Original Article

A Comparative Study On The Effect Of Positive End Expiratory Pressure (Peep) On Pre-Oxygenation In Supine Position And Propped Up Position In Patients Undergoing Ceaserian Section Under General Anaesthesia

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Abstract

Introduction:

To increase the amount of oxygen in the lung functional residual capacity, pre-oxygenation is preformed prior to Anaesthesia induction. The application of PEEP during the time of induction helps in preventing atelectasis formation and increase O2. This study was aim to compare the effect of PEEP on pre-oxygenation in supine position and propped up position in patients undergoing caesarean section under general anaesthesia.

Methods

In this prospective randomized controlled double blinded study 60 patients were grouped randomly into 3 groups of each (n=20).Group A (n=20) patients preoxygenated in supine position without PEEP 5 cm H2O and Group B (n=20) patients in supine position with PEEP of 5 cm H2O, Group C (n=20) patients pre-oxygenated in 25˚ headup position with PEEP 5 cm H2O.

Result: In this study, 60 patients were scheduled for elective/emergency caesarean section under general anaesthesia. The demographic variables like age group, BMI range and Type of surgery were found comparable in all study groups. The time required to achieve ETO2 90% was 370.21±47.5, 291.52±45.7 and 188.81±40.2 for Group A, B and C respectively. Haemodynamic changes like ETO2, SpO2, and blood pressure with positions of patient during pre-oxygenation were found comparable in all group. There were no side effects found during the period of study in any patient.

Conclusion:

We concluded that age, BMI range and Type of surgery were found comparable among the 3 study groups and there was no significance difference was reported between these groups and position of patient during pre-oxygenation.

Keywords: Positive end expiratory pressure; PEEP; Pre-oxygenation; Supine position; Propped up position; Caesarean; General anaesthesia.

Introduction:

Pre-oxygenation is a widely accepted procedure used to increase the body's oxygen reserves before tracheal intubation and the induction of anaesthesia, which is intended to delay the desaturation of arterial haemoglobin during apnoeic episodes.[1] It is preferred for all patients to require pre-oxygenation, notwithstanding the variable difficulties with ventilation and intubation. Pre-oxygenation's performance and efficiency are used to gauge it's efficacy. Increases in the alveolar O2 fraction (FAO2), decrease in the alveolar nitrogen fraction (FAN2) and improvements in arterial O2 stress (PAO2) are all key determinants of efficacy markers .[2] So, in this 2 process of pre-oxygenation, the patient breathes 100% oxygen using a mask that is tightly fitted in the supine position. This

process will help in replacement of nitrogen volume of lung with oxygen. The oxygen reserves capacity of the healthy patient will increase after apnoea by giving 3 minutes of pre-oxygenation.[3]

Positive end-expiratory pressure (PEEP) is used to stop the lungs from developing atelectasis. By the application of PEEP leads to increase the functional residual capacity, this may lengthen non – hypoxic apnoea episodes.[4-5] Within 5 minutes of induction of general anesthesia, upto 85-90% of patients experience atelectasis in dependent lung areas. As a result of atelectasis, both the body's stored oxygen and the FRC are reduced.[6] Furthermore, it raises intrapulmonary shunt, which speeds up desaturation to hypoxic levels. Applying PEEP during anaesthesia induction lengthens non hypoxic apnoea by avoiding the development of atelectasis, boosting oxygen reserves, and reducing intrapulmonary shunt.[7]

Supine positioning is not thought to be ideal because it is difficult to begin breathing fully while flat on the back and more of the rear lung is susceptible to atelectatic collapse.[8] It causes the lungs reserve of oxygen to decline, which lowers the safe apnoea time as a result. Pre-oxygenation in head up position is also practiced. Patients with spinal injuries who are immobilised may benefit from reverse trendelenburg position of pre-oxygenation.[9] For pre-oxygenation, several head up tilt angles between 20°and 90° have been taken into consideration to maximize it's effect. Pre-oxygenation in the head up position is theorised to minimise the likelihood of regurgitation as a whole while theoretically increasing the chance of aspiration if regurgitation occurs.[10]

The present study was aimed to aim to study on the effect of positive end expiratory pressure (peep) on pre-oxygenation in supine position and propped up position in patients undergoing caesarean section under general anaesthesia.

MATERIALS AND METHODS:

A Prospective randomized controlled double blinded study was performed on 60 patients undergoing elective / emergency caesarean section under general Anaesthesia in Department of anaesthesiology, CHRI. The study was performed for period of 6 months.

Inclusion criteria: Patients in age group of 18-60 with ASA physical status I and II. Patients scheduled for Elective / Emergency caesarean surgeries. Parturient Females with BMI >25kg/m^2 were enrolled for the study.

Exclusion Criteria: When room air SPO2 (Oxygen saturation) was less than 97%. Paediatrics and Geriatrics patient with history of epilepsy. Patients with cardiorespiratory or cerebrovascular disease were excluded from the study.

Study Procedure: After getting the ethical committee clearance, informed written consent will be obtained from the parturient females who are fulfilling the above eligibility criteria.

All of the patients will be required to fast for 8 hours prior to surgery and will be given 10 mg of oral diazepam the night before to surgery. On the day of surgery, patients will be shifted to operation theatre. Routine monitoring with electrocardiograph, non-invasive blood pressure, oxygen saturation and capnography will be attached to all of them. They will be hydrated with ringer's lactate solution intravenously of 10 ml/kg and pre oxygenated with tight fitting mask connected to a circle system with the fresh oxygen flow of 6L/min with 100% oxygen until they achieve EtO2 of 90%. They will be randomly divided into three groups of 20 each. Randomisation will be done with computer generated randomization code.

- GROUP A (n=20): Pre-oxygenation in supine position without PEEP 5cm H2O.
- GROUP B (n=20): Pre-oxygenation in supine position with PEEP 5cm H2O.
- GROUP C (n=20): Pre-oxygenation in propped up position with PEEP 5cm H2O.

In Group A (n=20),patients will be pre oxygenated in supine position without PEEP and in Group B(n=20) ,patients will be pre oxygenated in supine position with a PEEP of 5cmH20 whereas in Group c (n=20),patients will be pre oxygenated with a PEEP of 5cm H2O in head-up tilt position at 25 degree. The baseline values of heart rate, blood pressure, and SPO_2 will be recorded prior to preoxygenation. After achieving an EtO2 of 90%,general anaesthesia will be induced with inj. Propofol 2mg/kg intravenously until there is loss of verbal contact and inj.

succinylcholine 1.5mg/kg will be given IV to facilitate rapid sequence induction The time required to achieve EtO_2 of 90% will be noted in each group. Variations in haemodynamic parameters such as heart rate, blood pressure and SPO_2 will be noted in all the three groups. Any side effects like difficulty in breathing, tachycardia, hypotension, if present will be recorded. A senior anaesthesiologist will do conventional laryngoscopy to accomplish tracheal intubation 60 seconds after succinylcholine injection. Under direct visualisation, the endotracheal tube will be inserted between the vocal cords and will be confirmed by capnography. The endotracheal tube's cuff will be inflated with 5ml of air and the tube's proximal end (machine end) will be connected to anaesthesia work station. Any patient with a Cormack and lehane (CL) laryngoscopy grade III or IV, multiple intubation attempts, or an intubation time of more than 15 seconds will be excluded from the study. To ensure amnesia and analgesia until child birth, 50% N2O will be added to inhalational agent. Following child delivery, 1 mg of inj. Midazolam and 2mg/kg inj. Fentanyl will be given intravenously to ensure adequate depth of anaesthesia. To maintain neuromuscular inhibition, inj. Atracurium 0.5mg/kg will be given intravenously. At the end of sugery, all will be reversed from neuro- muscular blockade with inj. Myopyrolate 2.5mg IV. After ensuring adequate efforts of spontaneous respiration, patients will be extubated and shifted to recovery room. Heart rate, blood pressure, and SPO2 were all measured at this time.

The patients will be asked if they could recollect any intraoperative occurrences once they were completely aware and oriented. Any other negative incidents that occurred during the research period will also be recorded.

Statistical analysis:

Data were entered in MS excel and analysis was done using SPSS 21.0 version. Data were presented as Mean and Standard deviation for continuous variables and as percentages for categorical variables. A Chi-square test was done to find out any association between categorical variables. The difference between groups were assessed using one-way analysis of variance (ANOVA) and post- hoc analysis with Bonferroni correction was done if statistically significant was observed between groups. A p value of less than or equal to 0.05 was considered significant.

Results:

In present study total 60 patients were enrolled and divided in three groups of 20 patients each. Group A, patients received pre-oxygenation in supine position without PEEP 5cm H2O, group B patients received pre-oxygenation in supine position with PEEP 5cm H2O. Whereas Group C patients having pre-oxygenation in propped up position with PEEP 5cm H2O.The mean age, BMI range were reported comparable in all three A, B and C groups patients. Type of surgery was recorded 12.05±1.2, 13.04±2.1 and 12.08±2.2 for group A, B and C respectively.

Table 1: Demographic variables among study groups

	GROUP A	**GROUP B**	**GROUP C**	**P VALUE**
Age range	35.4 ± 9.8	29.5±10.1	30.4±6.8	0.478
BMI range	29.03±2.7	29.4±2.8	29.8±1.4	0.588
Type of surgery	12.05±1.2	13.04±2.1	12.08±2.2	0.435

The time required to achieve ETO2 90% in patients of all groups was observed in our study. It was found that time required to achieve ETO2 90% was 370.21±47.5, 291.52±45.7 and 188.81±40.2 for Group A, B and C respectively. The effect was statistically insignificant among all groups.

Table 2: Comparison of Time required to achieve ETO2 90% with 3 different positions

	Time required to achieve EtO_2 90%	**GROUP B**
GROUP A	370.21±47.5	0.892
GROUP B	291.52±45.7	0.063

GROUP C	188.81±40.2	0.061

Haemodynamic changes like ETO2, SpO2, blood pressure with positions of patient during pre-oxygenation was also recorded. All these parameters were found comparable in all groups with insignificant effect. There was no side effect was reported in patients of all group in current study.

Table 3: Comparison of haemodynamic changes with positions of patient during pre-oxygenation.

	GROUP A	GROUP B	GROUP C	P VALUE
ETO2	2.43±1.5	2.40±1.8	3.45±2.5	0.072
SpO2	1.50±1.8	2.30±1.8	2.30±1.8	0.259
Blood pressure	3.50±1.5	2.50±1.5	2.50±1.5	0.627

Discussion:

This study was performed on 60 pre-oxygenation of patients undergoing caesarean section under general anaesthesia. All demographic variables like mean age, BMI range and type of surgery were reported comparable in all three A, B and C groups patients. The uniform demographic parameters in all three group supported in unbiased comparative study.[11]

In Group C the time required to achieve ETO2 90% is less (188.81±40.2) compared to Group A (291.52±45.7) and Group B (370.21±47.5). Although, the time required to achieve ETO2 90% is lesser in Group B compared to Group A since p value of the 3 Groups are p (> 0.05), there is no significance between time required to achieve ETO2 90% and position of patient during pre-oxygenation. There was no side effects found during the period of study. Analysis of the effect of haemodynamic parameters, spo2, NBP and heart rate was done. There were no significant difference among the 3 study groups p value (>0.05).

Machlin et al illustrated in their comparative study conducted among 200 patients that 23 (11.5%) were unable to be adequately pre-oxygenated (to achieve an end tidal oxygen concentration of 90%).[12] Most of these were due to a poor mask fit in bearded or edentulous patients. There was no difference in the characteristics for these patients when compared with those who were adequately pre-oxygenated. The average time for pre-oxygenation was 154 seconds. But in our study there was no there is no difference in variables and the average time for pre-oxygenation was Group A (291.52±45.7) , Group B(370.21±47.5) , Group C (188.81±40.2).

There are many studies that compared the effects of application of PEEP of 6- 10 cmH2O with conventional pre-oxygenation. In those studies, the authors have found statistically significant increase in duration of safe apnoea period with application of PEEP compared to conventional technique. [13] This can be explained by one notable difference of methodology compared to ours is that patents in PEEP group received PEEP with intermittent positive pressure ventilation with the mask following induction and paralysis. Along with that the PEEP applied was greater than in our study. However, in our study we didn't apply intermittent positive-pressure ventilation (IPPV) or PEEP after induction of anaesthesia. This difference in methodology may explain why our results were different from those of other such studies.

Dixon et al. conducted a randomized controlled study. In this study they measured oxygen saturation and desaturation safety period after 3 minutes of pre-oxygenation in 42 consecutive severely obese patients who were undergoing laparoscopic adjustable gastric band surgeries and were randomly assigned to the supine position or the 25 degree head-up position.[14] Pre- oxygenation in the 25 degree head-up position achieved 23% higher oxygen tension, allowing a clinically significant increase in the desaturation safety period – greater time for intubation and airway control. Their findings were corroborative with our study, patients in propped up position with PEEP had less onset of ETO_2 and thereby safe apnoeic period. **Lane et al** in his prospective randomised controlled study concluded that desaturation within 95% was done 386 seconds versus 283 seconds in the supine position group. [15]

Conclusion:

60 patients scheduled for elective and emergency caesarean section is enrolled in this study. Based on the result we concluded that demographic variables such as age, BMI, and type of surgery were comparable among the 3 study groups. Analysis of the effect of PEEP on ETO2, SpO2 and Heart rate at varying time interval were comparable among the 3 study groups and they were not statistically significant.

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