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A Study for Evaluating Different Doses of Dexmedetomidine in Attenuating Extubation Response in Smoker Patients for Surgeries under General Anaesthesia

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Abstract: ***Introduction: Smokers are one of the at-risk group of patients prone for developing complications during extubation. Objective: A study for evaluating different doses of dexmedetomidine in attenuating extubation response in smoker patients for surgeries under general anaesthesia. Study design: Prospective randomized study. Method: The present study was carried out and completed on ninety ASA II patients, aged between 40-60 years posted for surgery under general anaesthesia. Total 90 patients who fulfilled our inclusion and exclusion criteria were included in the study and divided randomly into three groups: Group A(n=30) 0.5µg/kg of dexmedetomidine in NS (Total volume 10 ml) Group B(n=30) 0.75µg/kg of dexmedetomidine in NS (Total volume 10 ml) Group C(n=30) 1µg/kg of dexmedetomidine in NS (Total volume 10 ml). Results: The difference in quality of extubation was significant between group A and group B and between group A and group C whereas it was comparable between group B and group C. Suggesting that extubation was better in group B and group C with dexmedetomidine dose 0.75 µg/kg and 1 µg/kg respectively. None of the patients had post-operative complications such as laryngospasm, bronchospasm, or severe coughing. None of the patient had respiratory depression. None of the patients had hypotension (MAP < 65 mmHg or more than 20% decrease in SBP from baseline value or SBP<80 mm of Hg). Conclusion: We conclude that dexmedetomidine with dose of 0.75 µg/kg is the best dose for attenuation of extubation response in current smoker patients undergoing major surgery.***

Keywords: Surgery, dexmedetomidine, extubation

1. Introduction

Tracheal extubation has always received less emphasis than intubation with respect to attenuation of haemodynamic responses. It is well known that tracheal extubation may be associated with hypertension, tachycardia, and high plasma catecholamine levels.[1] The change in catecholamine concentration associated with tracheal extubation occurs rapidly and lasts for only about five min.[2]

Smokers are one of the at-risk group of patients prone for developing complications during extubation. Cigarette smoke contains over 4000 substances, some of which are pharmacologically active, some antigenic, some cytotoxic, some mutagenic and some carcinogenic.[3] Nicotine in smoke stimulates the adrenal medulla to secrete adrenaline, resets the carotid body and aortic receptors to maintain a higher blood pressure and stimulates autonomic ganglia, increasing sympathetic tone. The result is an increase in systolic and diastolic blood pressure, an increase in heart rate and an increase in peripheral vascular resistance.

Although dexmedetomidine has been used with varying success to attenuate hypertension and tachycardia during tracheal extubation, yet no study has evaluated effect of different doses of dexmedetomidine on haemodynamic and recovery response during extubation in smokers.

2. Methods

Place of study: After obtaining ethical committee clearance study was conducted at Dr RPGMC Kangra at Tanda

Study subjects: Smokers undergoing surgery were assessed for the inclusion and exclusion criteria.

Study design: Prospective study.

Sample size: 90 (30 each)

Sampling method: Simple random sampling

Statistical tests: SPSS version 21 program were used to enter data and statistical analysis. Continuous data were presented as Mean± SD and comparison between two groups were performed using Student's t-test. A p value <0.05 was considered statistically significant.

Inclusion criteria

1) Smokers undergoing surgery under general anaesthesia.
2) Aged 40-60 years.
3) American society of Anaesthesiologist physical status II.
4) Haemodynamically stable.
5) Current smoker according to U.S. Center for Disease Control and Prevention.32
6) BMI between 18.5 to 24.5 Kg/m2.

Exclusion criteria

1) History of severe cardiovascular disease, renal disease, diabetes mellitus and cerebrovascular disease.
2) Known hypersensitivity to the study drug.
3) Difficult airway.
4) Patient refusal for participation in the study.
5) If bradycardia (heart rate< 50/min) or hypotension (systolic blood pressure< 80 mm of Hg) occurred anytime during study period, patients were excluded

from the study.
6) SBP > 180 mmHg any time during study period.
7) Known asthmatic.
8) Patient suffering from upper airway tract infection.
9) Patient in respiratory distress.
10) If closure of surgery is not completed within 10 minutes of starting infusion.
11) Surgery of more than 2-hour duration.

The enrolled patients (current smoker patients) were allocated to one of the three groups by computer generated random number chart. The anaesthetic procedure was explained to the patients enrolled for study and thereafter written consent was taken in the pre anaesthetic check-up clinic 24 hours before surgery.

The drug administration and observations were made by investigator. The allocated groups were labelled as follows:
Group A (n=30) 0.5 µg/kg of dexmedetomidine in normal saline (Total volume 10 ml).
Group B (n=30) 0.75 µg/kg of dexmedetomidine in normal saline (Total volume 10 ml).
Group C (n=30) 1 µg/kg of dexmedetomidine in normal saline (Total volume 10 ml).

Ethical Consideration
The study was initiated following approval from IEC. All the included patients provided signed consent form.

Financial disclosure
The study did not place any additional financial burden to the study subjects. None of the study subjects received any financial assistance during the study period.

The anaesthetic procedure was explained to the patients enrolled for study and thereafter written consent was taken in the pre anaesthetic check-up clinic 24 hours before surgery. Before commencing the surgery, a case record form was filled for each patient in the preoperative room. All patients were kept nil orally for at least eight hours before the procedure. They were given premedication in the form of tablet alprazolam 0.5 mg and tablet ranitidine 150 mg at night before surgery and at 6:00 am on the day of surgery.

Statistical analysis
Data were entered into Microsoft spreadsheet and analysed using SPSS v21. Chi square test was used to compare categorical variables. Quantitative variables between 3 groups were compared using one-way analysis of variance followed by Bonferroni post-hoc correction. P value<0.05 was considered significant.

3. Results

General characteristics
Table 1 shows general characteristics of the patients. Mean age of the study subjects in group A, B and C was 50.57±6.36 years, 48.13±5.43 years and 51.17±5.75 years respectively and was comparable between the groups (P=0.111).All these groups were comparable in terms of BMI. The mean BMI was 20.27±1.5 kg/m2 in group A, 21.09±1.5 kg/m2 in and 21.09±1.68 kg/m2 in group C. The mean BMI of the patients was comparable between group A, group B, and group C (P=0.063). All the study subjects were in ASA grade II.

Duration of surgery
In the present study, the time taken for surgery was 61.67±8.74 min for group A, 61.71±7.47 min for group B and 57.68±6.79 min in group C. Duration of surgery was comparable between group A, B, and C (P=0.073).

Table 1: General characteristics

	Group A (n=30)	Group B (n=30)	Group C (n=30)	P Value
Age (Years)	50.57±6.36	48.13±5.43	51.17±5.75	0.111
BMI (Kg/m^2)	20.27±1.5	21.09±1.5	21.09±1.68	0.063
ASA Grade, *n* II	30	30	30	NA

Incidence of bradycardia
One patient in group A, 2 patients in group B, and 9 patients in group C showed incidence of bradycardia. These patients were excluded from the study (Figure 1).

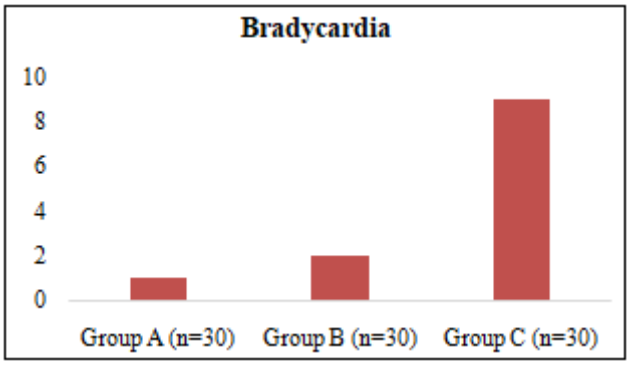

Figure 1: Incidence of bradycardia

Quality of extubation
Inter group comparison of patients with no coughing or smooth extubation with minimal coughing (quality of extubation 1 or 2).In the present study, quality of extubation was significantly poorer in group A in comparison to group B and group C (P=0.001).In group A, 16.7% (5/30) patients had no cough, while 3.3% (1/30) patients had severe cough while 46.7% (14/30) patients in group B had no cough, and none of the patients had severe cough. Our study observed that quality of extubation was better in group B in comparison to group A (P=0.003).In group A, 16.7% (5/30) patients had no cough while 3.3% (1/30) patients had severe cough while 60% (18/30) patients in group C had no cough, and none of the patients had severe cough. Our study observed that quality of extubation was better in group C in comparison to group A (P=0.003).

Table 2: Comparison of quality of extubation

Quality of extubation score	Group A (n=30)	Group B (n=30)	Group C (n=30)	P Value
1	5 (16.7%)	14 (46.7%)	18 (60%)	0.001
2	8 (26.67%)	12 (40%)	9 (30%)	
3	16 (53.3%)	4 (13.3%)	3 (10%)	
4	1 (3.3%)	0	0	

4. Discussion

Anaesthesiologists are more concerned about the problems associated with intubation, extubation, recovery and emergence. The problems at extubation are as common as problems at intubation. Tracheal extubation is associated with a 10–30% increase in arterial pressure and heart rate lasting 5–15 minutes. Respiratory complications after tracheal extubation are three times more common than complications occurring during tracheal intubation and induction of anaesthesia (4.6% vs. 12.6%).

In group C 60% (18/30) patients had no coughing at the time of extubation as compared to 46.67% (14/30) patients in group B and 16.7% (5/30) in group A. Both in group B 40% (12/30) patients & group C 30% (9/30) patients had smooth extubation with minimal coughing whereas in group A 26.67% (8/30) patients had smooth extubation with minimal coughing. So, there were less patients in group C who had coughing during extubation. With the intergroup comparison with no or minimal coughing there were 43.7%, 86.7and 90% patients in group A, group B and group C, respectively. The difference in quality of extubation is significant between group A and group B and between group A & group C whereas it is comparable between group B and group C. Suggesting that extubation was better in group B and group C with dexmedetomidine dose 0.75µg/kg and 1µg/kg respectively.

In our study in group C 60% (18/30) patients had no coughing at the time of extubation as compared to 46.6% (14/30) patients in group B and 16.6% (5/30) in group A. Both in group B 40% (12/30) patients and group C 30% (9/30) patients had smooth extubation with minimal coughing whereas 26.67% (8 /30) patients in group A had smooth extubation with minimal coughing. In a study of Aksu et al.[4] compared the effects of dexmedetomidine (0.5 µg/kg) and fentanyl (1 µg/kg) in patients undergoing rhinoplasty and concluded that dexmedetomidine was more effective in attenuating airway reflex responses to tracheal extubation and maintaining haemodynamic stability compared to fentanyl but was associated with bradycardia in two patients out of 20 patients. Fan et al.[5] concluded that dexmedetomidine in dose of 0.7 µg/kg was associated with a higher percentage of patients with a smooth extubation as compared to dexmedetomidine in dose of 0.5 µg/kg. Bindu et al.[6] studied the effect of intravenous dexmedetomidine infusion 0.75 µg/kg given 15 min prior to extubation and concluded that it facilitates smooth extubation, but there was bradycardia in 13 patients out of 25 patients. Similar results were obtained in our study. The quality of extubation increased with increase in dose of dexmedetomidine. In consistent with above studies in our study 18 patients in group C had no coughing at the time of extubation as compared to 14 patients in group B and 5 in group A. In our study when the intergroup comparison was done, there were 43.37%, 86.7% and 90% patients in group A (0.5 µg/kg), group B (0.75 µg/kg) and group C (1 µg/kg), respectively that could be extubated with no or minimal coughing. Similar results were found in study done by Antony et al.31 with 90% of patients in group with dexmedetomidine (0.5 µg/kg), 93.3% patients in group with dexmedetomidine (1 µg/kg), and 16.7% in group with saline could be extubated smoothly. Hence, it can be said that in our study also with the dose of 0.75 µg/kg and 1 µg/kg the quality of extubation is better as compared to the dose of 0.5 µg/kg of dexmedetomidine which was found by other authors also.

Dexmedetomidine has been used in dose of 0.1 to 1 µg/kg/h. The reported incidence of hypotension and bradycardia in patients receiving dexmedetomidine for sedation commonly exceeds 50 %.[7] The studies with higher infusion rates had more incidences of adverse effects like hypotension and bradycardia.[8] The incidence of bradycardia was significantly higher in the patients who received premedication of dexmedetomidine both in normotensive and hypertensive groups as compared to midazolam, which was especially pronounced in the hypertensive patients. Bindu et al.[6] and Aksu et al.[4] found that dexmedetomidine (0.75 µg/kg) led to higher incidence of bradycardia. Similar results were obtained in our study where we found that with increase in infusion of dexmedetomidine from 0.75 µg/kg to 1 µg/kg the side effects also increased as nine patients in group C (1 µg/kg) had bradycardia during dexmedetomidine infusion as compared to two patients in group B (0.75 µg/kg) and one patient in group A with dexmedetomidine 0.5 µg/kg. Hence, bradycardia was observed in patients who received dexmedetomidine the incidence being higher with 1 µg/kg dose.

5. Conclusion

Quality of extubation was better with dexmedetomidine in dose of 0.75 µg/kg and 1 µg/kg. Sedation was prolonged with dexmedetomidine in dose of 1 µg/kg as compared to other groups.Hence, we conclude that dexmedetomidine with dose of 0.75 µg/kg is the best dose for attenuation of extubation response in current smoker patients undergoing major surgery.

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