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Original Article

Anaesthesia Section

Comparison of Intubating Conditions using Fentanyl plus Propofol Versus Fentanyl plus Midazolam during Fiberoptic Laryngoscopy

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ABSTRACT

Introduction: Awake nasal or oral flexible fiberoptic intubation is the airway management technique of choice in known or anticipated difficult airway, unstable cervical fracture, limited mouth opening (as in temporomandibular joint disease), mandibular-maxillary fixation and severe facial burns. Both optimal intubating condition and patient comfort are important for fiberoptic intubation. Optimal intubating conditions provided by an ideal sedation regimen would ensure haemodynamic stability, patient comfort, attenuation of airway reflexes and amnesia.

Aim: To compare the intubating conditions using fentanyl plus propofol versus fentanyl plus midazolam during fiberoptic laryngoscopy.

Materials and Methods: A prospective, comparative and randomized study was conducted on 60 patients of either gender aged between 18 and 60 years belonging to the American Society of Anaesthesiologists (ASA) grade-I or II scheduled for elective surgery. Patients were randomly allocated into two groups of 30 each. In group I, patients received i.v. fentanyl 1 µg/kg+ propofol 1 mg/kg to achieve an adequate level of sedation that is Ramsay Sedation Scale (RSS) score of 3. In group II, patients received i.v. fentanyl 1 µg/kg + midazolam 0.03 mg/kg to achieve RSS= score of 3. Haemodynamic parameters (heart rate, systolic and diastolic blood pressure, mean arterial pressure), SpO_2, $EtCO_2$, total comfort scale values and patient's tolerance were assessed during preoxygenation, fiberscope insertion and endotracheal intubation.

Results: Fentanyl plus midazolam group showed better patient comfort and maintenance of oxygen saturation than fentanyl plus propofol group during fiberoptic intubation.

Conclusion: Both fentanyl plus midazolam and fentanyl plus propofol regimes are suitable for fiberoptic intubation. Fentanyl plus midazolam appeared to offer better tolerance, preservation of an airway and spontaneous ventilation, while maintaining haemodynamic stability.

Keywords: Patient's tolerance, Ramsay sedation scale, SpO_2, Total comfort scale

INTRODUCTION

Awake nasal or oral flexible fiberoptic intubation is an airway management technique of choice in known or anticipated difficult airway, unstable cervical fracture, severe cervical stenosis, vertebral artery insufficiency, chiari malformation, limited mouth opening (as in temporomandibular joint disease), mandibular-maxillary fixation and severe facial burns [1].

Fiberoptic intubation can be performed awake, under sedation with or without topical anaesthesia or with muscle relaxant (suxamethonium, vecuronium, rocuronium, atracurium). Both optimal intubating conditions and patient comfort are necessary for fiberoptic intubation. Optimal intubating conditions provided by an ideal sedation regimen would ensure haemodynamic stability, patient comfort, attenuation of airway reflexes and amnesia during fiberoptic laryngoscopy. For sedation, drugs such as fentanyl, midazolam, propofol, dexmedetomidine and remifentanil may be used. Each drug has its advantages and disadvantages. The use of fentanyl or other narcotics reduces the discomfort and haemodynamic changes associated with airway instrumentation [2,3].

Fentanyl is a phenylpiperidine derivative synthetic opioid agonist that is structurally related to meperidine and binds mu (µ) opioid G protein - coupled receptor [4].

Benzodiazepines exert pharmacologic effects by facilitating the action of GABA. Midazolam is water soluble and an ultrashort acting benzodiazepine derivative and used for conscious sedation [5,6]. Rolo R et al., and Rodrigues AJ et al., reported that fiberoptic bronchoscope intubation according to the conscious sedation protocol with midazolam and midazolam plus fentanyl respectively is effective and safe and does not affect significant haemodynamic changes in management of patients with difficult airway [7,8].

Propofol (2,6-diisopropylphenol) is a short-acting, intravenously administered hypnotic agent. It is used for the induction and maintenance of general anaesthesia, sedation for mechanically ventilated patients and procedural sedation [9].

Crawford M et al., reported oxygen saturation decreased in both midazolam and propofol groups, but the decrease was greater in propofol group in outpatient bronchoscopy [10].

The aim of this study was to compare different drugs that produce better intubating conditions with minimal or no side effects during fiberoptic laryngoscopy, the present study was conducted using fentanyl plus propofol versus fentanyl plus midazolam.

MATERIALS AND METHODS

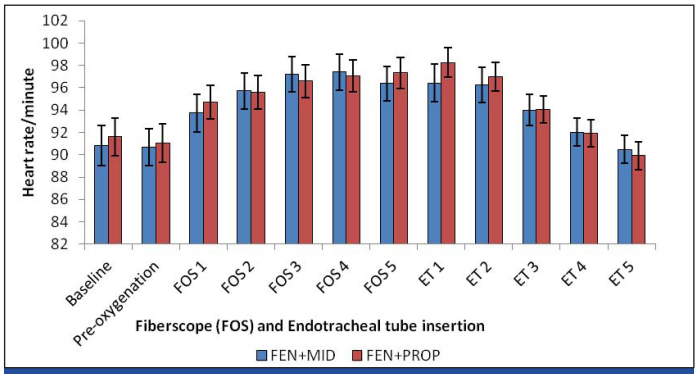
This prospective, comparative and randomized study was conducted on 60 patients aged between 18 and 60 years, belonging to the ASA grades I and II, scheduled for elective surgeries under general anaesthesia after obtaining approval from Ethical Committee, Government Medical College, Patiala, Punjab, India. A written informed consent was obtained from each patient after explaining the technique in vernacular language before including them in this study. With a power of 0.9 and type one error of 0.05, we calculated the sample size of at least 10 patients in each group, based on the result of previous study. As there is no upper limit of sample size and due to availabiliity of logistic support, 30 patients were taken in

Parameter	1	2	3	4	5
Alertness	Deeply asleep	Lightly asleep	Drowsy	Fully awake and alert	Hyper-alert
Calmness	Calm	Slightly anxious	Anxious	Very anxious	panicky
Respiratory response	No coughing and no sponta-neous respiration	Spontaneous respiration	Occasional cough	Coughing regularly	Frequent coughing or choking
Crying	Quiet breathing, no crying	Sobbing or gasping	Moaning	Crying	Screaming
Physical movement	No movement	Frequent slight movement	Vigorous movement limited to the extremities	Vigorous mov-ements including torso and head	Occasional slight movement
Muscle movement	Muscles totally relaxed, no muscle movement	Reduced muscle tone	Normal muscle tone	Increased muscle tone and flexing of fingers and toes	Extreme muscle rigidity and flexing of fingers and toes
Facial tension	Facial muscle totally relaxed	No facial tension evident	Tension evident throughout facial muscle	Facial muscle contorted	Grimacing

[Table/Fig-1]: Comfort scale, as modified by Ambuel B et al., [12]
*Total score=35

Group	Group I (Fentanyl + Propo-fol), Mean±SD	Group II (Fentanyl + Midazo-lam), Mean±SD	p-value	Signifi-cance
Age(years)	43.73±12.15	39.87±12.24	0.244	NS
Weight(kg)	63.55±4.47	62.60±6.82	0.091	NS
Sex(F/M)	20/10	17/13	0.42	NS

[Table/Fig-2]: Demographic data.

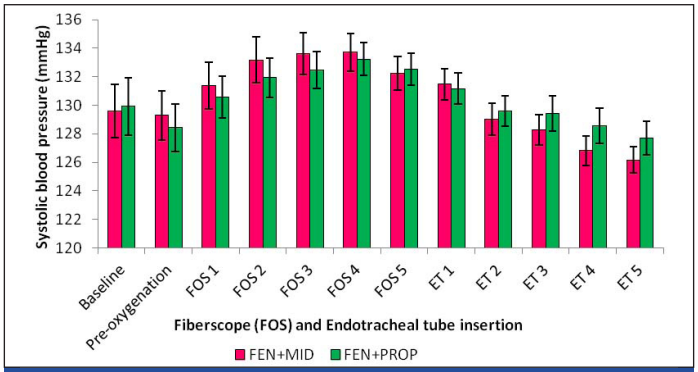


[Table/Fig-3]: Comparison of HR baseline, during preoxygenation, fiberscope and ET insertion in groups I and II.

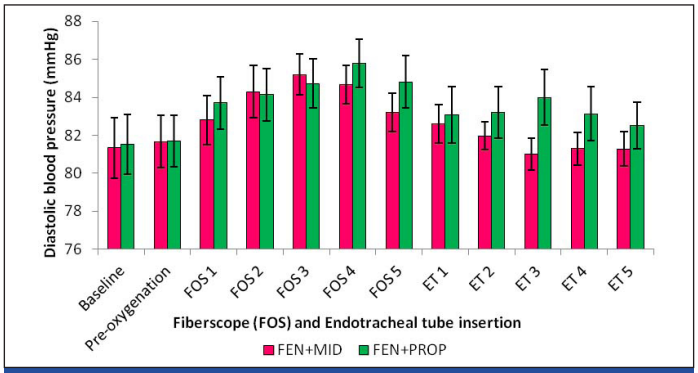
each group. Randomization was done by simple sealed envelope method. Exclusion criterias were patient's refusal and being allergic to the drugs involved in the study, a history of hypertension/ or diabetes mellitus/ or bronchial asthma, previous nasal surgery/ nasal trauma, severe bradycardia, any type of A-V block in ECG, thrombocytopenia, coagulopathy, liver cirrhosis, nasal polyp, mental illness patients, pregnancy and drug abuse.

Preparation of Patients

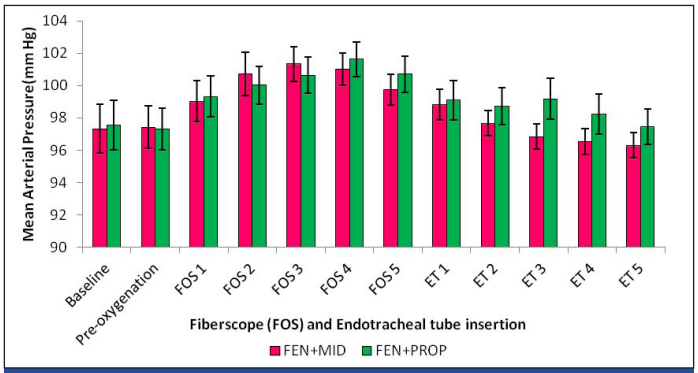
All patients received injection of glycopyrrolate (0.2 mg) as premedication 30 min before the procedure and 2% lignocaine viscous gargles were done to achieve adequate topical anaesthesia. Nasal mucosa was sprayed with xylometazoline 0.1% vasoconstrictor.



[Table/Fig-4]: Comparison of SBP baseline, during preoxygenation, fiberscope and ET insertion in groups I and II.



[Table/Fig-5]: Comparison of DBP baseline, during preoxygenation, fiberscope and ET insertion in groups I and II.



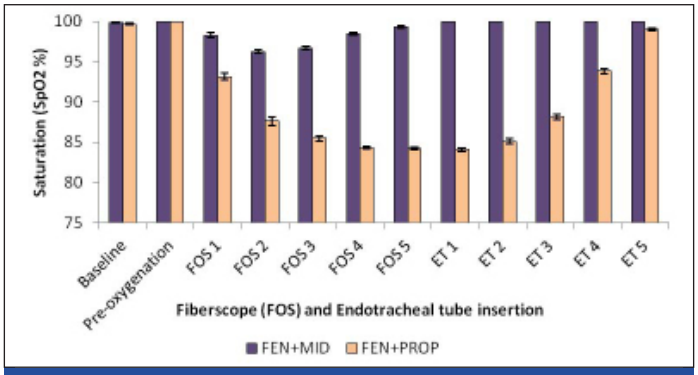
[Table/Fig-6]: Comparison of MAP baseline, during preoxygenation, fiberscope and ET insertion in groups I and II.

Each nostril was checked for patency. The nostril with least resistance was chosen for nasal intubation and nasal mucosa was sprayed with two puffs of 10% lignocaine. A nasopharyngeal dilator with lignocaine jelly was introduced. For further topical anaesthesia two puffs of 10% lignocaine were sprayed to tonsillar pillars and back of the throat.

Transtracheal block was performed by piercing the cricothyroid membrane in the midline of the neck with 4 ml of 4% lignocaine. Instillation of local anaesthetic invariably results in coughing that leads to dispersion of the drug, diffusely blocking the sensory nerve endings of the recurrent laryngeal nerve [11].

Group I patients received i.v. fentanyl 1 µg/kg+ propofol 1 mg/kg to achieve an adequate level of sedation that is RSS score of 3. Group II patients received i.v. fentanyl 1 µg/kg + midazolam 0.03 mg/kg to achieve RSS= score of 3.

Fiberoptic nasotracheal intubation was carried out in both groups of patients. Once tracheal intubation was completed and the tube was secured, general anaesthesia was administered. Haemodynamic parameters including Heart Rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), SpO_2 and $EtCO_2$ were recorded during preoxygenation, fiberscope insertion (1,2,3,4 and 5 min. intervals) and endotracheal



[Table/Fig-7]: Comparison of saturation (SpO_2%) baseline, during preoxygenation, fiberscope and ET insertion in groups I and II.

intubation (1,2,3,4 and 5 min. intervals). Comfort scale value and patient's reaction to placement of endotracheal tube were assessed during preoxygenation, fiberscope insertion (1,2,3,4 and 5 min. intervals) and endotracheal intubation (1,2,3,4 and 5 min. intervals). The surgical procedure then performed as planned.

The total comfort score for each patient was calculated by summing the scores of the seven comfort categories at each time point. The total score was 35 [Table/Fig-1]. Patient's tolerance [12] was assessed by an independent observer on the basis of 5 point Fiber Optic Index (FOI) score: No reaction (1); Slight grimacing (2); Severe grimacing (3); Verbal objection (4); Defensive movement of head, hands or feet (5).

STATISTICAL ANALYSIS

Statistical analysis was conducted using IBM SPSS statistics (version 22.0). Numerical data were expressed as mean and standard deviation and statistical analysis was performed using the independent t-test to compare the scores of the two groups. For skewed data/scores Mann-Whitney U-test was conducted. Gender was compared using Chi-square test. A p-value of <0.05 was considered as statistically significant.

RESULTS

The scores of both groups were compared demographically [Table/Fig-2]. All patients in both groups underwent uncomplicated fiberoptic intubation. The differences in mean HR, SBP, DBP and MAP were statistically insignificant among both groups during preoxygenation, fiberscope insertion and Endotracheal Tube (ET) placement [Table/Fig-3-6]. The mean SpO_2 was significantly lower in Group I compared to Group II during Fiberscope (FOS) and ET placement [Table/Fig-7]. No significant difference was found in $EtCO_2$ readings and sedation among either group. Total comfort scores were lower in Group II (they were more calm) during FOS and ET compared to those in Group I. Group I had high five point FOI score, implying better patient tolerance in Group II [Table/Fig-8-9].

Time Interval	Group I (Fentanyl + Propofol)		Group II (Fentanyl + Midazolam)		p-value	Significance
	Mean	SD	Mean	SD		
During Preoxgenation	13.27	0.94	12.87	1.38	0.74	NS
During FOS	13.60	0.85	12.70	1.29	0.001	HS
During ET	13.80	1.21	13.13	0.86	0.035	S

[Table/Fig-8]: Total comfort score (Mann -Whitney U-test).

Group	Group I (Fentanyl + Propofol)		Group II (Fentanyl + Midazolam)		p-value	Significance
	Mean	SD (±)	Mean	SD (±)		
Fiberscope insertion	3.23	0.81	2.70	0.91	0.01	S
Endotracheal tube	2.43	1.00	1.93	0.58	0.002	S

[Table/Fig-9]: Patient's Tolerance based on 5 point Fiberoptic Index Score (Mann-Whitney U-test).

DISCUSSION

Awake nasal or oral flexible fiberoptic intubation is the airway management technique of choice in patients with anticipated difficult airway. Both optimal intubating conditions and patient comfort are necessary for fiberoptic intubation. Optimal intubating conditions provided by an ideal sedation regimen would ensure haemodynamic stability, patient comfort, attenuation of airway reflexes and amnesia during fiberoptic laryngoscopy. The primary outcome of our study showed that both fentanyl plus propofol and fentanyl plus midazolam regimes provide adequate conditions for fiberoptic intubation. Both groups underwent uncomplicated fiberoptic intubation. No significant difference was found in HR, SBP, DBP and MAP between the two groups. These findings are similar to those reported in the studies conducted by Crawford M et al., Falkman H et al., and Clarkson K et al., who found no significant difference in haemodynamics parameters among propofol and midazolam groups during fiberoptic laryngoscopy [10,13,14]. However, study conducted by Grendelmier P et al., on comparative evaluation of propofol and midazolam as sedative agents concluded that patient randomized to propofol showed more episodes of hypotension [15]. It might be due to the dose of propofol used in the study. The median dose of propofol used was 310 mg corresponding to 4.69 mg/kg compared to 1 mg/kg in our study.

The mean SpO_2 was significantly lower in Group I compared to Group II during FOS and ET placement. These findings were similar to those reported by Grandelmeir P et al., who conducted study on comparative evaluation of propofol and midazolam as sedative agents in 90 consecutive patients undergoing medical thoracoscopy and observed that patients randomized to propofol group showed more episodes of hypoxia [15]. Tsai CJ et al., in their study concluded that airway obstruction and hypoxia occurred more frequently in the propofol group than in the dexmedetomidine group [16]. Crawford M et al., also showed the same result in their study [10]. However, the study conducted by Bailey PL et al., showed that midazolam alone does not produce ventilatory depressant effects in healthy volunteers [17], but the combination of midazolam (0.05 mg/kg) and fentanyl (2 µg/kg) i.v. resulted in hypoxemia and/or hypoventilation. In our study, no ventilatory depression and no decrease in arterial saturation was observed in patients receiving midazolam and fentanyl. It might be because of the dose of midazolam (0.03 mg/kg) and fentanyl (1 µg/kg) used in study which was just adequate for procedural sedation without causing respiratory depression.

Total comfort scores were lower in Group II (they were more calm) during FOS and ET compared to Group I. Group I had high five point FOI scores implying better patient tolerance than Group II. These findings are corroborated by the studies conducted by Rolo R et al., Rodrigues AJ et al., and Dhasmana S et al., show that midazolam and fentanyl provide better intubating conditions, patient comfort and tolerance in fiberoptic bronchoscopy [7,8,18]. However, the study conducted by Falkman H et al., in their study concluded that propofol shows more homogeneous satisfaction score [13]. The reason for this was the propofol dose used in this study was higher than that used in our study.

It can be concluded, that the use of midazolam (0.03 mg/kg) and fentanyl (1 µg/kg) is safe and effective in patients undergoing fiberoptic laryngoscopy offering conscious sedation, better tolerance and comfort while maintaining oxygen saturation without any haemodynamic alteration.

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