swabs soaked in 4% lidocaine with adrenaline were applied to both the nostrils to reduce bleeding and provide adequate analgesia and during the nasotracheal intubation, Xylometazoline hydrochloride 0.1% w/v nasal drop was used for nasal vasoconstriction. Topicalization of both upper and lower airway was done by nebulization with 4 ml of 2% lidocaine (80 mg) for 20 minutes. Pre- oxygenation with 100% oxygen was done for 3 min prior to procedure.

Group D - 30 patients received 1mcg/kg of Dexmedetomidine diluted up to 50ml, administered over 10 minutes followed by propofol infusion @ 50mcg/kg/min till endotracheal intubation was confirmed.

Group F - 30 patients received a loading dose of 2mcg/kg Fentanyl diluted up to 50ml followed by propofol infusion @ 50 mcg/kg/min till endotracheal intubation was confirmed.

Group M - 30 patients received 2 mcg/kg fentanyl diluted up to 50ml with 40 Mcg/kg of midazolam. The dose was adjusted to procure the desired level of sedation.

Lignocaine jelly was applied to the fiberscope and nostril. The fiberscope was introduced through the glottis opening entering the trachea visualizing the tracheal rings and the carina. On reaching the carina, suitable sized endotracheal tube was railroaded over fiberoptic bronchoscope into the trachea. The anaesthesiologist performing fiber-optic intubation graded the intubation conditions meanwhile another anaesthesiologist controlled the rate of drug infusion.

The successful passage and position of the tube through the vocal cords confirmed by identification of the carina through bronchoscope and reconfirmed by mainstream capnograph, after which tube was secured and the cuff inflated. And general anaesthesia was administered.

During this entire procedure that is, from the passage of the tube into the nares and the manipulation of the scope till placement of the tube in the trachea, the following observations were made:

I) Intubation Condition:

a) Vocal cord movements

Grade	1	2	3	4
Vocal cord	Open	Moving	Closing	Closed

b) Cough scoring during bronchoscopy

Score	1	2	3	4
Cough	No cough	Slight cough (no more than 2 coughs in sequence)	Moderate cough (3 -5 coughs in sequence)	Severe cough (>5 coughs in sequence)

c) Limb movements

Score	1	2	3	4
Limb movements	No movements	Slight (Flicker)	moderate (vigorous movement of extremities)	severe (vigorous movement involving torso and head).

d) Number of attempts of intubation

e) Intubation time (insertion of tracheal tube into the no setup to confirmation of tracheal intubation with capnograph)

II) Post Intubation Score:

f) Helps to analyze the tolerance to intubation after placement of tube in the trachea

Score	1	2	3
Tolerance to intubation	Co-operative	Minimal resistance	Severe resistance

I) Depth of Sedation:

Ramsay Sedation Score (RSS) was evaluated just after the infusion of study drug was completed. The score is as follows:

1	2	3	4	5	6
Anxious, agitated/ restless	Co-operative, oriented and tranquil	Sedated but responds to command	Asleep, brisk glabellar reflex, responds to loud noise	Asleep, sluggish glabellar reflex or responds to loud noise	Asleep with no response to painful stimulus.

IV) Intraoperative Monitoring:

Analysis of vital parameters that is pulse, NIBP- systolic and diastolic BP and SpO_2 at Pre-op (baseline), before intubation (after securing adequate level of sedation), immediately after intubation, 1 min, 3 min and 5 min after intubation.

V) Post Operative Complications like

g) Blood-stained device,
h) Sore throat,
i) Hoarseness of voice.

Statistical Analysis Plan

All the data obtained was compiled systematically and was entered on excel sheet MS office Excel and analyzed statistically using SPSS statistical software and XL stat. The data obtained was subjected to statistical analysis with the consult of a statistician. All the quantitative data were summarized in the form of mean +/- SD.

Chi-square test was used for

categorical data comparison between the three groups. Independent t-test was used to compare numerical data between the groups while paired t-test was implemented for

intra-group comparison.

The P value <0.05 was considered to indicate statistical significance.

Results

Demographic Parameters: There appeared no difference in age and gender distribution of the three groups (Table1)

Table1:Demographic profile

	Grp- D	Grp- F	Grp- M	P-value
Age	44.70±11.05	43.17±10.63	44.30±10.95	>0.05
Sex (M/F)	16 / 14	17 / 13	17 / 13	>0.05

Table 2: Intubation and Post-intubation score

		Grp-D	Grp-F	Grp-M	P-value
Vocalcord	=1	28	27	21	<0.05
	>/=2	02	03	09	<0.05
Coughscore	=1	29	25	21	<0.05
	>/=2	01	5	09	<0.05
Limbmovement	=1	28	26	20	<0.05
	>/=2	02	04	10	<0.05
Number of attempts of intubation	=1	29	27	21	<0.05
	>/=2	01	03	09	
Intubation time (sec)		117.43±2.58	130.13±2.01	138.63±2.49	< 0.05
RSS<3		2	5	15	<0.05
Postintubation Score	=1	29	28	18	<0.05
	>/=2	01	02	12	<0.05

Table 3: Hemodynamic parameters

	Grp D	GrpF	GrpM
Heart rate			
Baseline	78.53± 8.66	81.60±9.22	79.33±7.03
Immediate after intubation	80.07±5.71	86.53±9.67	92.07±4.96
5 minutes after intubation	77.67± 6.78	82.67±5.68	83.93±5.95
Systolic BP			
Baseline	126.27±6.29	124.33±6.15	124.87±6.36
Immediate after intubation	130.33±5.85	134.93±4.04	137.83±5.83
5 minutes after intubation	127.10±3.76	129.97±3.76	134.20±3.02
Diastolic BP			
Baseline	77.40±5.41	76.33±5.61	78.27±4.92
Immediate after intubation	79.80±5.18	78.80±5.03	80.60±4.49
5 minutes after intubation	76.27±5.34	76.27±5.14	77.73±3.55
SPO2 variation			
Baseline	98.70±1.02	98.77±0.89	98.67±0.99
Immediate after intubation	98.53±0.94	98.50±0.77	98.37±0.76
5 minutes after intubation	98.33±0.88	98.13±0.68	97.87±0.63

Table 4:Post-operative complications

	GrpD	GrpF	GrpM	Total	P value
Nil	29	30	19	78	<0.001
Sore throat	1	0	8	9	
Hoarseness of voice	0	0	3	3	

Intubation conditions

The vocal cord movement was grade 1 (open) in 28 cases of group D, 27 cases of group F and 21 cases of group M. Whereas, vocal cord movement grade was >=2 (moving, closing, closed) in 2 cases of group D, 3 cases of group F and 9 cases of group M. This difference was found to be statistically significant (p value= 0.026). In terms of cough scoring, grade 1 (no cough) was observed in 29 cases of group D, 25 cases of group F and 21 cases of group M. Whereas, cough score of>=2 (slight, moderate, severe) was found in 1 cases of group D, 5 cases of group F and 9 cases of group M with statistically significant difference (p value= 0.021). Limb movements grade 1 (no movements) was found in 28 cases of group D, 26 cases of group F and 20 cases of group M. Whereas, limb movement grade was >=2 in 2 cases of group D, 4 cases of group F and 10 cases of group M. Disparity was found to be statistically significant (p value= 0.019).

Group D required lesser attempts than group F and group M. Group F required lesser attempts than group M during fiberoptic intubation (P<0.05).The mean intubation time required was found to be lowest in group D (117.43+/-2.58 seconds), higher with group F (130.13+2.01 seconds) and highest with group M (138.63+/-2.49)(P<0.001).

Group M had the least favorable intubation conditions as compared to Group D and F for FOI.

Preferable post-intubation score(=1) was acquired in 29 cases from Group D, 28 cases from group F and 18 cases from Group M and the variation was statistically remarkable(P<0.001).

Ramsay Sedation Score obtained following conclusion of study drug infusion was 3 (sedated but responds to command) in 26 patients in group D, 25 of group F and 15 in group M(P<0.003).

Hemodynamic Parameters

The increase in the heart rate and mean systolic blood pressure was significantly higher in group F and group M than group D immediately after intubation and 5 minutes after intubation(P<0.05). The increase in these parameters was significantly higher in group M than group F immediately after intubation (P<0.05). But there was no significant difference in between group F and group M, 5 minutes after intubation. Although there was rise in diastolic BP in three groups, the difference was not found to be statistically significant.

SpO2: While performing FOI, there was more fall in SpO2 among group M, however, it was not found to be statistically significant. There was no statistically significant difference in mean SpO2 in participants of the three groups at any point of time during the study.

Post-operative complications

Among the participants with sore throat, majority were from group M (9 patients), none from group F and 1 from group D. Hoarseness of voice was observed only among 3 patients from group M. This result was found to be statistically significant (P<0.05).

Discussion

Currently, fiber-optic intubation with conscious sedation is the mainstay approach for suspected difficult airway, for which several drugs are being studied.

In our study, we compared 90 patients by dividing them in three groups containing 30 patients in each group to facilitate fiberoptic intubation, Group D (n=30)- received Dexmedetomidine and Propofol, Group F (n=30)- received Fentanyl and Propofol, Group M(n=30)- received Fentanyl and Midazolam.

Optimal intubation conditions in terms of vocal cord movements, cough score, limb movements, attempts at intubation, intubation timeand post intubation score

were found in dexmedetomidine with propofol as compared to fentanyl with propofol or midazolam with fentanyl.

Majority of the participants had Ramsay sedation score of 3 i.e., 26 participants of group D, 25 of group F and 15 of group M. This difference in sedation was found to be statistically significant (p value = 0.003) in favor of dexmedetomidine.

Veena Patodi et al (2018) [7] found that in Group A (dexmedetomidine 1.5 μg/kg), the number of patients with a favourable cough score (cough score ≤ 2) were significantly more (24 out of 30) compared to 16 out of 30 in Group B (IV fentanyl 2 μg/kg) (p = 0.0285).

Ashwini Rajesh et al (2020) [8] found in their study, vocal cords were open in 24 out of 30 patients in group D (dexmedetomidine 1μg/kg) whereas in only 14 out of 30 patients in group F(2μg/kg). Similarly, post intubation score of 1 in 22 out of 30 patients in group D (Dexmedetomidine 1μg/kg) and only 4 patients out of 30 patients in group F (Fentanyl 2μg/kg). The difference was found to be statistically significant (p value<0.05).

T. Srikandan (2016) [9] supported our study in having statistically (p value <0.001) higher intubation time 120.87 +/- 4.27 seconds in group FM (2 mcg/kg of fentanyl and 40 mcg/kg of midazolam) as compared to 115.92+/-2.56 seconds in group D (received dose of 1 mcg/kg dexmedetomidine) and better Ramsay sedation score with dexmedetomidine.

Dexmedetomidine group displayed superior hemodynamic stability. The three groups were equivalent when the baseline hemodynamic parameters (HR, SBP, DBP and SpO2) were compared. The rise in heart rate and systolic BP, post-intubation was found to be significant in group M as compared to group F and D. There was no statistically significant difference in mean SpO2 and diastolic BP in participants of the three groups.

Sunil Rajan et al (2018) [10], found significantly higher heart rate postintubation than baseline when fentanyl 2μg/kg was used as compared to dexmedetomidine1μg/kg.

Post-op complication of sore throat was observed majorly in group M (9 patients), none from group F and 1 from group D. Hoarseness of voice was observed among 3 patients from group M. This result was found to be statistically significant (p = <0.001)

Conclusion

Based on our experience in the present study, we conclude that the use of dexmedetomidine with propofol for fiberoptic intubation gives better hemodynamic stability and ease of intubation with adequate sedation and minimal post-operative complications as compared to fentanyl with propofol or midazolam with fentanyl during fiberoptic intubation. Similarly, the use of fentanyl with propofol provides better conditions for fiberoptic intubation than midazolam with fentanyl.

As the primary concern for awake fiberoptic intubation is to minimize the hemodynamic changes and provide adequate sedation for the patient while maintaining spontaneous respiration with minimal discomfort to patient and post-op complications. All these conditions were fulfilled with the use of dexmedetomidine with propofol better than fentanyl with propofol or midazolam with fentanyl

References

1. Rosenblatt WH. Airwaymanagement. In: Barash PG, Cullen BF, Stoelting RK, et al., editors. Clinical Anesthesia. 4th ed. Philadelphia: Lippincott Williams &Wilkins; 2001;595-638.
2. Parmod Kumar, Tripat Kaur, Gurpreet Kaur Atwal, Jatinderpaul Singh Bhupal, and Ajay Kumar Basra. Comparison of Intubating Conditions using Fentanyl plus Propofol Versus Fentanyl plus Midazolam during Fiberoptic Laryngoscopy. J Clin Diagn Res. 2017 Jul; 11(7): UC21–UC24.
3. Bailey PL, Pace NL, Ashburn MA, Moll JW, East KA, Stanley TH. Frequent hypoxemia and apnea after sedation with

midazolam and fentanyl. Anesthesiology. 1990; 73:826 - 30.
4. Lee JH, Han SW, Kim YY, Yum KW. Sedation and Hemodynamic Stability during Fiberoptic Awake Nasotracheal Intubation: Comparison between Propofol Infusion and Intravenous Boluses of Fentanyl and Midazolam. Korean J Anesthesiol. 1997 Oct;33(4):741-749.
5. Wang SY, Mei Y, Sheng H, Li Y, Han R, Quan CX, et al. Tramadol combined with fentanyl in awake endotracheal al intubation. J Thorac Dis. 2013; 5:270- 7.
6. Radha Mariyappa, Yatish Bevinaguddaiah2, Sadasivan S Iyer. A comparison of the effectiveness of dexmedetomidine versus propofol-fentanyl combination for sedation during awake fibreoptic nasotracheal intubation. Indian Journal of Clinical Anaesthesia, January-March, 2019; 6(1): 157-164.
7. Ashwini Rajesh Sonsale. To evaluate the efficacy of dexmedetomidine infusion versus fentanyl infusion for sedation during awake fibreoptic intubation (AFOI). ijca.in/html-article/ 11380.
8. Patodi V, Upreti B, Sethi SK, Jain N, Gurjar SS. A prospective randomized double-blind study to compare the effects of dexmedetomidine and fentanyl on intubating conditions during awake fiberoptic bronchoscopy guided intubation. Indian J ClinAnaesth. 2018;5(3):415-422.
9. T. srikandan. Comparison between Dexmedetomidine and a combination of Midazolam and Fentanyl for sedation during awake fiberoptic intubation: A prospective randomized parallel group double-blinded study. repositorytnmgrmu.ac.in/8483/1/201000816.
10. Sunil Rajan, Rittick Talukdar, Pulak Tosh, Jerry Paul, Bindu K. Vasu, and Lakshmi Kumar. Hemodynamic Responses and Safety of Sedation Following Premedication with Dexmedetomidine and Fentanyl during Fiberoptic-assisted Intubation in Patients with Predicted Difficult Airway. Anesth Essays Res. 2018 Jan-Mar; 12(1): 11–15.
11. Chakroborty B., Parvin S., Hossain M. M., & Hossain, M. J. Self- Examination of Breast of the Students of Nursing College in Bangladesh. Journal of Medical Research and Health Sciences, 2022;5(12): 2339–2344.