

Compare the Mean Non Hypoxic Apnea Duration of 20° Head up with Conventional Supine Position during Pre-oxygenation in Patients Undergoing Elective Surgery

TANZEELA FIRDOUS¹, ALI KASHIF², SAHIRA NAWAZ KHAN³, AYESHA WAQAR⁴, SUFYAN ALI⁵, SUMAYYA TARIQ⁶

¹Assistant Professor Anaesthesia SMCH

²Senior Consultant Anaesthesiology, Hameed Lateef Hospital, Lahore

³Senior Registrar Anaesthesia, Allama Iqbal Medical College, Jinnah Hospital Lahore

⁴Anaesthesia

⁵Post Graduate Trainee, SMCH

⁶Senior Registrar Anaesthesia, SMCH.

Correspondence to: Tanzeela Firdous, Email: dr.tanzeela@yahoo.com

ABSTRACT

Introduction: Pre-oxygenation is routinely carried out before general anaesthesia with the aim of maximizing oxygen stores in the functional residual capacity of the lungs. This is a method to avoid hypoxia during the apnoeic interval after general anaesthetic induction. When initiating general anaesthesia, it is a practice to pre-oxygenate for 3 minutes in the supine position, since this is considered to be related with reduced cardiovascular instability. While the best timing for pre-oxygenation has been found, the best body posture for pre-oxygenation has yet to be determined.

Objective: To compare the mean non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery

Design of the study: Randomized Controlled Trial

Setting: This study was conducted in the Operative Rooms of Jinnah Hospital, Lahore

Result: Total 200 patients included, the mean age was 26.21±5.21 in Group A & 24.87±4.69 in Group B. The age range was 15-50 years, 41%(n=41) in Group A 39%(n=39) & in Group B between 15-25 years of age which was in majority. There were 45(45%) males and 55(55%) in Group A & 51.0(51%) male and 49.0(49%) female in Group B which shows that basic demographics were insignificant in both groups while comparing the mean non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery, we revealed 352.28±74.43 in Group A and 449.75±67.31 in Group B, p value was calculated as 0.04 i.e. ≤0.05

Conclusion: Comparison of the average non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery reveals prolonged duration in patients with 20° head up than conventional supine position during pre-oxygenation.

Keywords: Mean non hypoxic apnea duration, 20° head up, conventional supine position, pre-oxygenation

INTRODUCTION

Pre-oxygenation (also known as denitrogenation) is achieved by having the patients breathe 100% oxygen from a close-fitted facemask before induction of anaesthesia¹. By replacing nitrogen in the lungs with an equal oxygen volume, it boosts the body's oxygen storage, which delays the development of arterial desaturation and hypoxemia during the apnoeic phase, with induction of anaesthesia & intubation². This has a large influence on body oxygen stores, resulting increase in apnoea tolerance².

Various parameters affecting non-hypoxic apnoea duration following pre-oxygenation have been studied e.g., duration of pre-oxygenation³, circuits used for pre-oxygenation^{4,5} position during pre-oxygenation⁶ e.g. supine, head up or sitting position has been studied. Position during pre-oxygenation has significant effect on nonhypoxic apnea duration, it decreases in supine position especially in elderly patients⁷.

Smith et al⁸ concluded that there's no evidence that pre-oxygenation i.e. supine 32.7±7.3 versus 32.6±6.7 on 45° seated group in the 45° seated position improves tissue oxygenation compared with the supine position. A recent study found that supine and 20° head up tilt offer longer duration of non-hypoxic apnoea than standard pre-oxygenation. (Non-hypoxic apnoea duration in 20° head up 452±71s compared to conventional supine group 364±83s)¹⁰.

The positive effects of position on pre-oxygenation has been studied but with variable results. I want to study effects of head up position to conventional supine position on nonhypoxic apnoea time, so that better technique for pre-oxygenation having longer nonhypoxic apnoea duration can be determined.

MATERIAL AND METHODS

This randomized controlled trial was conducted 01-02-2012 to 31-07-2012 in Operation theatres, Jinnah Hospital, Lahore. Sample size of 200 patients (100 in each group) was calculated 95%

confidence level, with 80% power of test by taking expected mean of non-hypoxic apnea duration i.e. in supine group 364±83 sec and in 20° head up group 452±71 sec in patient undergoing elective surgeries.

Patients ASA class I & II with age group 15-50 years of both gender and patients undergoing elective surgery were included. Individuals with significant cardio respiratory or cerebro-vascular disease on history + ECG, suspected difficult intubation i.e. MP 4 & 4, patients Body Mass Index >25kg/m² and haemoglobin <8g/dl were excluded.

Patients were randomly assigned (using random number tables) in two groups, Group A, in which 100 patients were kept in supine during pre-oxygenation and Group B, 100 patients placed supine with the torso tilted 20° head-up. Follow parameters were monitored: ECG, NIBP and SpO₂. Hartmann's solution (10ml/kg) was injected into the upper leg through an intravenous line. Pre-oxygenation was performed by tight fitted face mask with 100% oxygen at flow of 5l/min for 3 minutes. While continuing oxygenation, anaesthesia was included with Intravenous Nalbuphine 0.1mg/kg followed by propofol 1-2mg/kg. Immediately after patient's loss of consciousness, succinylcholine was administered in a dosage of 2 mg/kg without assessing the capacity to mask ventilate. Midazolam 2mgIV was managed soon after to ensure amnesia during the apnoeic period. Sixty seconds later, intubation was performed by conventional laryngoscope. The endotracheal tube position was confirmed by the passage of tube between the vocal cord under vision. Atracurium was used to paralyse the patient at a dosage of 0.03 mg/kg. The time spent in a non-hypoxic apnoeic state was recorded and taken from intubation to point where arterial saturation was drop to 93% on pulse oximeter or apnoeic period of 10 min, which ever was earlier. After study is over, the surgery was started with routine maintenance anaesthesia.

Data was analyzed into SPSS version 25.0. Age, duration of apnea was presented as mean + SD. Gender was presented as frequency & percentages. T test was used to compare the duration of non-hypoxic apnea in both groups. P value ≤ 0.05 was taken as significant.

RESULTS

Total 200 patients were enrolled. The mean age was 26.21+5.21 in Group A and 24.87+4.69 in Group B. 41(41%) in Group-A & 39(39%) in Group-B between 15-25 years of age, 24(24%) in Group A & 27(27%) in Group-B between 26-35 years, 19(19%) in Group A & 23(23%) in Group B between 36-45 years of age while 16(16%) in Group A and 11(11%) in Group B were recorded between 45-50 years of age. Table: 1 There were 45(45%) males and 55(55%) in Group A & 51.0(51%) male and 49.0(49%) female in Group B. Table: 2

Comparison of mean non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery was done which reveals 352.28+74.43 in Group A and 449.75+67.31 in Group B, p value was calculated as 0.04 i.e. ≤0.05. Table: 3.

Table 1: Age Distribution of the Patients

	Group A	Group B
Mean +SD	26.21+5.21	24.87+4.69
15-25	41(41%)	39(39%)
26-35	24(24%)	27(27%)
36-45	19(19%)	23(23%)
46-50	16(16%)	11(11%)

Table 2: Distribution of Gender

Gender	GroupA	GroupB
Male	45(45%)	51(51%)
Female	55(55%)	49(49%)

Table 3: Comparison of mean non hypoxic apnea duration of 20o head up with conventional supine position during pre-oxugenation in patients undergoing elective surgery.

Group A (100%)	Group B (100)	p-value
352.28+74.43	449.75+67.31	0.004

DISCUSSION

Pre-oxygenation is carried out before general anaesthesia in order to maximize oxygen storage in the lungs' functional residual capacity. When initiating general anesthesia, it is a practice to pre-oxygenate for 3 minutes in the position of supine, since this is considered to be related with reduced cardiovascular instability^{9,10}. While the best timing for preoxygenation has been determined, the best body posture for preoxygenation has yet to be determined¹¹.

The positive effects of position on pre-oxygenation has been studied but with variable results, however we intend to study the effects of head up position to conventional supine position on nonhypoxic apnoea time, so that better technique for pre-oxygenation having longer nonhypoxic apnoea duration can be determined.

The current study shows that age range was 15-50 years, majority of the patients 41(41%) in Group A & 39(39%) in Group B between 15-25 years of age, mean age was 26.21+5.21 in Group A and 24.87+4.69 in Group B. In both groups while comparing the mean non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery, we revealed 352.28+74.43 in Group A and 449.75+67.31 in Group B, p value was calculated as 0.04 i.e. ≤0.05, which shows a significant shorter duration in Group A & Group B was recorded with statistically significant longer duration.

The findings of this study are in agreement with the study conducted by 2017 study, who compared the pre-oxygenation method (group C) with 20° head-up tilt (group H) & 5.0 cmH2O PEEP (group P) in non-obese people for duration of non-hypoxic apnea and recorded duration of non-hypoxic apnea was larger with

group B (452 ± 71 s) compared to group A (364 ± 83 s, P < 0.05), the results of our study are closely related to the above mentioned study, during our study we strictly follow the BMI of the patients and excluded obese patients which could alter the results of the study¹².

Comparison of our results with some other studies who compared the effects of head up (range from 20° - 60°) on the non-hypoxic apnea duration in comparison with conventional pre-oxygenation also shows a statistically significant difference in both techniques by following head-up position with longer duration¹²⁻¹⁴.

Other data suggest that with the 200 head-up position, the duration of non-hypoxic apnea is 40 seconds longer than with PEEP, which we did not consider in our study¹⁵.

Preoxygenation in a head-up place is believed to increase the risk of aspiration, should regurgitation happen, While the risk of regurgitation is reduced in general with the position of head-up, as shown in our study, also not included variable of interest in our study's^{10,16}.

Some anesthesiologists believe that in female patients, gravitational retraction of the breast tissue allows for better placement of the head for effective intubation and better access to the airway. In this study, we didn't encounter any problem in intubation, not was any incident of regurgitation or aspiration noted though not presented as a variable of interest considering the limitation of the study. However, when obese people sit on the floor, their arterial oxygen saturation and FRC may fall; this can be increased by induction of anaesthesia as a result of diaphragm tone deterioration^{17,18}.

However, in light of the findings of current study supported with some other international studies, it may be established that in non-obese individuals, in a 20° head-up posture, pre-oxygenation is more effective and efficient than in a supine position.

CONCLUSION

Comparison of the mean non hypoxic apnea duration of 20° head up with conventional supine position during pre-oxygenation in patients undergoing elective surgery reveals prolonged duration in patients with 20° head up than conventional supine position during pre-oxygenation.

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