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"A COMPARATIVE STUDY OF VARIOUS TECHNIQUES AND VARIOUS PERIODS OF PREOXYGENATION DURING ELECTIVE SURGERIES."

Anesthesiology

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ABSTRACT

Preoxygenation with 100% oxygen replaces nitrogen in the functional residual capacity and increases oxygen stores thus prolonging the safe duration of apnea after induction of general anaesthesia and administration of muscle relaxants.

The present study compare the effects of varying periods of preoxygenation on oxygen saturation and arrive at a value of the optimal duration of preoxygenation to tide over the period of hypoxia that occurs during the process of intubation.

Materials and Methods:-

60 ASA grade II and III patients in the age group of 20 to 50 years were studied under three equal groups. Patients in group I received preoxygenation in the form of eight deep breaths within 60 seconds at an oxygen flow of 10 L per min. Group II and III patients received preoxygenation for 3 and 5 minutes respectively. Oxygen saturation was monitored by pulse oximeter.

Smokers, pregnant women, patients with a difficult airway, patients with cardiorespiratory diseases, neuromuscular disorders, haemoglobinopathies were excluded from the study.

Results:-

The results were analysed using the "Analysis of variance" method. It was observed that patients in group I after one minute of apnea, post intubation, had a fall in saturation to a mean of 87% ± 1.1 in comparison to 96% ± 0.70 and 99% ± 0.52 in group II and III respectively.

It was also observed that for the saturation to come to 100% in the post intubation phase, the patients took an average of 78, 35 and 5 seconds in the three groups respectively.

We concluded that routine preoxygenation of 5 minutes must be carried out in all patients scheduled for elective surgery.

Table showing SpO_2 values in the preinduction, induction and in the post intubation periods.

Group	No.	Pre-op SpO_2	0 sec	15 sec	30 sec	45 sec	60 sec	Post induction	
								30 sec	60 sec
I	20	98.72 ± 0.4	99.4 ± 0.4	96.84 ± 1.6	93.16 ± 2.5	89.48 ± 1.2	87.28 ± 1.1	94.14 ± 0.3	98.16 ± 0.1
II	20	99.0 ± 0.2	100 ± 0.0	100 ± 0.4	98.4 ± 0.5	97.84 ± 0.6	96.92 ± 0.7	99.97 ± 0.2	100 ± 0.0
III	20	98.88 ± 0.3	100 ± 0.0	100 ± 0.0	99.97 ± 0.2	99.88 ± 0.3	99.28 ± 0.3	100.0 ± 0.0	100 ± 0.0

KEYWORDS

Preoxygenation, various periods, various techniques, oxygen saturation.

INTRODUCTION

Preoxygenation with 100% oxygen replaces nitrogen in the functional residual capacity and increases oxygen stores thus prolonging the safe duration of apnea after induction of general anaesthesia and administration of muscle relaxants. Thorpe et al in their study have shown that 98% of patients not preoxygenated developed hypoxia during intubation following induction of general anaesthesia. Numerous studies [3,4,5,6,7] have also emphasized the need for routinely pre-oxygenating any patient undergoing general anaesthesia. The present study sought to compare the effects of varying periods of preoxygenation on oxygen saturation and arrive at a value of the optimal duration of pre-oxygenation to tide over the period of hypoxia that occurs during the process of intubation.

MATERIAL AND METHOD

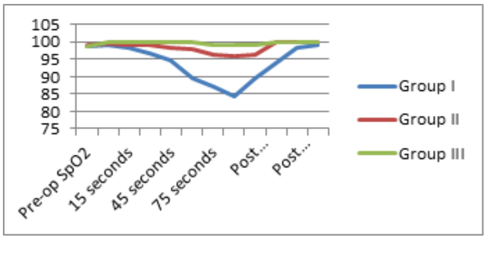
After obtaining institutional ethical committee clearance and written informed consent from all of the patients. 60 patients of ASA grade II and III, age between 20-50 years scheduled for elective surgery. The patients were randomly allocated into the three groups of 20 each, Patients in group I received preoxygenation in the form of eight deep breaths within 60 seconds at an oxygen flow of 10 L per mintues, group II patients received preoxygenation for three minutes and group III patients received five minutes of preoxygenation with 100% oxygen at 10 liters with the aid of an anatomical face mask prior to the induction of general anaesthesia. Smokers, pregnant women, patients with cardiorespiratory diseases, patients with a difficult airway, patients with neuromuscular disorders, patients with haemoglobinopathies excluded from the study.

In the operation theatre after securing an intravenous access the pulse rate, ECG, blood pressure and SpO_2 values were recorded on room air. All patients were pre-medicated with intravenous injection Glycopyrrolate 0.2 mg, intravenous injection Midazolam 0.02 mg/kg and intravenous injection Fentanyl 2 µg/kg. Depending on the group the patients belonged to preoxygenation. Patients in all the three groups were induced with injection of Propofol 2.5 mg/kg intravenously followed by injection Suxamethonium 2 mg/kg. The patients were then kept apneic for a period of one minute. At the end of one minute, time took for laryngoscopy and intubation were noted and the patients were intubated with an adequate sized endotracheal tube. The patients were then ventilated with 100% oxygen and 0.2%-1% Isoflurane. The heart rate, ECG, blood pressure and SpO_2 values of all the patients were recorded every 15 seconds till the saturation reached 100% following this nitrous oxide was administered and the surgery was commenced.

OBSERVATIONS AND RESULTS

A total of 60 patients of ASA physical status II and III were enrolled in this study. The mean age in years was 30.96 ± 7.97. The mean weight of the patients was 47.98 ± 5.15 kilograms with male to female ratio of 40:60. It was observed that in patients of all groups after one minute of apnea post induction time took for laryngoscopy and intubation was 20.6 seconds. In group I patients, there was a fall in oxygen saturation to a mean of 87% ± 1.1 whereas it was 96% ± 0.70 in group II and 99% ± 0.52 in group III. It was also observed that for the saturation to come to 100% in the post intubation phase the patients took an average of 78, 35 and 5 seconds in the three groups respectively. It was also observed that there was no statistically significant variation in heart rate and blood pressure between these three groups. The results were analyzed using the "Analysis of variance" (ANOVA) method. All data were presented as means ± standard deviation.

Line diagram -1: SpO_2 values in the pre-induction, apnea periods and post intubation periods.



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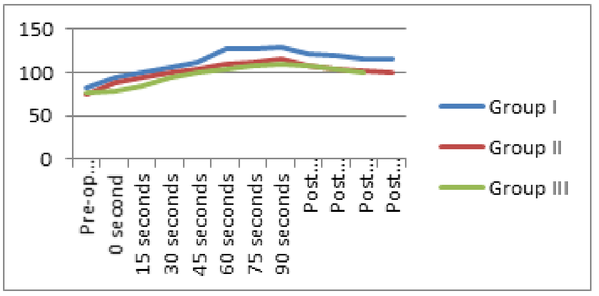
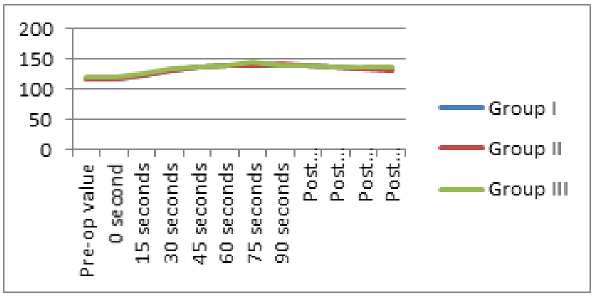
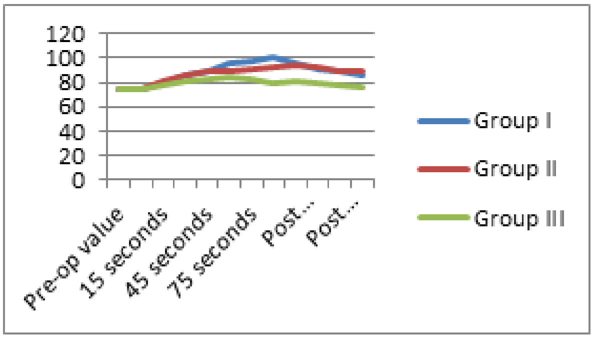
Line diagram -2: Pulse rate values in the pre-induction, apnea periods and post intubation periods.



Line diagram -3: Systolic blood pressure values in the pre-induction, apnea periods and post intubation periods.



Line diagram -4: Diastolic blood pressure values in the pre-induction, apnea periods and post intubation periods.



DISCUSSION

Pre-oxygenation before induction of general anaesthesia is used less frequently despite the fact that hypoxemia does occur during the period of laryngoscopy. The reasons for hypoxia included a decreased functional residual capacity, respiratory depression, decreased cardiac output and ventilation perfusion mismatch. Pre-oxygenation does protect against hypoxia during intubation and has been recommended by several authors for all cases. There are many possible reasons for the reluctance to pre-oxygenate routine cases which may include a perceived lack of time on a busy operating list and the fact that holding an anatomical face mask is a labour intensive task preventing the anaesthesiologist or his assistant from carrying out any other activity.

This study was carried out to evaluate the need for pre-oxygenating a patient prior to the induction of general anaesthesia and also to assess the speed of desaturation and resaturation in patients who receive varying periods of pre-oxygenation.

Thopre et al determined the incidence of hypoxia using pulse oximetry during induction of anaesthesia. It was concluded that 98% of the patients not pre-oxygenated adequately developed hypoxia during intubation. Skea et al observed that in pre-oxygenated patients the SpO_2 values remained at a mean of 98% during the apneic period of intubation whereas it fell to a mean of 86% in the non pre-oxygenated group. So, it was suggested that serious consideration be given to the routine use of pre-oxygenation prior to the induction of general anaesthesia. Hett et al observed that 97% of patients in whom no adequate pre-oxygenation was done had a fall in saturation to a mean of 87% and in patients in whom three minutes of pre-oxygenation was done had a mean saturation of 98% during the apneic period of intubation.

In our study it was found that in group I in whom pre-oxygenation was instituted in the form of eight deep breaths within 60 seconds at an oxygen flow of 10 L per minutes, after a minute of apnea in the induction phase resulted in a fall of saturation to a mean of 87% ± 1.1. This was in sharp contrast to the groups in whom pre-oxygenation was given for three and five minutes respectively. In these later groups the saturation fell to a mean of 96% ± 0.70 and 99% ± 0.52 respectively.

The results in our study correlate well with those obtained in the study conducted by Hett et al, wherein the patients who did not receive adequate pre-oxygenation had a fall in saturation to a mean of 85.5% and patients who had three minutes of pre-oxygenation had a fall in saturation to a mean of 96%.These results are also in accordance with the study done by Skea et al who reported a mean fall in oxygen saturation to 86% in the group not adequately pre-oxygenated to a mean of 98% in the pre-oxygenated group. Motoyama et al reported that a reasonable amount of desaturation was noticed in patients in whom routine adequate pre-oxygenation was not carried out. Laycock et al and Weitzner et al, also noticed a significant amount of desaturation in patients in whom adequate pre-oxygenation was not advocated prior to induction of general anaesthesia.

CONCLUSION

In conclusion we suggest that serious consideration should be given to the routine use of pre-oxygenation of five minutes before induction of general anaesthesia specially during COVID-19 pandemic situation. As the degree of desaturation occurring in patients who are adequately pre-oxygenated for five minutes is significantly lower than that in the eight deep breaths within 60 seconds at an oxygen flow of 10 L per min and three minutes pre-oxygenated groups. Also the vital parameters such as the heart rate and blood pressure remain closer to the baseline values in the pre-oxygenated group which could make a significant degree of difference in a compromised patients.

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