Original Research Article

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A Comparative Study of Dexmedetomidine (1 mcg/kg) and Fentanyl (2 mcg/kg) with Dexmedetomidine (1 mcg/kg) Alone for Sedation during Awake Fiberoptic Intubation

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Abstract

Aim of Study: Many drugs are used for providing favorable intubation conditions during awake fiberoptic intubation (AFOI). However, most of them cause respiratory depression and airway obstruction leading to hypoxemia. The aim of this study was to compare intubation conditions, and incidence of desaturation between dexmedetomidine in combination with fentanyl and dexmedetomidine alone. *Material and Methods:* This randomized double-blind prospective study was conducted on a total of 60 patients scheduled for maxillo facial surgeries who were randomly allocated into two groups: Group DF received dexmedetomidine 1 mcg/kg along with fentanyl 2 mcg/kg and Group D received dexmedetomidine 1 mcg/kg over 10 min. Patients in both groups received glycopyrrolate 0.2 mg intravenous, nebulization with 2% lidocaine 4 ml over 15min and 10% lidocaine spray before undergoing AFOI. Adequacy of intubation condition was evaluated by Incidence of desaturation, cough score and post-intubation score, hemodynamic changes and sedation using Ramsay sedation scale (RSS) were noted and compared between two groups. *Results:* Cough score <2 was considered as favourable intubation condition, which was achieved in 27 out of 30 patients in Group DF, but only in 5 out of 30 patients in Group D which is statistically significant. ($P < 0.0001$) Better tolerance score (Score 1) was found in 21 patients of Group DF and only 4 patients in Group D. This difference was also statistically significant ($P < 0.0001$). higher RSS was achieved in Group DF(3.7±0.79)than in Group D (1.7±0.65) ($P < 0.0001$). We observed that 8 patients of Group DF and 28 patients in Group D were able to maintain SpO_2 (≥95%) ($P < 0.0001$) during the procedure *Conclusion:* Dexmedetomidine with fentanyl provides good intubation conditions than Dexmedetomidine alone during AFOI.

Keywords: Awake Fiber Optic Intubation (AFOI); Dexmedetomidine; Fentanyl; Cough Score; Intubation Conditions.

Introduction

Oral or nasal flexible fiber optic intubation (AFOI) is usually the gold standard method for airway management in the expected difficult airway. Success of the fibre optic intubation is highly dependent on adequate preparation and sedation techniques [1].

A patient who is comfortable, cooperative, free of oropharyngeal blood and secretions, and able to maintain his/her airway with spontaneous ventilation are the adequate conditions for AFOI. In order to achieve controlled sedation and analgesia, the pharmacologic agents which are short acting, easily titratable, provide the required amount of sedation with little suppression of spontaneous ventilation should be used.

Dexmedetomidine is a centrally acting, selective alpha-2 agonist which was approved in 1999 by the Food and Drug Administration (FDA) as a short term sedative and analgesic (<24 hours) for critically ill or injured people on mechanical ventilation in the intensive care unit (ICU) [2,3], for intraoperative sedation during surgery under regional anesthesia [4], for awake craniotomies [5], and for sedation of pediatric patients in different settings [6]. More recently, there have been several case reports of dexmedetomidine being used for AFOI [7-10].

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Opioids like as fentanyl and remifentanil are helpful for attenuating hemodynamic response and discomfort during fibre optic intubation but incidence of hypoxia is very high due to their respiratory depressant action [11,12]. Fentanyl in high dose may cause apnea and loss of tone of upper airway producing difficulty during the negotiation of the bronchoscope beyond epiglottis [13,14].

In the present study, we compared dexmedetomidine alone and dexmedetomidine with fentanyl for conscious sedation during AFOI in adult patients scheduled for oro maxillo-facial surgeries. The aims of our study were to compare between these two groups: Intubation condition by cough score, tolerance to intubation bypost-intubation score, hemodynamic parameters and incidence of oxygen desaturation (SpO_2).

Materials & Methods

After obtaining institutional ethical committee approval and written informed consent from study subjects, this double blinded randomized prospective study was conducted on 60 patients from march 2017 to august 2017 at narayana medical college, Nellore with each group having 30 patients of either sex, aged 20-60 years, belonging to American Society of Anesthesiologists physical status (ASA-PS) I and II, and posted for elective maxillofacial surgeries. Exclusion criteria for study was patients with bradycardia (baseline HR <60 beats/min), any type of atrioventricular block, heart failure, having significant neurological, hepatic, renal and pulmonary disease, emergency surgeries, any contraindication for nasal intubation like thrombocytopenia or coagulopathies.Patients were allocated by computer generated random numbers and were divided into two groups. Group DF – dexmedetomidine+fentanyl group (n = 30) and Group D-dexmedetomidine group (n = 30). Dose of study drug was calculated according to patient's body weight, diluted with normal saline to make equal volume of 50 ml and enveloped according to patient's inclusion number. The anesthesiologist preparing the study drug and the observer anesthesiologists were blinded to each other. Bronchoscopy was performed by a single anesthesiologist in all patients.

Patients were pre-medicated with tab alprazolam 0.5 mg, tab ranitidine 150 mg night before surgery. In the operating room, intravenous line (i.v.) was secured with wide bore cannula (18G) and multichannel monitor was applied to record baseline Heart rate (HR), Mean arterial pressure (MAP), SpO_2 and electrocardiogram. Injection glycopyrrolate 0.2 mg i.v. was given. Patency of both nostrils was tested and the nostril with better patency was chosen for awake nasal fiberoptic intubation. Topicalization of both the upper and lower airway was accomplished by nebulization with 2% lidocaine 4 ml (80 mg) for 15 min. Xylometazoline nasal drops and lidocaine jelly were applied to both the nostrils. Tongue and hypopharynx were sprayed with two puffs of 10% lidocaine (20 mg). After that dexmedetomidine (1 mcg/kg over 10 min) and fentanyl (2mcg/kg) in DF group, dexmedetomidine (1 mcg/kg over 10 min) in D group was infused according to the subject's inclusion number. After lubrication bronchoscope was loaded with appropriate size cuffed polyvinyl chloride endotracheal tube. At the end of the study drug infusion, sedation was evaluated by Ramsay sedation scale (RSS) [15]. Bronchoscopy was performed through nasal approach.

After proper placement of tube in trachea general anesthesia was induced and surgery was allowed to proceed. Intubation condition was evaluated by cough score during bronchoscopy as Score 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) [16]. Tolerance to intubation was evaluated by post-intubation score after placement of tube in the trachea as: 1 = Co-operative, 2 = minimal resistance, 3 = severe resistance [17]. Level of sedation was evaluated by Ramsay sedation score (RSS) just after completion of infusion of study drug as: 1 = Anxious, agitated or restless, 2 = cooperative, oriented and tranquil, 3 = sedated but responds to command, 4 = asleep, brisk glabellar reflex responds to loud noise, 5 = asleep, sluggish glabellar reflex or responds to loud noise, 6 = asleep with no response to a painful stimulus. MAP and HR were noted as a baseline and immediately after intubation. SpO_2 was monitored throughout the procedure and lowest one was noted. Hypotension (reduction of MAP >20% from baseline) was treated with i.v. fluid and/or phenylephrine 50 mcg i.v. bolus, repeat dose after 5 min. Bradycardia (HR <60 beats/min) was treated with atropine 0.6 mg i.v. Oxygen desaturation (SpO_2 < 95% for >10 s) was treated with oxygen supplementation either through a nasal cannula or oxygen port of bronchoscope.

Statistical Analysis

Numerical data were expressed as mean with a standard deviation and categorical data were put

into tables. Statistical analysis were carried out using the statistical package for the social sciences 16.0 statistical software packages.

Numerical data were compared between two groups using independent *t*-test. Categorical data were compared between two groups using Chi-square test and P value < 0.05 was considered statistically significant.

Results

Demographic characteristics like age, weight and ASA-PS (I/II) were comparable between two groups as shown in (Table 1, Figure 1 & 2).

Cough score <2 was considered as favourable intubation condition, which was achieved in 27 out of 30 patients in Group DF, but only in 5 out of 30 patients in Group D. The difference was statistically significant ($P < 0.0001$) as shown in(Table 2 & Figure 3).

Better tolerance score (Score 1) was found in 21 patients of Group DF and only 4 patients in Group D. This difference was also statistically significant ($P < 0.0001$) as shown in (Table 2 & Figure 4).

At the end of study drug infusion, higher RSS was achieved in Group DF (3.7±0.79) than in Group D (1.7 ± 0.65) ($P < 0.0001$) as shown in (Table 2 & Figure 5).

We observed that 8 patients of Group DF and 28 patients in Group D were able to maintain SpO_2 (eH 95%) ($P < 0.0001$) during the procedure. 2 patients in Group D and 8 patients in Group DF suffered from significant desaturation (SpO_2 dH 94%), which was managed by administration of oxygen through the port of the bronchoscope as shown in (Table 2 & Figure 6).

There was a rise of MAP compared with baseline values in both groups. The increase of MAP was minimal in Group DF as well as Group D as shown in (Table 3 & Figure 7). There was no episode of hypotension in both groups.

There was a significant increase in HR in the post-intubation period (77.30±5.98 beats/min) in comparison with the baseline value (65.50±7.25 beats/min) in Group D. The post-intubation HR (73.10±5.62 beats/min) increased in comparison with baseline value (64.39±4.31 beats/min) in Group DF as shown in (Table 3 & Figure 8). However, no patient developed bradycardia (HR <60 beats/min) requiring atropine.

Table 1:

	Group DF Mean±SD	Group D Mean±SD	P value
Age (in Years)	42.40±10.07	40.63±10.10	**0.500**
Weight (Kgs)	67.33±9.14	66.10±8.48	0.590
ASA-I_II	1.17±0.37	1.13±0.35	0.72

Table 2:

	Group DF Mean±SD	Group D Mean±SD	P Value
Cough Score	1.1±0.31	2.2±0.89	<0.0001
Tolerance Score	1.3±0.45	2.27±0.69	<0.0001
Ramsaysedation Score	3.7±0.79	1.7±0.65	<0.0001
Oxygen Saturation	92.2±3.89	98.10±1.78	<0.0001

Fig. 1:

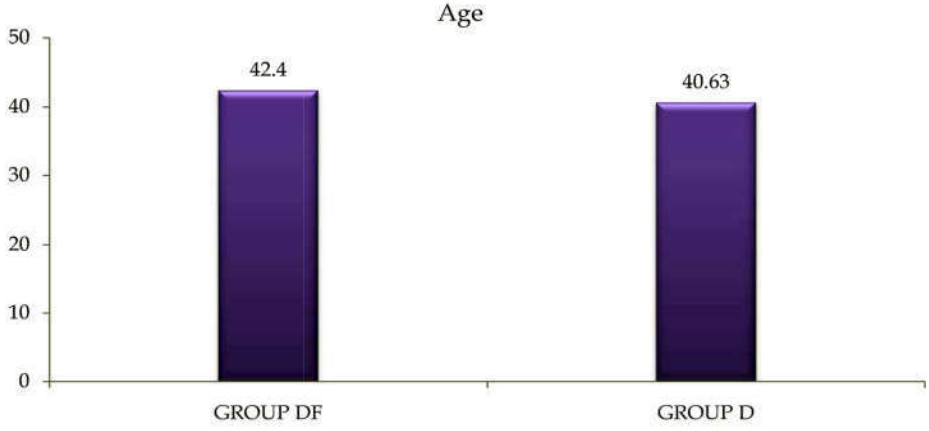


Table 3:

	Group DF Mean ± SD	Group D Mean ± SD	P Value
Baseline MAP	72.43±4.53	74.32±4.36	0.112
Post Intubation MAP	73.93±4.91	75.0±4.37	0.387
Baseline HR	64.39±4.31	65.50±7.25	0.294
Post Intubation HR	73.10±5.62	77.30±5.98	<0.0001

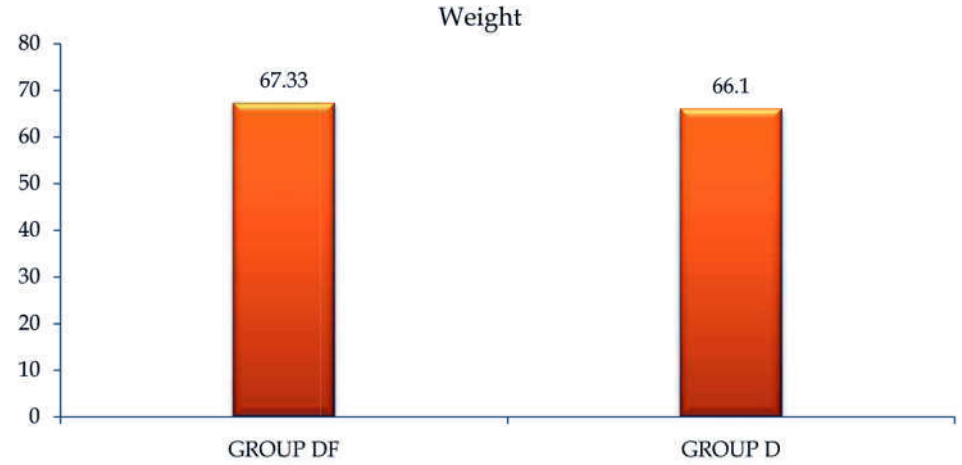


Fig. 2:

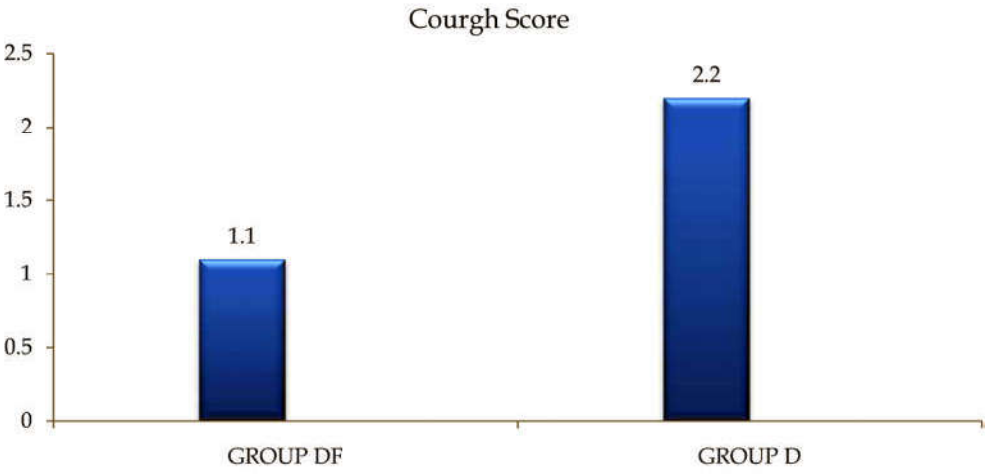
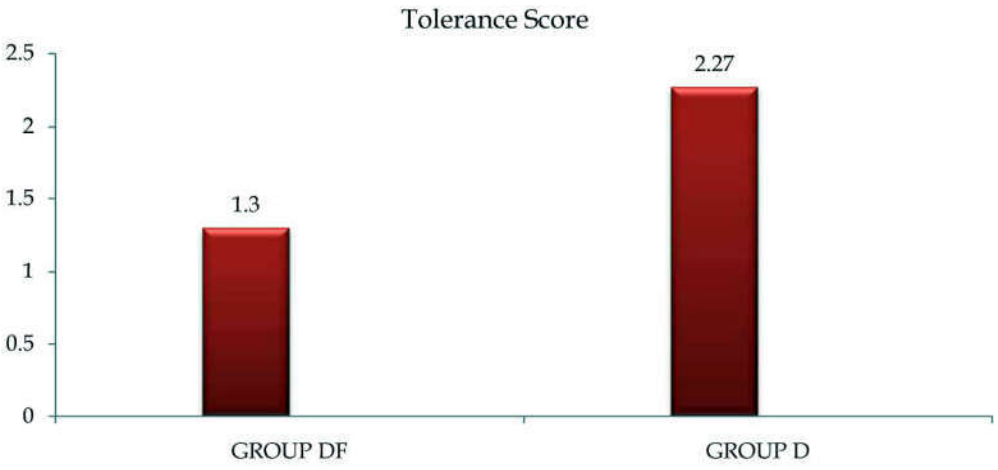


Fig. 3:



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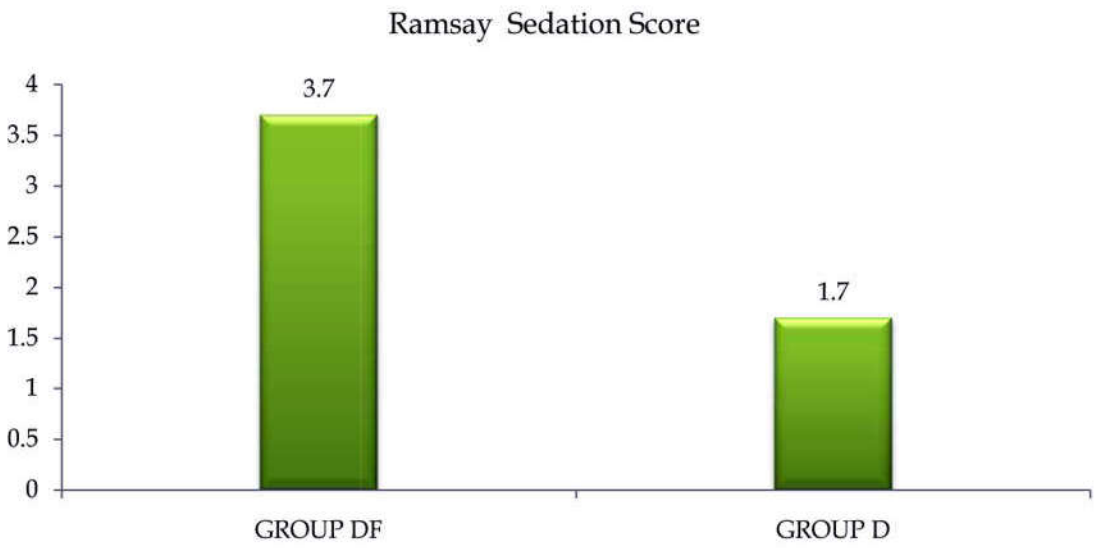

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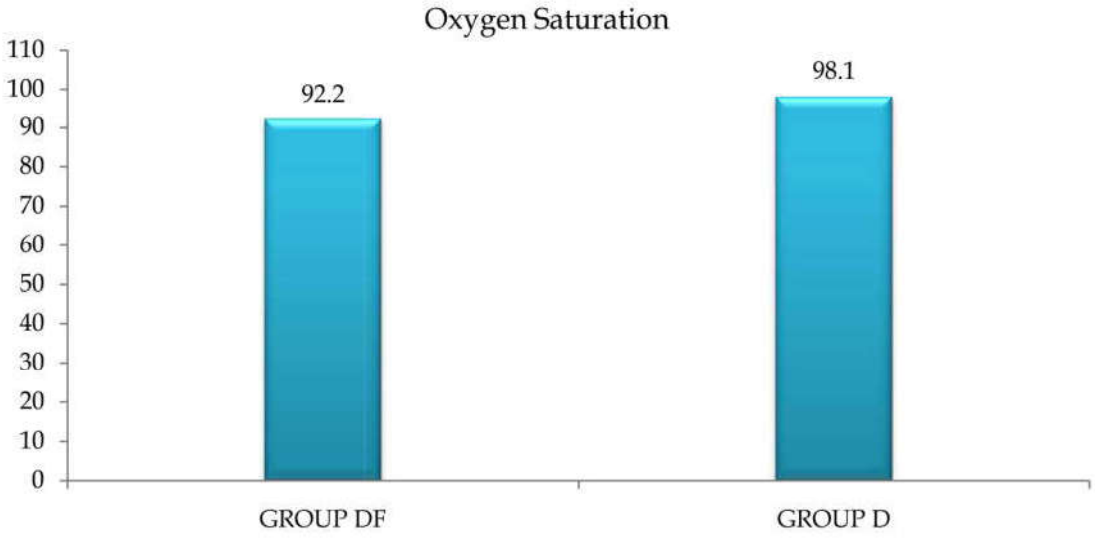
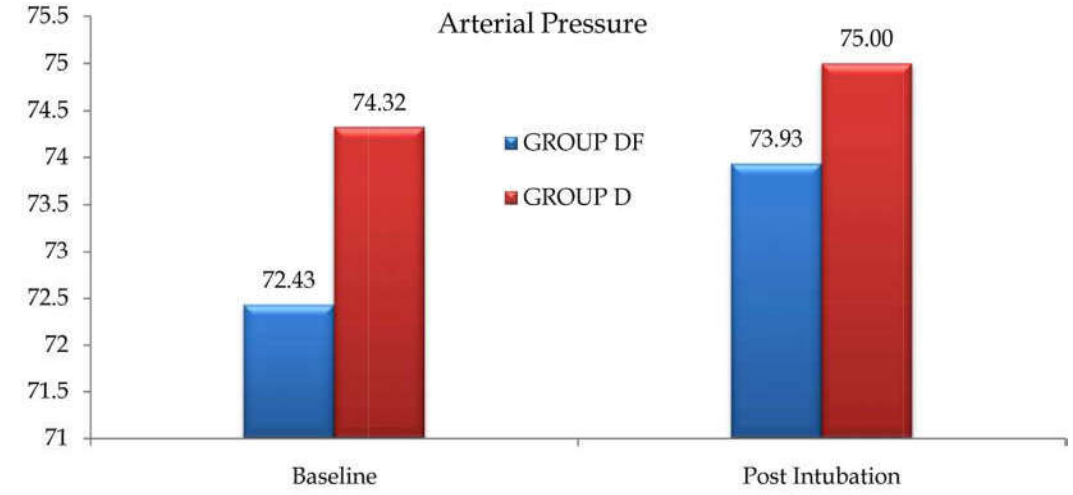


Fig. 6:



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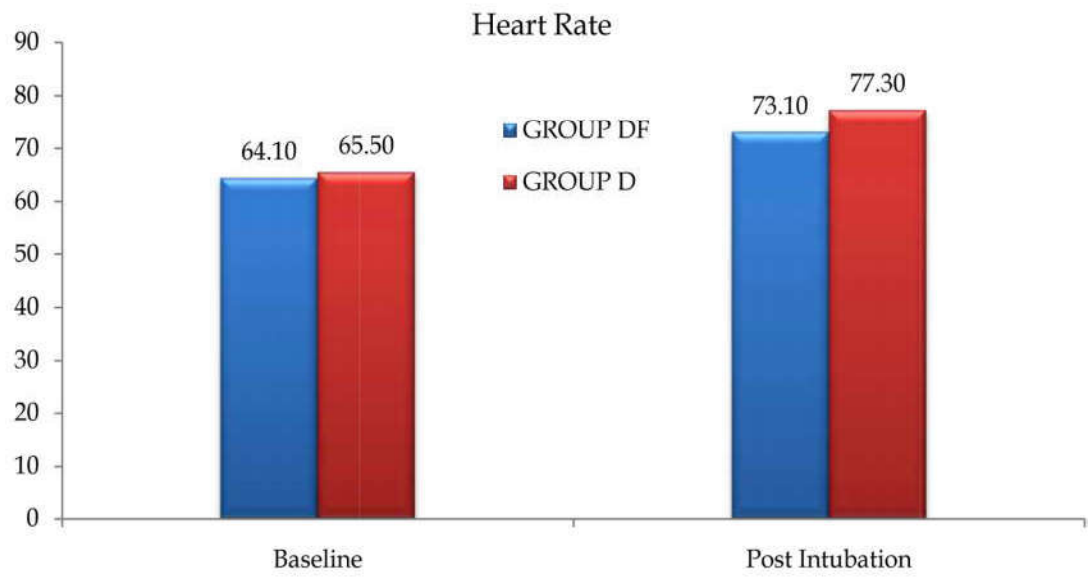

Fig. 8:

Discussion

In difficult airway scenarios, The ASA difficult airway algorithm emphasizes on awake intubation or tracheostomy as primary or alternate option [18]. Now-a-days, AFOI is the preferred method for securing a difficult airway and which requires conscious sedation during AFOI.

The aim of ideal sedation during AFOI is to achieve comfortable, cooperative patient and smooth patient tolerance of the technique through blunting of airway reflexes and attenuating the hemodynamic sympathetic response to intubation, while simultaneously achieving spontaneous breathing through a safe patent airway [19].

Dexmedetomidine is a highly selective, centrally acting α-2 agonist. It acts on presynaptic α-2 receptors to provide negative feedback causing less neurotransmitter (norepinephrine, epinephrine) available at post-synaptic α-1receptors.

Dexmedetomidine induces sedation involving activation of endogenous sleep promoting pathway through the post-synaptic α-2 receptors in the locus ceruleus, which modulates wakefulness. It produces hypnosis, amnesia, analgesia, anxiolysis, sympatholysis and antisialogogue effects all of which are desirable during AFOI [20]. The major advantages of dexmedetomidine infusion during AFOI are a unique form of sedation where patients remain sleepy, but are easily aroused, cooperative with minimum respiratory impairment. The feasibility of dexmedetomidine has been recently studied either as a sole sedative agent or as an adjuvant during AFOI [21,22].

We compared dexmedetomidine 1mcg/kg along with fentanyl 2 mcg/kg (Group DF) with dexmedetomidine 1 mcg/kg (Group D) and found that cough score was < 2 was considered as favorable intubation condition, which was achieved in 27 out of 30 patients in Group DF, but only in 5 out of 30 patients in Group D.

The difference was statistically significant ($P < 0.0001$) and Better tolerance score (Score 1) was found in 21 patients of Group DF and only 4 patients in Group D. This difference was also statistically significant ($P < 0.0001$).

Chu et al [23] observed better tolerance to intubation without respiratory depression and upper airway obstruction in dexmedetomidine group (1 mcg/kg) compared with fentanyl group (1 mcg/kg).

In our study, dexmedetomidine & fentanyl produced better intubating conditions than dexmedetomidine alone. Dexmedetomidine has also been proved as an effective agent for AFOI in certain difficult airway scenarios [24].

Bergese et al [25] noted that dexmedetomidine at 1 mcg/kg bolus was safe and beneficial for patients undergoing AFOI even without airway nerve block or topical anesthesia.

Bergese et al [25] found that dexmedetomidine in combination with low dose midazolam is more effective than midazolam alone for sedation in AFOI. However, dexmedetomidine dose in excess

of 1 mcg/kg/h with midazolam produced airway obstruction, which was managed by simple chin lift.

In our study higher RSS was achieved in Group DF (3.7±0.79)than in Group D (1.7±0.65) which provided with better cooperative condition during intubation (P < 0.0001). We observed that 8 patients of Group DF and 28 patients in Group D were able to maintain SpO 2 (≥95%) (P < 0.0001) during the procedure. 2 patients in Group D and 8 patients in Group DF suffered from significant desaturation (SpO2 ≤94%), which was managed by administration of oxygen through the port of the bronchoscope.

Ryu et al [26] compared remifentanil with dexmedetomidine for conscious sedation during bronchoscopy. They found that there were no significant difference of sedation level, MAP, HR and patient satisfaction score (P > 0.05) but cough score and incidence of desaturation was significantly lower (P < 0.01) in dexmedetomidine group than remifentanilgroup.

In our study, the baseline MAP, HR and were comparable between two groups. There was a rise of MAP compared with baseline values in both groups. The increase of MAP was minimal in Group DF as well as Group D. There was no episode of hypotension in both groups as well noticed that high bolus dose of dexmedetomidine does not cause hypertension. There was a significant increase in HR in the post-intubation period (77.30±5.98 beats/min) in comparison with the baseline value (65.50±7.25 beats/min) in Group D. The post-intubation HR (73.10±5.62 beats/min) increased in comparison with baseline value (64.39±4.31 beats/min) in Group DF .

Dexmedetomidine infusion may cause bradycardia, atrial fibrillation, hypotension or hypertension particularly in higher dose [27]. In our study there was no such untoward complications because we used dosage of 1 ìg/kg.

Bergese et al [25] compared dexmedetomidine plus midazolam versus midazolam alone, and he noticed no difference in both groups regarding systolic blood pressure. This may be because of using loading dose of 1μg/kg infused over 15 min (longer duration then our study) followed by a small infusion dose of 0.2 μg/kg/h and titrated to 0.7μg/kg/h.

Prommer [28] who compared dexmedetomidine with midazolam for sedation of 375 ICU mechanically ventilated patients and revealed that dexmedetomidine was associated with a greater incidence of bradycardia.

Gupta et al [29] compared dexmedetomidine versus propofol premedication for fiberoptic intubation in patients with temporomandibular joint ankylosis and found that the HR decreased significantly in the dexmedetomidine group at the end of drug infusion.

Conclusion

Dexmedetomidine with fentanyl provided better patient tolerance, less cough score,good sedation, and reduced hemodynamic responses&provided favourable intubating conditions but desaturation was more when compared with dexmeditomidine alone which was manageable by providing oxygen supplementation.

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