Study Of Effects Of Varying Durations Of Pre-Oxygenation

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Citation

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Abstract

200 ASA grade I and II patients in the age group of 18 to 50 years were studied under four equal groups. Group I patients did not receive any pre-oxygenation; Group-II patients received pre-oxygenation in the form of four vital capacity breaths; Group III and IV patients received pre-oxygenation for 3 and 5 minutes respectively. All the result were compared statistically using Analysis of Variance" (ANOVA) method It was observed that the percentage of fall of Sp02 was less in group III and group IV (92.84% and 97.04%) as compared to Group I and Group II (80.66% and 87.94%) suggesting vital role of preoxygenation before induction.

INTRODUCTION

Pre-oxygenation with 100% oxygen is performed routinely before induction of anaesthesia. Its goal is to increase the body's oxygen stores by replacing nitrogen in the lungs by an equivalent volume of oxygen, thus delaying the onset of arterial desaturation and hypoxemia during the apneic period following induction of anaesthesia[1].

This desaturation is thought to be of more significance during induction but should things go awry one is already on the knee of the hemoglobin- oxygen dissociation curve and desaturation will then be immediate and profound [2].

The need for de-nitrogenation of anaesthetized patients has been understood for the past two and a half decade [3]. By replacing the alveolar nitrogen with oxygen, only three gases remain in the alveoli- oxygen, carbon- dioxide and water vapour. Since the $P_{H2O}$is constant at 47 mm Hg and the P_{CO2}cannot rise higher than the PCO_2 of mixed venous blood (46 mm Hg) the remainder of the alveolar partial pressure must be exerted by the oxygen[4].

The present study was sought to compare and study the effects of varying periods of pre-oxygenation, on oxygen saturation, time required for recovery of oxygen saturation after intubation and its hemodynamic effect. So as to 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.

METHOD

The present study was conducted in the department of anesthesiology, Jawaharlal Nehru Medical College, Sawangi after approval from the Ethical Committee and with consent of patients. 200 Adult patients of ASA grade I and II of age group 18-50 years of Mallampati class I scheduled for elective surgery were included in this study. Smokers, pregnant women and patients with a difficult airway were excluded from study. All 200 patients were divided into four equal groups. Group I patients were not preoxygenated before induction of general anesthesia. Group II patients were preoxygenated and advised to take four deep breaths using the Magill's circuit with adequate size anatomical face mask (four vital capacity breaths). Group III Group IV patients were given three and five minutes of preoxygenation using the Magills circuit with adequate size anatomical face mask.

All the patients selected for the study were sedated on previous night with tablet diazepam 0.2 mg/kg orally. In the operating room after securing an intravenous access the pulse rate, blood pressure and SpO2 values were recorded on room air. Intravenous line was secured with 18guage intravenous cannula and premedicated with fortwin 0.6 mg/kg and diazepam 0.2 mg/kg intravenously.

Depending on the group the patient belonged to pre-oxygenation was done with anatomical face mask prior to the induction of general anesthesia. All patients of four groups were induced with inj. Thiopentone sodium 5 mgkg-1 given slow intravenously followed by inj. suxamethonium 1.5 mgkg-1. The patients were then kept

apneic for a period of one minute. At the end of one minute laryngoscopy was done and the patients were intubated with an adequate sized endotracheal tube. The patients were then ventilated with 100% oxygen and 0.5% Halothane. The heart rate, blood pressure and SpO2 values of all the patients were further recorded every 15 seconds till the saturation reached 100%. Following this nitrous oxide was administered and the surgery was commenced.

RESULT

The analysis was done by using ANOVA to compare the mean SpO_2 values among all groups. Unpaired T Test was used to compare mean SpO_2 values in different groups. Paired T Test was used to compare mean SpO2 values within groups.

Lowest mean SpO_2 values in group I is 80.66%, in group II is 87.94%, in group III 92.84% while in group IV is 97.04% as shown in table 1.

Figure 1

Groups	Lowest means SpO_2(%)
I	80.66 (3.35)
II	87.94 (2.4)
III	92.84 (2.2)
IV	97.04 (1.9)

It was also observed that the mean heart rate and blood pressure was about 20% higher in group I compared to the other study groups as in tables 2, 3 and 4. There was no statistically significant variation in these parameters between the other groups.

Figure 2

Table: 2 Showing mean Pulse Rate In Pre induction induction & Post intubation Period.

Time (Sec.)	Group I	Group II	Group III	Group IV
Pre induction	79.08 (6.7)	80.2 (5.9)	81.72 (5.4)	81.48 (6.0)
Induction O sec.	81.72 (7.4)	81.68(6.1)	79.88 (5.4)	81.56(6.4)
15 sec.	82.36 (8.7)	83.34 (5.9)	78.54 (5.3)	81.42 (6.2)
30 sec.	81.66 (9.1)	88.78 (11.2)	89.92 (5.1)	80.54 (5.8)
45 sec	81.1 (9.3)	85.5 (6.9)	81.66 (4.8)	80.94 (5.5)
60 sec	81.6 (4.8)	85.4 (6.9)	82.02 (5.2)	80.86 (5.7)
intubation 30 sec	85.18 (8.5)	86.22 (6.1)	83.58 (5.9)	81.62 (5.5)
60 sec	87.94 (7.7)	88.96 (6.7)	85.5 (6.3)	81.96 (6.1)

Figure 3

Table: 3 Showing the mean Systolic Blood Pressure in the Pre-induction, Induction & Post Intubation Period

Time (Sec.)	Group I	Group II	Group III	Group IV
Pre induction	116.10 (10.2)	120.12 (10.3)	121.44 (10.3)	121.86 (7.2)
Induction O sec.	118.10 (9.5)	120.12 (10.3)	121.44 (10.3)	121.86 (7.2)
15 sec.	119.54 (9.2)	122.68 (10.0)	119.46 (10.0)	119.18 (6.4)
30 sec.	120.74 (9.4)	122.58 (10.1)	119.06 (9.8)	119.12 (6.4)
45 sec	122.70 (9.8)	122.46 (18.1)	119.06 (9.8)	119.9 (6.0)
60 sec	124.08 (10.1)	124.66 (9.9)	120.82 (9.1)	119.9 (6.0)
intubation 30 sec	130.0 (10.7)	128.78 (13.4)	125.44 (8.3)	121.6 (5.3)
60 sec	133.46(10.4)	128.74 (9.2)	127.48 (7.4)	125.98 (5.8)

Figure 4

Table 4: Showing the mean Diastolic Blood Pressure in the Pre induction, Induction & Post Intubation Period

Time (Sec.)	Group I	Group II	Group III	Group IV
Pre induction	73.54 (5.1)	79.60 (6.3)	77.52 (5.5)	77.48 (5.2)
Induction O sec.	75.88 (5.8)	79.60(6.3)	77.52 (5.5)	76.52 (5.2)
15 sec.	77.0 (6.0)	80.18 (6.3)	77.00 (5.2)	76.52 (5.2)
30 sec.	78.78 (6.6)	80.18 (6.3)	77.00 (5.2)	77.68 (4.6)
45 sec	79.42 (6.3)	81.94 (6.1)	79.20 (5.2)	77.68 (4.6)
60 sec	81.14 (6.8)	81.94 (6.1)	79.20 (5.2)	78.98 (4.6)
intubation 30 sec	85.06 (7.1)	83.84 (5.9)	81.18 (5.1)	81.50 (4.5)
60 sec	89.10 (7.4)	86.78 (5.8)	83.28 (5.2)	83.74 (4.6)

DISCUSSION

Varying period of Pre-oxygenation is done before induction of general anesthesia knowing the fact that hypoxemia does occur during the period of laryngoscopy.1,2 . Decreased functional residual capacity, respiratory depression, decreased cardiac output and ventilation perfusion mismatch are various reason for hypoxia. Pre-oxygenation does protect against hypoxia during intubation and has been recommended by several authors for all cases. Multiple task at a time or lack of time on a busy operating prevents the anesthesiologist from holding face mask for preoxygenation.

The present study was carried out to evaluate the need of pre-oxygenating a patient prior to induction of general anesthesia and also assessing the speed of desaturaion and resaturation in patient who receive varying periods of preoxygenation by the use of pulseoxymeter. Although the validity and accuracy of pulseoxymeters as an noninvasive clinical monitoring tool of arterial oxygenation have been established, artifacts induced by movement, voltage fluctuations, extraneous light interference or low tissue perfusion can not be ignored. Precautions against artifacts and strict patient selection were necessary for reliable results.

Drummond and Park demonstrated that patients who breathed air before induction of anesthesia and were not ventilated after induction developed hypoxemia within 60 seconds. To increase the amount of oxygen available (oxygen reserve) and to prevent hypoxia, patients should receive 100% oxygenation prior to induction of general anesthesia ($_5$). Hamilton and Eastwood found that de-nitrogenation was 95 % complete within 2-3 minutes of tidal breathing using anesthesia system with 5 litres/minute. flow which led to recommendations of standard anesthesia text for three to five minutes preoxygenation prior to rapid sequence induction of anesthesia ($_6$). Preoxygenation for 5 minutes was recommended by Dillon and Darsie for prevention of hypoxemia after induction of general anesthesia. However they did not mention the shorter duration of preoxygenation, which was sufficient ($_7$). Thorpe et al determined the incidence of hypoxia using pulse oximeter during induction of anesthesia while Skea et al observed that in preoxygenated patients theSpO_2 values remained at a higher level than the non preoxygenated group during the apneic period of intubation ($_{8,9}$).Hett et al found that patients in whom no preoxygenation was done had a fall in saturation than in patients in whom preoxygenation was done for three minutes ($_{10}$). Sanjay et al noted that in non-preoxygenated patients there was a fall in SpO_2 compared with preoxygenated group ($_{11}$).

In our study it was found that in group I patients, in whom no pre-oxygenation was given a minute of apnea in the induction phase resulted in a fall of saturation to a mean of 80.66, as compared to 87.94 in the group II in whom pre-oxygenation was instituted in the form of four vital capacity breaths. This was in sharp contrast to the groups in whom pre-oxygenation was given for three and five minutes respectively. In these latter groups the saturation fell to a mean of 92.84 and 97.04 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 any pre-oxygenation had a fall in saturation to a mean of 84% and patients who had three minutes of pre-oxygenation had a fall in saturation to a mean of 98% (10). These results were also in accordance with the study done by Skea et al who reported a mean fall in oxygen saturation to 81% in the non pre-oxygenated group to a mean of 98% in the pre-oxygenated group (9). Motoyama et al reported that a reasonable amount of desaturation was noticed in patients in whom routine pre-oxygenation was not carried out ($_{12}$). Laycock et al and Weitzner et al also noticed a significant amount of desaturation in patients in whom pre-oxygenation was not advocated prior to induction of general anesthesia

([13,14]).

CONCLUSION

For inexperienced anesthetists, preoxygenation of patients is particularly important where airway problems may be less well recognized and may occur more frequently. A large percentage of patients show desaturation even during uneventful induction of anesthesia by experienced anesthetists and preoxygenation offer protection against this desaturation completely.

The major obstacle to routine preoxygenation is patient acceptance. Preoxygenation itself is likely to induce undue anxiety in some patients and it is time consuming in a busy operating list.

In summary it was found that SpO_2 decreases more rapidly in patients preoxygenated with four deep breaths compared with those preoxygenated for 3 and 5 minutes. Although healthy patients undergoing routine anaesthesia induction receive adequate protection against hypoxia with four maximal inspirations of oxygen, patients in whom a prolonged period of apnea might occur after induction of anesthesia should breath oxygen for at least three minutes before the administration of anesthetic drugs.

In conclusion it is suggested that sincere use of preoxygenation before induction of general anesthesia prevents desaturation than compared to non preoxygenated patients. Also the vital parameters such the pulse rate and the blood pressure almost remain normal in preoxygenated group, which could make a significant degree of difference in a compromised patient.

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