Original Article

Indian Journal of Anesthesia and Analgesia
2017, 4 (4, Part-I), 917-739
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.4417.25

Comparative Evaluation of Dexmedetomidine and Fentanyl as Adjuvant to Propofol on Intubation Conditions during Fiberoptic Intubation

Sourabh Kumar[1], Vikas Kumar Gupta[2], Aditya Agarwal[3]

[1]Resident [2]Assistant Professor [3]Professor, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh 462001, India.

Abstract

Fiber-optic intubation (FOI) is recommended for patients with anticipated difficult airway, failed intubation, unstable cervical spine injurywhere optimum positioning for laryngoscopy is difficult to achieve. Fentany l, an opioid, is useful for fiber-optic intubation as it ensures mild sedation and analgesia with stable hemodynamics. Dexmedetomidine acts on presynaptic alpha-2 receptors and results in sedation, hypnosis, amnesia, analgesia, anxiolysis, sympatholysis and antisialogogue. Aims: To compare the efficacy of Dexmedetomidine and Fentanyl as adjuvant to Propofol on intubating conditions during fiber-optic intubation. Materials and Methods: An observational, prospective clinical study was carried out on 60 patients of ASA grade I and II of either sex, aged 20-60 yrs undergoing surgeries under general anaesthesia. Patients were allocated into two groups - Group D- Dexmedetomidine group (n = 30) and Group F- Fentanyl group (n = 30). Intubation condition, post intubation score, depth of sedation, intubation time, any episode of hypoxia and hemodynamic changes were documented. Results: Satisfying intubation condition was procured in 27 subjects in group D as compared to 4 subjects in group F. Recommended post-intubation score (= 1) was acquired in 23 Group D subjects in contrast to 3 Group F subjects. In group D, Ramsay sedation score obtained following conclusion of study drug infusion was notably high (3.23-0.352) as compared to Group F (2.02-0.262). Remarkable desaturation (SpO2 £ 94%) were encountered in 4 Group D subjects and 24 Group F subjects. Hemodynamic stability was also found more in group D. Conclusion: Dexmedetomidine by imparting superior intubation condition, stable hemodynamic parameters and appropriate sedation without desaturation is more efficacious as compared to Fentanyl when used for FOI.

Keywords: Fiber-Optic Intubation; Fentanyl; Dexmedetomidine.

Introduction

From an anaesthesiologist point, management of difficult airway becomes an utmost difficult task when it is further supervened by inability to implement head tilt and jaw thrust manoeuvres. Under these conditions, fiber-optic intubation becomes a definitive and infallible technique to manage the patient's airway.

Fiber-optic intubation (FOI) is recommended for patients with anticipated difficult airway, failed intubation, unstable cervical spine injury where optimum positioning for laryngoscopy is difficult to achieve.

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

In present scenario BZDs, opioids and propofol are being used individually or in combination for procedural sedation and comfort [2]. Midazolam causes amnesia and helps in keeping the patient restful. Propofol provides fervent amnesia with rapid

Corresponding Author: Vikas Kumar Gupta, Assistant Professor, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh 462001, India.
E-mail: 1074vicky@gmail.com

Received on 14.07.2017, **Accepted on** 12.08.2017

onset and offset of action. To diminish the hemodynamic response and uneasiness during passage of the bronchoscope via vocal cords, opioids are useful. Although these combinations may render better conditions for intubation, all these drugs are respiratory depressants, therefore having high incidence of hypoxemia [2,3]. It can give rise to fatal consequences in difficult airway cases with can't intubate, can't ventilate situations.

In high doses, propofol causes marked apnoea and loss of upper airway tone which makes the negotiation of bronchoscope beyond epiglottis more demanding [4].

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

Fentanyl, a phenylpiperidine derivative of synthetic opioid, is useful for fiber-optic intubation as it ensures mild sedation and analgesia with stable hemodynamics. But it has some major side effects like respiratory depression, nausea and vomiting and chest wall rigidity [5].

Dexmedetomidine (highly selective, centrally acting α -2 agonist) acts on presynaptic α-2 receptors and provides negative feedback which diminishes the availability of neurotransmitter (norepinephrine, epinephrine) at post-synaptic α-1 receptors. The effects produced by dexedetomidine which are beneficial for fiber-optic intubation are hypnosis, amnesia, analgesia, anxiolysis, sympatholysis and antisialogogue. The sedation is induced by involving activation of endogenous sleep promoting pathway through the post-synaptic α-2 receptors in the locus ceruleus, which modulates wakefulness [6].

The significant beneficial effects of dexmedetomidine infusion during fiber-optic intubation includes sleepy but easily aroused patient, cooperation and mere respiratory impairment, which provides a distinctive sedation. The suitability of dexmedetomidine is recently being studied as an onliest sedative agent or as an adjuvant for fiber-optic intubation.

The following study deals with adult patient who are scheduled for elective surgeries under GA and provides the comparison of dexmedetomidine with fentanyl for the purpose of conscious sedation during fiber-optic intubation.

The aim of the study was to compare between these two groups: Intubation condition by cough score, tolerance to intubation by post-intubation score, hemodynamic parameters and incidence of oxygen desaturation (SpO_2) if any.

Material and Method

After acceptance from ethical committee and procuring consent from the patients, an observational, prospective clinical study was carried out on 60 patients of ASA grade I and II of either sex, aged 20-60 yrs undergoing various surgeries under general anaesthesia. Through chit in box method, patients were allocated into two groups - Group D-Dexmedetomidine group (n = 30) and Group F-Fentanyl group (n = 30). According to body weight of the patient, dose of the study drug was calculated and diluted with normal saline to make equal volume of 50ml each and enclosed with respect to patient's inclusion number. The anaesthesiologist who prepared the study drug and the observer anaesthesiologist were blinded to each other. A single anaesthesiologist performed bronchoscopy in all patients. The intubation performing anaesthesiologist and data recorder were all kept blinded towards the group identities.

All patients were operated following standard regimen under GA after fasting overnight.

Patients were monitored for pulse rate, NIBP, ECG, respiratory rate, SpO_2 and $EtCO_2$ by attaching multi channel monitor.

15 minutes prior to procedure, patients were administered Inj Glycopyrrolate 0.01 mg/kg body weight, Inj Ranitidine 0.25-1 mg/kg body weight and Inj Ondansetron 0.1 mg/kg body weight as premedications.

For the procedure, the nostril with better patency was chosen after testing both nostrils. To attain adequate analgesia and reduce bleeding during the nasotracheal intubation, cotton wool-tipped swabs were soaked in 4% lidocaine with adrenaline and applied to both the nostrils. Xylometazoline hydrochloride 0.1% w/v nasal drop was used to obtain nasal vasoconstriction. Nebulization with 2% lidocaine 4 ml (80 mg) for 20 min perpetuated topicalization of both upper and lower airway. Nasal oxygenation with 100% oxygen was started 3 min prior to procedure.

Group D patients were given a loading dose of dexmedetomidine 1 μg/kg infused over 10 min followed by propofol infusion whereas Group F received a loading dose of fentanyl 2 μg/kg infused over 10 min followed by propofol infusion. The dose

was adjusted to procure the desired level of sedation.

The anaesthesiologist performing fiberoptic intubation also graded the intubating conditions meanwhile another anaesthesiologist controlled the rate of drug infusion.

Bronchoscope was loaded with appropriate size cuffed flexometallic endotracheal tube after lubrication. Ramsay Sedation Scale (RSS) help in assessing the depth of sedation which was evaluated at the end of study. After Score ≥ 2 was achieved, bronchoscopy was performed via nasal approach. As soon as tube was placed satisfactorily in trachea, GA was induced and surgery proceeded.

Intubation condition was evaluated by:

A. Vocal cord movement

Grade	1	2	3	4
Vocal cord	Open	moving	closing	Closed

B. Cough score during bronchoscopy

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

C. Limb Movements

Grade	1	2	3	4
Limb movement	None	Slight	Moderate	Severe

The post intubation score help to analyse tolerance to intubation after placement of tube in the trachea (1 = Co-operative, 2 = minimal resistance, 3 = severe resistance)

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

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.

The other parameters which were recorded were- Bronchoscopy time (time from insertion of the fiberoptic bronchoscope in the nostril to visualization of the carina), Intubation time (insertion of tracheal tube into the nose upto confirmation of tracheal intubation with capnograph), Any episode of hypoxia (SpO_2 <90%), Number of attempts at intubation and any postoperative adverse events of hoarseness and sore throat.

Hemodynamic changes in heart rate and mean arterial blood pressure were documented for both groups at following levels:

1. Preinduction
2. At the end of propofol infusion- after securing adequate level of sedation
3. Immediately after intubation.

SpO_2 was monitored throughout the procedure and lowest reading was recorded.

Statistical Analysis

The data obtained was subjected to statistical analysis with the consult of a statistician. The data so obtained was compiled systematically. Numerical data were expressed as mean with a standard deviation and categorical data were put into tables. Statistical analyses were done with the statistical package for the social sciences 16.0 statistical software packages. Independent *t*-test was used to compare numerical data between two groups while paired *t*-test was implemented for intra-group comparison. Chi-square test was used for categorical data comparison between two groups. Significance level was fixed at $P \leq 0.05$.

Results

Demographic Parameters: There appeared no difference in age, sex, weight and ASA Grade of the two groups (Table 1).

Table 1: Demographic profile

	Grp D	Grp F	P value
Age	46.23± 9.23	45.07± 10.34	>0.05
Weight (in Kg)	57.9±8.37	55.98± 10.2	>0.05
Sex (M / F)	23 / 7	20 / 10	>0.05
ASA (I / II)	24 / 6	23 / 7	>0.05

Table 2: Intubation and Post-intubation score

		Grp D	Grp F	P value
Vocal cord	= 1	17	11	< 0.05
	>/= 2	13	19	< 0.05
Cough score	</= 2	27	4	< 0.05
	>/= 3	3	26	< 0.05
Limb movement	</= 2	20	13	< 0.05
	>/= 3	10	17	< 0.05
RSS		3.23 ± 0.352	2.02 ± 0.262	< 0.05
Post intubation	= 1	23	3	< 0.05
Score	>/= 2	7	27	< 0.05
Intubation time (in Sec)		123 ± 8.6	131	< 0.05
SPO_2	>/= 95%	26	6	< 0.05
	</= 94%	4	24	< 0.05

Table 3: Hemodynamic Parameters

		Grp D	Grp F	P value
HR	Baseline	87.13 ± 12.787	84.93 ± 9.244	>0.05
	Post-intubation	80.22 ± 8.34	88.07 ± 10.096	< 0.05
MAP	Baseline	94.27 ± 8.65	95.23 ± 6.170	>0.05
	Post-intubation	98.47 ± 8.69	106.3 ± 4.69	< 0.05

Satisfying intubation condition (Cough score ≤ 2) was accomplished in 27 subjects in group D as compared to 4 subjects in group F and the disparity was statistically striking (P < 0.0001).

Preferable post-intubation score (= 1) was acquired in 23 Group D subjects in contrast to 3 Group F subjects and the variation was statistically remarkable (P < 0.0001).

Ramsay Sedation Score: In group D, RSS obtained following conclusion of study drug infusion was notably high (3.23 ± 0.352) as compared to Group F (2.02 ± 0.262) (P < 0.0001).

SpO_2: While performing FOI, 26 subjects belonging to Group D and 6 subjects of Group F sustained ($SpO_2 \geq 95\%$) (P < 0.0001). Remarkable desaturation ($SpO_2 \leq 94\%$) encountered in 4 Group D subjects and 24 Group F subjects were handled by delivering oxygen via bronchoscope port (Table 2).

Hemodynamic Parameters: The two groups were equivalent when the baseline hemodynamic parameters (MAP, HR, SpO_2) were compared/ juxtaposed. MAP escalated from the baseline in both groups during FOI with nominal rise in Group A (P>0.05) while the increase in Group B was statistically astounding (P<0.0001). No incidence of hypotension were noted in either group. In Group D, an appreciable slump in HR (80.22±8.34) post-intubation when compared with the baseline (87.13±12.787) was noted(P<0.005). A noteworthy surge in post intubation HR (88.07±10.096 beats/min) in group B as compared to baseline HR (84.93±9.244 beats/min) was observed ($P < 0.05$). None of the patient encountered bradycardia [Table 3].

Discussion

Presently, fiberoptic intubation with conscious sedation is the mainstay approach for suspected difficult airway patients, for which several drugs have been studied/tried/tested.

Fentanyl, a synthetic phenylpiperidine derivative, is effective for FOI as it ensures mild sedation and analgesia with stable hemodynamics. But it has side effects like respiratory depression, nausea, vomiting and chest wall rigidity.

Dexmedetomidine is an extremely selective, centrally acting α -2 agonist acting on presynaptic α-2 receptors. Boasted with sedative, analgesic and anxiolytic properties, with hemodynamic and

sympathoadrenal stability and no effect on the respiration along with conscious sedation, it can be used for FOI.

In our study we compared 60 subjects by dividing them in two groups-

Group D- dexmedetomidine 1 mcg/kg

Group F- fentanyl 2 mcg/kg.

Promising conditions for intubation and tolerance was found in dexmedetomidine subjects when compared to fentanyl subjects. Cough score ≤2 was procured in 27 subjects in group A as compared to 4 subjects in group B and disparity was statistically striking ($P < 0.0001$). Preferable post-intubation score (= 1) was acquired in 23 Group D subjects in contrast to 3 Group F subjects and the variation was statistically remarkable ($P < 0.0001$).

Chu *et al* compared dexmedetomidine (1 mcg/kg) with fentanyl (1 mcg/kg) for FOI and noted greater tolerance to intubation without respiratory depression or upper airway obstruction in dexmedetomidine group. In our subjects dexmedetomidine (1µg/kg) provided superior intubating environment/situation/ circumstances compared to fentanyl (2µg/kg). Dexmedetomidine has been shown as a potent sole agent or adjuvant for FOI [7].

Abdelmalak *et al* used dexmedetomidine as sedative agent and performed effective AFOI in subjects with difficult airway. Bergese et al observed that dexmedetomidine (1µg/kg bolus) was riskfree and advantageous for AFOI even without triple nerve block or topical anaesthesia [8].

Bergese *et al* observed that for sedation in FOI a combination of dexmedetomidine and low dose midazolam is more efficacious than midazolam alone. Nonetheless/notwithstanding dexmedetomidine in dosage of more than 1µg/kg with midazolam resulted in airway obstruction [9].

All subjects in our study attained RSS ≥2. In group D, RSS obtained was notably high (3±0.371) as compared to Group F (2.07 ± 0.254) ($P < 0.0001$).

Ryu *et al* did a comparative study on remifentanil and dexmedetomidine for bronchoscopy and observed no noteworthy dissimilarity of sedation level, MAP and HR (P>0.05). However cough score and desaturation episodes were significantly lesser in dexmedetomidine group (P<0.01) [10].

Subjects belonging to dexmedetomidine group displayed superior hemodynamic steadiness. The two groups were equivalent when the baseline hemodynamic parameters (MAP, HR, SpO_2) were juxtaposed. Baseline HR and MAP were comparable for either group. MAP escalated from the baseline in both groups during FOI with nominal rise in Group D (P>0.05) while the increase in Group F was statistically astounding (P<0.0001). No incidence of hypotension was noted in either group. In Group D, an appreciable slump in HR post-intubation when compared with the baseline was noted (P<0.005). A noteworthy escalation in post intubation HR in group F as compared to baseline HR was observed ($P < 0.0001$). None of the patient encountered bradycardia. Dexmedetomidione exerts its hemodynamic sequelae via diminishing noradrenaline release, reduced centrally mediated sympathetic tone and increased vagal tone. Bradycardia, hypotension and atrial fibrillation may occur as a sequelae to dexmedetomidine infusion.

Yavascaoglu *et al* in a comparative study between dexmedetomidine and esmolol observed that dexmedetomidine attenuate hemodynamic sequelae to tracheal intubation superiorly as compared to esmolol [11].

Peden *et al* noticed bradycardia and sinus arrest after bolus and infusion of dexmedetomidine and adviced glycopyrrolate administration before infusion as a preventive measure[12]. We did not encounter any such instance as glycopyrrolate was employed as an antisialogogue agent prior to bronchoscopy in all our subjects. No episodes of bradycardia, arrhythmia or hypotension were noted in dexmedetomidine subjects.

Fentanyl depresses respiratory centre, contributes to chest wall rigidity that may results in hypoxia and desaturation. Dexmedetomidine has the distinctive property of conscious sedation deprived of airway obstruction and respiratory suppression. Remarkable desaturation ($SpO_2 \geq 94\%$) encountered more in Group F subjects than Group D subjects were handled by delivering oxygen via bronchoscope port.

Conclusion

Dexmedetomidine by dispensing superior intubation condition, stable hemodynamic parameters and appropriate sedation without desaturation is more efficacious as compared to fentanyl when used for FOI.

References

1. Rosenblatt WH. Airway management. In: Barash PG, Cullen BF, Stoelting RK, et al., editors. Clinical

Anesthesia. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2001.p.595–638.

2. Lallo A, Billard V, Bourgain JL. A comparison of propofol and remifentanil target-controlled infusions to facilitate fiberoptic nasotracheal intubation. Anesth Analg. 2009; 108:852–7. [PubMed].
3. Rai MR, Parry TM, Dombrovskis A, Warner OJ. Remifentanil target-controlled infusion vs propofol target-controlled infusion for conscious sedation for awake fibreoptic intubation: A double-blinded randomized controlled trial. Br J Anaesth. 2008;100:125–30. [PubMed].
4. 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. [PubMed].
5. Wang SY, Mei Y, Sheng H, Li Y, Han R, Quan CX, et al. Tramadol combined with fentanyl in awake endotracheal intubation. J Thorac Dis. 2013;5:270–7. [PMC free article] [PubMed].
6. Dexmedetomidine for conscious sedation in difficult awake fiberoptic intubation cases. J Clin Anesth. 2007;19:141–4. [PubMed].
7. Chu KS, Wang FY, Hsu HT, Lu IC, Wang HM, Tsai CJ. The effectiveness of dexmedetomidine infusion for sedating oral cancer patients undergoing awake fiberoptic nasal intubation. Eur J Anaesthesiol. 2010;27:36–40. [PubMed].
8. Abdelmalak B, Makary L, Hoban J, Doyle DJ. Dexmedetomidine as sole sedative for awake intubation in management of the critical airway. J Clin Anesth. 2007; 19:370–3. [PubMed].
9. Bergese SD, Patrick Bender S, McSweeney TD, Fernandez S, Dzwonczyk R, Sage K. A comparative study of dexmedetomidine with midazolam and midazolam alone for sedation during elective awake fiberoptic intubation. J Clin Anesth. 2010;22:35–40. [PubMed].
10. Ryu JH, Lee SW, Lee JH, Lee EH, Do SH, Kim CS. Randomized double-blind study of remifentanil and dexmedetomidine for flexible bronchoscopy. Br J Anaesth. 2012;108:503–11. [PubMed].
11. Yavacaoglu B, Kaya FN, Baykara M, Bozkurt M, Korkmaz S. A comparison of esmolol and dexmedetomidine for attenuation of intraocular pressure and hemodynamic responses to laryngoscopy and tracheal intubation. Eur J Anaesthesiol. 2008;25:517–9. [PubMed].
12. Peden CJ, Cloote AH, Stratford N, Prys-Roberts C. The effect of intravenous dexmedetomidine premedication on the dose requirement of propofol to induce loss of consciousness in patients receiving alfentanil. Anaesthesia. 2001;56:408–13. [PubMed].