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Research Article

Comparison between Fentanyl, Clonidine and Dexmedetomidine for Awake Fiberoptic Intubation

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ABSTRACT

Background: Currently Awake fibreoptic intubation- (AFOI) is the gold standard for the management of patients with an anticipated difficult airway. Various medications have been used to perform intubation during AFOI. The ideal drug for AFOI must provide comfort, cooperation, amnesia and hemodynamic stability along with maintenance of spontaneous respiration. The study aimed to compare fentanyl, clonidine and dexmedetomidine in providing favourable intubating conditions along with hemodynamic stability during AFOI.

Methods: This prospective and randomized trial was carried out in 90 patients who were scheduled for elective surgery and required awake fibreoptic intubation. The patients were randomly divided into three different groups; Group A: Received Injection Dexmedetomidine-1ug/kg over 10 minutes; Group B: Received Injection Clonidine-2ug/kg over 10 minutes; and Group C: Received Injection Fentanyl-2ug/kg over 10 minutes. Cough score, post-intubation score, Ramsay sedation score (RSS) and the changes in hemodynamic, were used to evaluate the effectiveness of the intubation condition and the results were then compared among the groups.

Results: Demographic variables such as gender, age, weight and American Society of Anaesthesiologists-Physical Status ASA-PS (I/II) were comparable among the three groups and not statistically significant. The cough score and the post intubation score were lower in Group A. RSS was noted to be higher in Group A and there was a lower incidence of desaturation. Hemodynamic parameters were also favourable in Group A.

Conclusion: Dexmedetomidine was found to be more effective than clonidine and fentanyl in those undergoing awake fibreoptic intubation. There were fewer adverse effects such as coughing, discomfort, oxygen desaturation, and intolerance to intubation.

Introduction

"Awake fibreoptic intubation" (AFOI) is recommended in those with an anticipated difficult airway, in cervical spine injury and failed intubation where laryngoscopy is difficult to perform [1].

It is necessary to prepare the patients prior to performing AFOI. The AFOI preparation includes providing adequate sedation, mitigation of airway reflexes, alleviating anxiety together with maintenance of a patent airway and normal ventilation.

Various drugs have been used to provide sedation during AFOI. These drugs include propofol, ketamine, benzodiazepines, opioids, clonidine, dexmedetomidine and sevoflurane

[2-3].

Midazolam makes the patient comfortable and produces amnesia. Propofol causes profound amnesia and has a fast onset and offset of action. Opioids like remifentanil and fentanyl are useful for attenuating the

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discomfort and hemodynamic changes during the passage of the bronchoscope through the vocal cords. However, all these drugs cause respiratory depression. The combination of some of these drugs can provide better intubating conditions, but the incidence of desaturation was noted to be high [4-5].

Scenarios with difficult airway, may lead to cannot intubate, cannot ventilate situations which can lead to fatal issues like hypoxemia. Administering propofol in higher doses may cause apnoea and loss of the tone of the upper airway causing difficulty for the passage of the bronchoscope beyond the epiglottis [6-7].

Hence there is a need for an ideal drug for conscious sedation, which can ensure spontaneous respiration with a patent airway, adequate cooperation and comfort, favourable conditions for intubation and stable hemodynamics.

The aim of this study was to compare fentanyl, clonidine and dexmedetomidine in providing optimal intubating conditions by comparing the cough score, tolerance to intubation by post-intubation score, Ramsay sedation score (RSS), hemodynamic parameters and the incidence of oxygen desaturation (SpO2).

Methods

This prospective randomized study was conducted in the Department of Anaesthesiology at a tertiary care institution. After obtaining institutional Ethical Committee approval and written informed consent, this study was done among a total of 90 patients who were scheduled to undergo awake fibreoptic intubation during elective surgery.

Inclusion Criteria: Age of the patients in the range of 18-60 years; American Society of Anaesthesiologists-Physical Status I/II and Mallampati Grading I & II.

Exclusion criteria: Pregnancy, alcoholics /drug abusers, bradycardia (baseline HR <60 beats/min), allergy to the drugs involved in the study, any type of atrioventricular block, heart failure, emergency surgeries, significant neurological, hepatic, renal and pulmonary disease, any coagulopathies were excluded from this study. An anticipated difficult intubation was excluded after assessment by the modified Mallampati grading (MP) and thyromental distance (TMD). Mallampati grade III and IV and TMD <6.5 cm was excluded.

Patients were were divided into three groups. Group-A received intravenous dexmedetomidine ,1 ug/kg for 10 minutes, Group B - received intravenous clonidine ,2 ug/kg for 10 minutes, and Group C received intravenous fentanyl ,2 ug/kg over 10 minutes The anesthesiologist who was involved in preparation of the study drug and the observer anaesthesiologists were blinded to each other. Bronchoscopy was done by a single anaesthesiologist in all the patients. The anaesthesiologist who performed awake fibreoptic intubation and who recorded the data were also blinded to the group identities.

All patients received oral alprazolam 0.5 mg the night prior to surgery. Tablet ondansetron 4 mg on the morning 2 hours before surgery was given. Inside the operating theatre, an 18G intravenous line (i.v.) was inserted and multipara monitor was used to record the baseline Mean arterial pressure (MAP), Heart rate (HR), SpO2 and electrocardiogram. Intravenous glycopyrrolate 0.2 mg was given. Both the nostrils were checked for patency and the nostril with a better patency was chosen for AFOI. Nebulization with 2% lignocaine 4 ml (80 mg) was administered to topicalize the upper and lower airway. Xylometazoline nasal drops and lignocaine jelly were administered to both the nostrils. The posterior part of the tongue and hypopharynx were sprayed with 2 puffs of 10% lignocaine (20 mg).

Intubation conditions were evaluated by the following scores.

Cough score: Score 1= there is no cough, 2 = there is slight cough (no more than two cough in a sequence), 3 = there is moderate cough (3-5 cough in a sequence), 4 = there is severe cough (>5 cough in a sequence).

Tolerance to intubation was evaluated by the post-intubation score after placement of the tube in the trachea as: 1 = Cooperative, 2 = minimum resistance, 3= severe resistance.

Level of sedation was evaluated by the Ramsay sedation score (RSS) just after the completion of the study drug infusion as: 1 = Paatient anxious, restless or agitated, 2 =patient oriented, cooperative and tranquil, 3= patient is sedated but responds to commands, 4=patient asleep, brisk glabellar reflex or responds to loud noise, 5= patient asleep, sluggish glabellar reflex or there is response to loud noise, 6 = patient asleep with no response to any painful stimulus."

The baseline means arterial pressure and heart rate and that immediately after intubation were noted. SpO2 monitoring was done throughout the procedure and the lowest reading was recorded. Hypotension (a reduction of MAP >20% from the baseline) was treated with fluids and/or with phenylephrine 50 mcg i.v. bolus. Bradycardia (Heart rate < 60 beats/minute was treated using atropine 0.6 mg iv. Oxygen desaturation (SpO2 < 95% for >10s) was treated with supplemental oxygen either with a nasal cannula or via the oxygen port of the bronchoscope.

Statistical Analysis

Numerical data were analysed and expressed as mean ± standard deviation and categorical data were organised into tables. Statistical analyses were done using SPSS version 23. Comparison of numerical data between the groups was performed using independent t-test and within the same group by using paired t-test. Chi-square test was used to compare categorical data. A P value< 0.05 was considered statistically significant.

Results

Demographic elements such as age, weight, gender and ASA-PS (I/II) were comparable among the three groups

(Table 1). On comparison between the groups the variables were not statistically significant.

(Table 2) shows the various scores noted. The mean cough score of patients was lowest in Group A and group C had the highest score and this was statistically significant (p= 0.004). The mean post-intubation score was also lowest in Group A which was statistically significant.

The mean Ramsay Sedation Score was higher in group A (2.93±0.44) as compared to group B (2.27±0.44) and group C (1.93±0.51), which was statistically significant. The mean Saturation of Peripheral Oxygen was (Spo2) was notably higher in Group A, which was statistically significant.

On comparison between the mean baseline heart rate and mean baseline MAP between the groups there was no statistical significance noted (Table 3).

On comparison between the post intubation heart rate between the groups, Group B was found to be the lowest. On comparison between the post Intubation MAP between the groups, Group A was found to have the lowest. Both the post intubation parameters were statistically significant on comparison.

Table 1- Demographic Data has been classified into different groups of patients

	Mean±SD			
Variables	**Group A**	**Group B**	**Group C**	**P value**
Age (years)	34.33±8.02	32.83±7.39	33.60±7.80	0.755
Weight (kg)	63.90±6.11	64.07±6.20	64.17±6.41	0.985
ASA(I/II)	25/5	25/5	26/4	0.918
Gender(M/F)	17/13	17/13	17/13	0.988

Table 2- Cough score, post intubation score, Ramsay sedation score and Spo2

Intubation and Post Intubation Parameters	**Group A**	**Group B**	**Group C**	**P value**
Cough Score	2.03 ±0.41	2.57 ±0.50	2.90 ±0.30	0.004
Post Intubation Score	1.10 ±0.30	1.73 ±0.44	2.00 ±0.45	0.007
Ramsay Sedation Score (RSS)	2.93 ±0.44	2.27 ±0.44	1.93 ±0.51	0.005
Spo2	0.97 ±0.02	0.93 ±0.02	0.93 ±0.02	0.004

Table 3- Hemodynamic parameters

Hemodynamic Parameters	**Group A**	**Group B**	**Group C**	**P value**
Baseline HR	85.23± 8.40	81.90 ±11.21	81.47 ±7.52	0.227
Post Intubation HR	80.07± 7.31	67.57 ±11.27	114.50± 17.43	0.003
Baseline MAP	96.70 ±3.48	94.97 ±6.44	95.60 ±4.02	0.376
Post Intubation MAP	90.27± 5.40	93.20 ±6.46	113.87 ±4.54	0.002

"HR-Heart Rate"; MAP: "Mean Arterial Pressure"

Discussion

After the introduction of the guidelines on Difficult Airway Management by the American Society of Anaesthesiologists (ASA), awake fiberoptic intubation has become the gold standard for an anticipated difficult airway [8].

Endotracheal intubation performed with a fiberoptic bronchoscope while the patient is awake is extremely unpleasant and a stressful experience for the patient if enough anaesthesia is not administered. Various drugs have been used to achieve sedation while performing AFOI.

The hypnotic effects of α2 agonists is achieved through the hyperpolarization of the noradrenergic neurons present in the locus ceruleus of the brain stem, which is one of the primary location in modulating wakefulness.

Although clonidine and dexmedetomidine belong to similar pharmacological group, there is a significant difference in their pharmacokinetic and pharmacodynamic profile such as a greater selectivity of dexmedetomidine for the α2 receptors (8:1) and a smaller distribution and elimination half-life, as compared to clonidine [9].

Fentanyl is a synthetic opioid drug, which provides analgesia, mild sedation along with good hemodynamic stability, which is beneficial for performing AFOI but there is a risk of nausea/vomiting, respiratory depression and chest wall rigidity [10-12].

Dexmedetomidine acts on the presynaptic α-2 receptors to provide a negative feedback causing a lower neurotransmitter (norepinephrine, epinephrine) availability at the post-synaptic α-1 receptors. It produces analgesia, amnesia, hypnosis, sympatholysis, anxiolysis and antisialogogue effects all of which are needed during AFOI [13].

We compared dexmedetomidine (Group A), clonidine (Group B) and fentanyl (Group C) and found the most favourable intubating conditions in the dexmedetomidine group. Most of the patients in the dexmedetomidine

group had a cough score ≤ 2 as compared to the other two groups.

On comparing the postintubation score the dexmedetomidine group was more cooperative for AFOI compared to the other two groups.

The dexmedetomidine group was more tranquil and sedated on analysing the Ramsay Sedation Score as compared to clonidine and fentanyl.

The incidence of desaturation was also less with dexmedetomidine as compared to the other two groups.

Chu et al. [14] in their study observed a good tolerance to intubation in the dexmedetomidine group (1 mcg/kg) as compared to the fentanyl group (1 mcg/kg) without causing respiratory depression and upper airway obstruction. In our study also we found that dexmedetomidine produced good intubating conditions than clonidine and fentanyl.

Bergese et al. [15] in their study noted that dexmedetomidine at a dose of 1 mcg/kg bolus was beneficial and safe for patients undergoing AFOI even without the use of any topical anesthesia or airway nerve blocks.

In our study, patients of the dexmedetomidine group showed a better hemodynamic stability. The initial MAP and HR were similar in all the three groups. There was a significant change of MAP and HR in the post-intubation period when compared to the baseline in all the three groups. But there was no incidence of hypotension or bradycardia in any patient.

Ryu et al. [16] in their study compared dexmedetomidine and remifentanil for sedation while performing bronchoscopy. They noted that there was no significant difference of sedation level, HR, MAP and patient satisfaction score ($P > 0.05$) but the cough score and incidence of desaturation was noted to be significantly lower ($P < 0.01$) in the dexmedetomidine group than the remifentanil group.

Yavascaoglu et al. showed that dexmedetomidine was more effective compared to esmolol in obtunding the hemodynamic response to intubation [17].

Sonsale et al [18] in their study noted that dexmedetomidine provided better intubation conditions, better tolerance to intubation with a greater patient satisfaction and also hemodynamic stability. Also it helped in providing adequate sedation without causing any desaturation making it very effective for AFOI than fentanyl.

Solimon et al noted in their study that both the dexmedetomidine and the propofol–fentanyl groups provided good upper airway patency which was comparable to that of awake patients, favourable intubating conditions, patient and anesthesiologist satisfaction in the majority of patients who underwent awake fiberoptic intubation but dexmedetomidine appeared to give greater patient satisfaction, lesser patient recall of the procedure, better anesthesiologist satisfaction, and a decreased hemodynamic response to intubation[19].

Limitations

Our study sample size was comparatively small. As we have included only ASA physical status Classes I and II patients, further studies are required to assess the effect of these drugs in patients with a difficult airway having significant comorbid conditions, where a better hemodynamic stability provided by the α2 agonists will be of benefit.

Conclusion

Dexmedetomidine is more effective than clonidine and fentanyl during AFOI, as it provides better intubating conditions, hemodynamic stability and adequate sedation without causing desaturation.

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