EFFECT OF TWO DIFFERENT INTRAOPERATIVE INSPIRED OXYGEN CONCENTRATIONS ON POSTOPERATIVE PULMONARY ATELECTASIS IN GERIATRIC PATIENTS UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA: A RANDOMIZED CONTROL TRIAL

THESIS

Submitted to

All India Institute of Medical Sciences, Jodhpur in partial fulfilment of the requirement for the degree of

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ANAESTHESIOLOGY AND CRITICAL CARE

JULY 2020 **DR CHITRA PRABHA SAUN**

AIIMS, JODHPUR

DECLARATION

I hereby declare that the thesis titled **"EFFECT OF TWO DIFFERENT INTRAOPERATIVE INSPIRED OXYGEN CONCENTRATIONS ON POSTOPERATIVE PULMONARY ATELECTASIS IN GERIATRIC PATIENTS UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA: A RANDOMIZED CONTROL TRIAL''** embodies the original work carried out by me at All India Institute of Medical Sciences, Jodhpur.

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Department of Anaesthesiology and Critical Care

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Jodhpur

CERTIFICATE

This is to certify that the thesis titled **"Effect of two different intraoperative inspired oxygen concentrations on postoperative pulmonary atelectasis in geriatric patients undergoing elective surgery under general anaesthesia: a randomized control trial''** is the bonafide work of **DR CHITRA PRABHA SAUN** carried out under our guidance and supervision, at Department of Anaesthesiology and Critical Care, All India Institute of Medical Sciences, Jodhpur.

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Professor and Head
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"*No one who achieves success does so without acknowledging the help of others. The wise and confident acknowledge this help with gratitude"*

(*Alfred North Whitehead)*

This thesis has become reality with the constant support and help of every individual. I like to express my deep gratitude towards them.

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Dr Chitra Prabha Saun

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
ASA	American Society of Anaesthesiologists
BMI	Body mass index
FiO2	Fraction of inspired oxygen
HR	Hours
IV	Intravenous
IQR	Inter Quartile Range
Min	Minutes
NMT	Neuromuscular monitoring
PONV	Postoperative nausea & vomiting
PaO2	Partial pressure of arterial oxygen
PEEP	Positive end expiratory pressure
P/F	PaO2/FiO2
SD	Standard Deviation
SSI	Surgical site infection

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EFFECT OF TWO DIFFERENT INTRAOPERATIVE INSPIRED OXYGEN CONCENTRATIONS ON POSTOPERATIVE PULMONARY ATELECTASIS IN GERIATRIC PATIENTS UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA: A RANDOMIZED CONTROL TRIAL THESIS Submitted to All India Institute of Medical Sciences, Jodhpur in partial fulfilment of the requirement for the degree of DOCTOR OF MEDICINE (MD) ANAESTHESIOLOGY AND CRITICAL CARE INTRODUCTION Oxygen administration is necessary for all patients undergoing operations under general anaesthesia. However, different anaesthetists have varied opinions regarding the ideal level of inspired oxygen to supplement intraoperatively. The physiology of the lungs are altered by high inspired oxygen concentration (FiO2), which might cause atelectasis and postoperative pulmonary problems. [1,2] High FiO2 is a significant contributor to the development of absorption atelectasis and hence serves as a solid justification for reducing the perioperative inspired oxygen concentration. [3] However, even in the presence of a high inspired oxygen content, the administration of PEEP during the induction and maintenance phases of general anaesthesia reduces the development of atelectasis.. [4] An important risk factor for postoperative pulmonary problems is geriatric age. Age- related changes in the physiology of the lungs in elderly individuals reduce the respiratory system's compliance, their ability to respond to hypoxemia and hypercapnia, and their ability to activate protective airway reflexes. [5] Altered intraoperative gas exchange and postoperative atelectasis are also caused by the closure volume tending to exceed functional residual capacity with age. [5] Because hyperoxia is expected to lower the frequency of surgical site infections, the WHO and the US Centers for Disease Control and Prevention (CDC) recently advised delivery of 80% inspired oxygen in surgeries carried out under general anaesthesia. [6,7] This recommendation, however, sparked debate, primarily among anaesthetists, who claimed that there was little proof that it prevented surgical site infections and that hyperoxia was linked to higher levels of oxidative stress, atelectasis, and postoperative pulmonary problems. A few recent studies have found no difference between using 80% oxygen during the perioperative phase compared to 30% oxygen in terms of the incidence and severity of atelectasis and alveolar gas exchange. [8-10] To our knowledge, there are no research on geriatric patients, and all studies were carried out on healthy adult patients. So,

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SUMMARY

Background: All the patients requiring general anaesthesia need oxygen administration and different anaesthetists have different opinions regarding the ideal inspired oxygen concentration to be supplemented intraoperatively. Intraoperative high inspired oxygen concentration is considered to have harmful effects on lung physiology and increases the chances of postoperative pulmonary complications.[1-2] However, a few recent studies have suggested that there is no clinically significant difference in postoperative lung atelectasis between low and high intraoperative inspired oxygen. High inspired oxygen concentration is also found to be beneficial in reducing incidence of postoperative vomiting and surgical site infection. Most of the studies have been conducted in young healthy individuals. Ageing affects the functioning of all organ systems. Decreased pharyngeal muscle tone, decreased lung compliance & impaired response to hypoxia makes the geriatric population more prone to atelectasis and pulmonary complications post-surgery. So, the present study was planned to study the effect of high inspired oxygen (0.8 FiO2) and low inspired oxygen (0.3 FiO2) on postoperative pulmonary atelectasis in geriatric patients undergoing elective surgery.

Material and Methods: Total 50 patients aged more than 60 years of age undergoing elective surgery under general anaesthesia were enrolled in the study. After induction, the airway was secured with appropriate size supraglottic devices or endotracheal tubes. The patients were randomly divided into two groups of 25 each using computer generated random number tables. Group I (0.3) received inspired 30% oxygen and Group II (0.8) received inspired 80% oxygen mixed with air. In Group II, 3 patients were lost to follow up and finally data of 47 patients were analyzed.

Lung protective ventilation with tidal volume of 6-8 ml/kg & PEEP of 5 was set for intraoperative ventilation. Postoperatively CT thorax was done to assess the incidence and severity of postoperative atelectasis within 24 h after surgery. PaO2 was noted in all patients with the help of arterial blood gas (ABG) analysis before preoxygenation, and postoperatively at 1-hour, 6-hours and 12-hours. The incidence of postoperative nausea and vomiting was compared till 24 hours postoperatively and surgical site infection compared at postoperative day 5 in all patients. The requirement of postoperative respiratory support (oxygen supplementation/ mechanical ventilation) and incidence of postoperative pneumonia at day 3 was also compared in the two groups.

Results: Both the groups were comparable with regards to demographics and other confounding variables. The median (IQR) percentage of atelectasis area as assessed by HRCT thorax was comparable between group I [1.40 (1.20-1.7)] and group II [1.45 (1.20-1.75)] (p-value-0.7). The gaseous exchange as assessed by the P/F ratio at different time intervals showed no statistically significant difference in both the groups (p-value >0.05). None of the patients in either group experienced PONV, SSI or pneumonia. No postoperative pulmonary complications (pneumonia) or requirement of oxygen or mechanical ventilation was seen in any of the patient of either group.

Conclusion:

Intraoperative administration of high inspired oxygen concentration (FiO2 = 0.8) is as safe as low inspired oxygen (FiO2 = 0.3) in terms of development of significant postoperative atelectasis in geriatric population. Even it didn't adversely affect the gaseous exchange and post-operative pulmonary complications. None of the patients in either group experienced PONV, SSI suggesting no beneficial effect of hyperoxia in preventing PONV & SSI.

INTRODUCTION

Oxygen administration is necessary for all patients undergoing surgery under general anaesthesia. However, different anaesthetists have varied opinions regarding the ideal level of inspired oxygen to be supplemented intraoperatively. The physiology of the lung is altered by high inspired oxygen concentration (FiO_2), which might cause atelectasis and postoperative pulmonary problems.[1,2] High FiO_2 is a significant contributor to the development of absorption atelectasis and hence serves as a solid justification for reducing the perioperative inspired oxygen concentration.[3] However, even in the presence of a high inspired oxygen content, the administration of PEEP during the induction and maintenance phases of general anaesthesia reduces the development of atelectasis.[4]

An important risk factor for postoperative pulmonary problems is geriatric age. Age-related changes in the physiology of the lungs in elderly individuals reduce the respiratory system's compliance, their ability to respond to hypoxemia and hypercapnia. Their ability to activate protective airway reflexes is also impaired.[5] Altered intraoperative gas exchange and postoperative atelectasis are also caused by the closing volume tending to exceed functional residual capacity with age. [5]

Hyperoxia is expected to lower the frequency of surgical site infections, so WHO and the US Centre for Disease Control and Prevention (CDC) recently advised delivery of 80% inspired oxygen in surgeries carried out under general anaesthesia.[6,7] This recommendation, however, sparked debate, primarily among anaesthetists, who claimed that there were weak recommendations that it prevented surgical site infections and that hyperoxia was linked to higher levels of oxidative stress, atelectasis, and postoperative pulmonary problems. A few recent studies have found no difference between using 80% oxygen during the perioperative phase compared to 30% oxygen in terms of the incidence and severity of atelectasis and alveolar gas exchange. [8-10] To best of our knowledge, all studies were carried out on healthy adult patients and there are no studies exclusively on geriatric patients. So, present study was planned to investigate the effects of high inspired oxygen (FiO_2 0.8) and low inspired oxygen (FiO_2 0.3) on postoperative pulmonary atelectasis in elderly patients undergoing elective surgery. We hypothesize that there would be no clinically significant difference between the incidence and severity of postoperative atelectasis with 30% vs. 80% of inspired oxygen administered intraoperatively in geriatric patients undergoing elective procedures under general anaesthesia.

AIMS AND OBJECTIVES

Aim - To study the effect of 30% v/s 80% inspired oxygen given intraoperatively on incidence and severity of postoperative atelectasis, postoperative gas exchange, postoperative nausea/vomiting and surgical site infection in geriatric patients undergoing elective surgery under general anaesthesia.

Primary Objective - To compare the incidence and severity of postoperative atelectasis determined by CT thorax.

Secondary Objective –

1.To compare postoperative gas exchange by PaO_2/FIO_2.

2.To compare incidence of postoperative nausea and vomiting.

3.To compare incidence of surgical site infection.

4.To compare requirement of postoperative respiratory support (oxygen supplementation/ mechanical ventilation).

5.To compare incidence of postoperative pneumonia.

REVIEW OF LITERATURE

Akca et al[8] (1999) compared postoperative pulmonary atelectasis in patients undergoing colon resection who are given 30% or 80% oxygen during and 2 hours after colon resection. They found that ventilation was reduced in both groups as compared to preoperative values, but there was not significant difference between either group. Chest radiographs and pulmonary function tests (forced vital capacity and forced expiratory volume) were obtained preoperatively and on the first postoperative day. Arterial blood gas measurements were obtained intraoperatively, after 2 hour of recovery, and on the first postoperative day. Postoperative radiographs showed findings suggestive of atelectasis in 36% of patients supplemented with 30% oxygen and in 44% of patients supplemented with 80% oxygen. The study was supplemented with CT scan findings taken postoperatively which showed no significant difference in both the groups. Relatively small amounts of pulmonary atelectasis (expressed as a percentage of total lung volume) were observed on the computed tomography scans, and the percentages (mean ± SD) did not differ significantly in the patients given 30% oxygen(2.5% ± 3.2%) or 80% oxygen (3.0% ± 1.8%).Arterial gas partial pressures and the alveolar–arterial oxygen difference were also comparable in the two groups. They concluded that supplementing patients with 80% oxygen won't worsen the pulmonary function. Therefore, patients who may benefit from generous oxygen partial pressures should not be denied supplemental perioperative oxygen for fear of causing atelectasis.

Staehr et al [9] (2012) conducted a randomized trial to assess if a high FiO_2 is associated with impaired oxygenation and decreased pulmonary functional residual capacity (FRC). Thirty-five patients scheduled for laparotomy for ovarian cancer were randomized to receive either 30% oxygen (n = 15) or 80% oxygen (n = 20) during and for 2 hour after surgery. The oxygenation index (PaO_2/FiO_2) was measured every 30 min during anesthesia and 90 min after extubation. FRC was measured the day before surgery and 2 hour after extubation by rebreathing method using the inert gas SF6. Authors found no significant difference in oxygenation index or functional residual capacity between patients given 80% and 30% oxygen for a period of approximately 5 hours.

Hovaguimian et al[10] (2013) conducted a systematic review and meta-analysis of randomized controlled trials to evaluate effect of intraoperative high inspired oxygen fraction on surgical site infection, postoperative nausea and vomiting, and pulmonary

function. The authors included 22 trials (7,001 patients) published in 26 reports. High FiO_2 ranged from 80 to 100% (median, 80%); normal FiO_2 ranged from 30 to 40% (median, 30%). In nine trials (5,103 patients, most received prophylactic antibiotics), the incidence of surgical site infection (SSI) decreased from 14.1% with normal FiO_2 to 11.4% with high FiO_2. After colorectal surgery, the incidence of SSI decreased from 19.3 to 15.2%. In 11 trials (2,293 patients), the incidence of nausea decreased from 24.8% with normal FiO_2 to 19.5% with high FiO_2. In patients receiving inhalational anaesthetics without prophylactic antiemetics, high FiO_2 provided a significant protective effect against both nausea and vomiting. Nine trials (3,698 patients) reported on pulmonary outcomes. The risk of atelectasis was not increased with high FiO_2. Authors concluded that intraoperative high FiO_2 further decreases the risk of SSI in surgical patients receiving prophylactic antibiotics, has a weak beneficial effect on nausea, and does not increase the risk of postoperative atelectasis.

Cohen et al[11] (2019) studied the effect of intra-operative FiO2 of 80% v/s 30% undergoing colon resection on postoperative ratio of arterial saturation to fraction of inspired oxygen (SpO_2/FiO_2). The investigator also evaluated the effect of 80% inspired oxygen on postoperative pulmonary complications. No difference was found in the lowest SpO_2/ FiO_2 ratio between the two groups. The incidence of postoperative pulmonary complications was 16.3% and 17.6% in the 30% and 80% FiO_2 groups, respectively. From the results authors concluded that intra-operative hyperoxia did not change the postoperative SpO_2/FiO_2 ratio or the risk for pulmonary complications. Clinicians should not refrain from using hyperoxia for fear of provoking respiratory complications.

Grandville et al [12] (2019) conducted a double-blind randomized controlled trial to compare lung volume, ventilation heterogeneity, and respiratory mechanics in anaesthetized children randomized to receive low or high FiO_2 intraoperatively. Results showed that FRC decreased in the FiO2>0.8 group after discharge from recovery, but normalized 24 h later. Ventilation inhomogeneity increased in both groups after discharge from recovery, but persisted in the FiO2>0.8 group II (0.8) 4 hour after surgery. They concluded that FiO_2>0.8 decreases lung volume in the immediate postoperative period, accompanied by persistent ventilation inhomogeneity

Song et al [13] (2019) conducted a randomized controlled, trial to evaluate the effect of different FiO_2 on development of intraoperative atelectasis in mechanically ventilated children using lung ultrasound. The low FiO_2 group consistently received 30% air-oxygen

mixture during preoxygenation, ultrasound-guided recruitment manoeuver, and mechanical ventilation. The high FiO_2 group received 100% oxygen during preoxygenation and ultrasound-guided recruitment manoeuvre and 60% air-oxygen mixture during mechanical ventilation. Results showed that incidence of atelectasis on the postoperative lung ultrasound was similar between the low and high FiO_2 groups. Significant atelectasis incidence on the preoperative lung ultrasound was also similar between the groups. Authors concluded that FiO_2 did not affect significant atelectasis formation in mechanically ventilated children who received ultrasound-guided recruitment manoeuver and positive end-expiratory pressure.

Eskandr et al [14] did a randomised control trial on patients with BMI >30kg/m2 scheduled for laparoscopic cholecystectomy. One Group of patients were supplemented with 40% FiO_2 while another Group of patients were supplemented with 90% FiO_2. The effect of inspired O_2 on atelectasis was approved by CT scans and chest radiographs. Atelectasis was detected by computed tomography scans of the chest performed in the first postoperative day in 60% of patients receiving 40% FiO_2, whereas it was detected in 76.7% of patients receiving 80% FiO_2 without significant difference between the groups. Postoperative forced vital capacity and forced expiratory volume in 1 sec were significantly reduced in the two groups compared with the preoperative values in both groups without significant difference between the two groups. The intraoperative partial pressure of arterial oxygen values showed an insignificant change in the postoperative measurements between the groups. The authors concluded that administration of low percentage of oxygen concentration (40%) was associated with decreased incidence of atelectasis without worsening of pulmonary function.

Hedenstierna et al[15] (2020) conducted a study to assess the effect of age & BMI on the effect of atelectasis during general anaesthesia. This primary analysis included pooled data from previously published studies of 243 subjects aged 18-78 year, with BMI of 18-52 kg/m^2. The subjects had no clinical signs of cardiopulmonary disease, and they underwent computed tomography (CT) awake and during anaesthesia before surgery after preoxygenation with an inspired oxygen fraction (FIO2) of >0.8, followed by mechanical ventilation with FIO2 of 0.3 or higher with no PEEP. Atelectasis area of up to 39 cm2 in a transverse scan near the diaphragm was seen in 90% of the subjects during anaesthesia. The log of atelectasis area was related to a quadratic function of (age $\pm age^2$) with the most atelectasis at ~50 yr (r^2=0.08; P<0.001). Log atelectasis area was also related to a broken-

line function of the BMI with the knee at 30 kg/m^2(r^2=0.06; P<0.001). A multiple regression analysis, including a quadratic function of age, a broken-line function of the BMI, and dichotomised FIO2 (0.3-0.5/1.0) adjusting for ventilatory frequency, strengthened the association (r^2=0.23; P<0.001). Atelectasis during general anaesthesia increased with age up to 50 yr and decreased beyond that. Atelectasis increased with BMI in normal and overweight patients, but showed no further increase in obese subjects (BMI >30kg/m^2). Therefore, greater age and obesity appear to limit atelectasis formation during general anaesthesia

W.Yang et al[16] conducted a meta-analysis which included 17 randomized controlled trials with 8093 patients. Infection rates were 13.11% in the control group and 11.53% in the hyperoxic group, while the overall risk ratio was 0.893. However, high FiO_2 was found to be of significant benefit in patients undergoing colorectal surgery, with a risk ratio of 0.735. There is moderate evidence to suggest that administration of high FiO_2 to patients undergoing surgery, especially colorectal surgery, reduces the risk of SSI.

Lim et al [17] conducted a meta- analysis of 26 trials enrolling 4991 patients to determine whether high perioperative inspired oxygen fraction (FiO_2) compared with low FiO_2 has more deleterious postoperative clinical outcomes in patients undergoing non-thoracic surgery under general anaesthesia. The mortality in the high FiO_2 group did not differ from that in the low FiO_2 group with, P-value: 0.81. Nor were there any significant differences between the groups in such outcomes as pneumonia (P = 0.470), respiratory failure (P = 0.270), PPCs P = 0.830), ICU admission (P = 0.810), and length of hospital stay (P= 0.340). The high FiO_2 was associated with postoperative atelectasis more often (risk ratio 1.27, 95% CI 1.00–1.62, P = 0.050), and lower postoperative arterial partial oxygen pressure.

Kim et al[18] did a randomized control trial enrolling 54 paediatric patients undergoing elective lower abdominal surgery. The patients were randomized into 3 different oxygenation Group:100%, 80% & 60%. Lung ultrasound was done to assess atelectasis after induction and at the end of surgery. After anaesthetic induction, the number of atelectatic lung regions was significantly different among the three groups (median [IQR], 2.0 [1.0-2.5], 2.0 [1.0-2.8], and 3.0 [2.0-3.0] in the 60%, 80%, and 100% oxygen groups, p = .033) and between the 60% and 100% groups (p = .015), but not between 80% and 100% groups (p = .074). However, no differences in the number of atelectatic lung regions were found among the three groups at the end of surgery (2.0 [1.3-3.8], 3.0 [1.8-3.0], and 4.0

[2.0-4.0] in the 60%, 80%, and 100% oxygen groups; p =0.169). Lower oxygen concentration during anesthetic induction is associated with less atelectasis formation immediately after anesthetic induction in children. In addition, applying 80% oxygen instead of 100% oxygen is not enough to prevent atelectasis formation, and 60% oxygen should be applied to prevent atelectasis. However, this effect does not last until the end of surgery.

Bormann et al[19] did an observational trial and collected data of patients posted for non-cardiothoracic surgery from 1995-2009 .He observed that pure oxygen ventilation led to a decreased incidence of postoperative hypoxic events (4.3 to 3.0%; $p < 0.0001$) and hospital mortality (2.1 to 1.6%; $p = 0.088$) as well as SSI (8.0 to 5.0%; $p < 0.0001$) and PONV (21.6 to 17.5%; $p < 0.0001$). There was no effect on unplanned ICU-admission (1.1 to 0.9; $p = 0.18$). Pure oxygen ventilation during general anaesthesia is harmless, as long as certain standards are adhered to. It makes anaesthesia simpler and safer and may reduce clinical morbidity, such as postoperative hypoxia and surgical site infection.

Fernandez et al[20] performed prospective observational study to determine clinical and radiological PPCs and respiratory insufficiency therapies in a high-risk surgical patients . This study included 1202 patients who underwent predominantly abdominal, orthopaedic, and neurological procedures under general anaesthesia for duration of 2 or more hours. Postoperative pulmonary complications(PPC) occurring within the first 7 postoperative days were prospectively identified. Patients with 1 or more PPCs, even mild, had significantly increased early postoperative mortality, intensive care unit (ICU) admission, and ICU/hospital length of stay. Significant PPC risk factors included non-modifiable factors like nature of surgery and surgical site, age. Modifiable factors like intraoperative fluid administration, preoperative oxygenation, preoperative haematocrit, anaesthesia duration [in minutes] and tidal volume [in millilitres per kilogram of predicted body weight]. Postoperative pulmonary complications are common in patients with American Society of Anaesthesiologists physical status 3, despite current protective ventilation practices. Even mild PPCs are associated with increased early postoperative mortality, ICU admission, and length of stay (ICU and hospital). Mild frequent postoperative pulmonary complications (eg, atelectasis and prolonged oxygen therapy need) deserve increased attention and intervention for improving perioperative outcomes.

Patel et al[21] did study to assess whether there is a correlation between perioperative atelectasis and duration of anesthesia, pneumoperitoneum, and length of surgery in patients

undergoing laparoscopic cholecystectomy. Seventy-two American Society of Anesthesiologists (ASA) grade I-III patients of either gender undergoing elective laparoscopic cholecystectomy who met the inclusion criteria were enrolled in this observational study. The lung ultrasound (LUS) score was used to determine the amount of aeration loss. He found that even with short-term surgeries such as laparoscopic cholecystectomy, atelectasis can occur. The duration of pneumoperitoneum and ASA status can contribute to atelectasis.

MATERIAL AND METHODS

The present study was carried out in the department of Anaesthesiology and Critical Care at AIIMS, Jodhpur after getting approval from institutional ethics committee [Institutional Ethics Committee, All India Institute of Medical Sciences, Jodhpur 342005 (Raj.); Certificate Reference Number: AIIMS/IEC/2021/3460 dated 01/01/2020; approved by *Dr Parveen Sharma*] and informed written consent from patients. We registered the study prospectively at the clinical trial registry of India (CTRI: www.ctri.nic.in) (Ref. No. CTRI/2021/09/036699, Date of Registration: 15/09/2021, Patient Enrolment date: 16/09/2021).

Patients aged more than 60 years and scheduled for elective major surgery of duration more than 2 hours under general anaesthesia were enrolled after exercising the following exclusion criteria: -

1. Patient undergoing cardio-thoracic surgery, thoracotomies
2. Patients with active upper or lower airway infection
3. Patients with abnormal preoperative chest X-ray findings
4. Patients who require/likely to require postoperative mechanical ventilation
5. Morbidly obese patients (BMI-35Kg/m2)

All patients were kept on fasting as per standard ASA protocol. After arrival of the patient in the operating room, standard monitoring - pulse oximetry, non-invasive arterial blood pressure, electrocardiography and capnography (Drager-Primus Anaesthesia Device Monitor, Drager Medical Systems, Inc., Denver, MA, USA) were started and baseline vital parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP), and arterial O_2 saturation (SpO_2) were recorded in all patients. A radial artery catheterisation were performed under local anaesthesia for ABG sampling after performing Allen's test. All patients received premedication with intravenous (IV) midazolam (0.04–0.06 mg/kg) and IV fentanyl (2µg/kg). Following pre-oxygenation with 100% FiO2, anaesthesia was induced with IV propofol 2 mg/kg and for muscle relaxation either IV rocuronium 0.9 mg/kg or atracurium 0.5 mg/kg was used and airway was secured with appropriate size supraglottic devices or endotracheal tubes.

Following this, patients were randomly divided into two separate groups of 25 each using random number tables created by a computer. Use of sealed, opaque envelops allowed for the concealment of allocations. Group I (0.3) received inspired 30% oxygen while Group II

(0.8) received inspired 80% oxygen mixed with air. The concentration of the inspired oxygen was unknown to the patients and the assessors.

The lungs were ventilated with a tidal volume of 6-8 ml/kg using volume-controlled ventilation with positive end-expiratory pressure (PEEP) of 5. Maintenance of anaesthesia was achieved with inhalational agent in oxygen and air mixture (MAC - 1.0). The respiratory rate was adjusted to maintain an end-tidal carbon dioxide partial pressure 30–35 mmHg with an inspiratory/expiratory ratio of 1:2.

Adequate analgesia was assured using IV route or regional anaesthesia. At the end of surgery, both the groups received injection ondansetron 0.1mg/kg and injection paracetamol 15mg/kg approximately 15 mins before extubation. On completion of surgery, anaesthetic agents were discontinued and residual neuromuscular blockade was antagonized with neostigmine and glycopyrrolate in the doses of 0.05 mg/kg and 0.01 mg/kg respectively in combination. After being awake and responsive, patients were extubated (TOF ratio 0.9) and shifted to post anaesthesia care unit (PACU). In PACU oxygen was administered, if required, via venturi mask to achieve SpO2 > 94%.

In all randomized patient's surgical procedure, position and duration of surgery, requirement of oxygen concentration postoperatively and for what duration was noted according to attached proforma. Postoperatively CT thorax was done to assess the incidence and severity of postoperative atelectasis within 24 h after surgery. All CT scans were performed with the patient in the supine position, with a frontal scout view covering the chest obtained at end expiration. Scans in the transverse plane were done at end expiration, 1 cm above the top of the right diaphragm dome (lung base). To determine the degree of atelectasis, the dorsal border between the thoracic wall and the dense area was drawn manually, and the ventral border between the inflated lung tissue and atelectasis was identified by a region-of-interest programme with exclusion of any visible vessels. All pixels with attenuation values between -100 and +100 Hounsfield units were considered to represent atelectatic lung tissue.[15] Lung densities between −500 to −100 were considered as poorly aerated areas and densities between −500 to −1000 as normally aerated areas.[16, 17] The calculated area was presented as the percentage of the total lung area in the basal slice.

PaO2 was noted in all patients with the help of arterial blood gas (ABG) analysis before preoxygenation, and postoperatively at 1-hour, 6-hours and 12-hours. Subsequently, PaO2/FIO2 ratios was calculated and analysed as an indicator of pulmonary gas exchange. The incidence of postoperative nausea and vomiting was compared till 24 hours

postoperatively and surgical site infection compared at postoperative day 5 in all patients. Preoperative Antibiotic was given to all the patients as per institute protocol. The requirement of postoperative respiratory support (oxygen supplementation/ mechanical ventilation) and incidence of postoperative pneumonia at day 3 was compared in the two groups. Postoperative pneumonia was evaluated on the basis of clinical signs- fever, tachypnoea along with deranged leucocyte count and appearance of new consolidation on chest X-ray.

SAMPLE SIZE:

Based on previous data, the presence of an atelectatic area (expressed as percentage of total lung area) of less than 2% in the CT scan considered negligible (negative), because it did not cause a clinically relevant alveolar shunt. [15,22-23] We assumed that intraoperative FiO_2 of 0.8 would not produce clinically significant shunt (mean atelectasis area <2% of lung area). With a standard deviation of approximately 1.2 percentage points, we calculated that a sample size of 24 patients in each group would achieve 80% power (ß=0.2) in detecting a difference of 50% in atelectasis with 5% significance (α=0.05)) between the groups.

Statistical analysis

The data collected was compiled and analysed using SPSS 23. Categorical variables were expressed as the number and percentage, whereas continuous variables were summarized as the mean and standard deviation (normally distributed data) or the median and interquartile range (skewed or non-normally distributed data). The normality of distribution for continuous variables was confirmed with the Kolmogorov-Smirnov test. The chi-squares test was used to compare categorical variables between the groups. To compare normally distributed and non-normally distributed continuous variables between two groups, we used Student's t-test and the Mann-Whitney U-test, respectively. The values were considered statistically significant when P value was < 0.05.

RESULTS

Total sixty-four patients were assessed for eligibility out of them fourteen were excluded (5 not meeting inclusion criteria and 9 refused to participate) and remaining fifty patients were randomised into two groups based on computer generated randomization sequence. Twenty-five patients were randomized in Group I (0.3) and the remaining twenty-five patients in Group II (0.8). In group II (0.8), 3 patients were lost to follow up and finally data from 47 patients were analyzed (Figure 4).

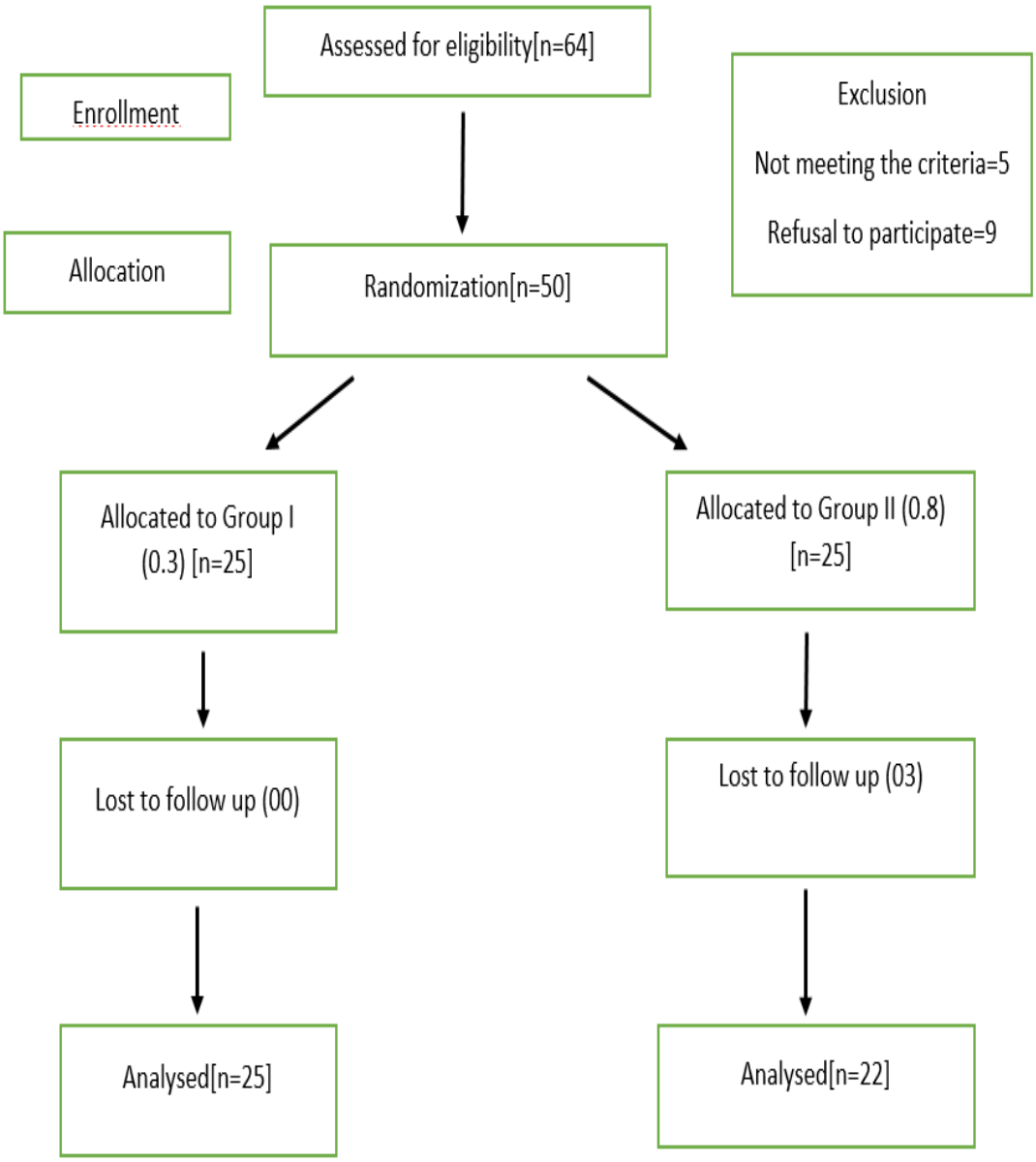

Figure 1: Consort Flow Diagram

DEMOGRAPHICS

AGE

TABLE 1: Comparison of mean age between the study groups.

Age (yrs)	Group I (%)	Group II(0.8) N (%)	Mean Difference (95% CI)	p-value
Mean± SD	67.20 ± 6.31	67.18 ±6.30	0.018 (-3.69 to 3.73)	0.992

The above table shows the comparison of mean± SD age between group I(0.3) and group II(0.8). The mean± SD age (years) in group I(0.3) and group II(0.8) was 67.20 ± 6.31 and 67.18 ±6.30 respectively. The unpaired Student's t-test was used to compare the age between the study groups which showed a mean difference (95% CI) of 0.018 (-3.69 to 3.73) between groups with corresponding p-value of 0.99 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the age.

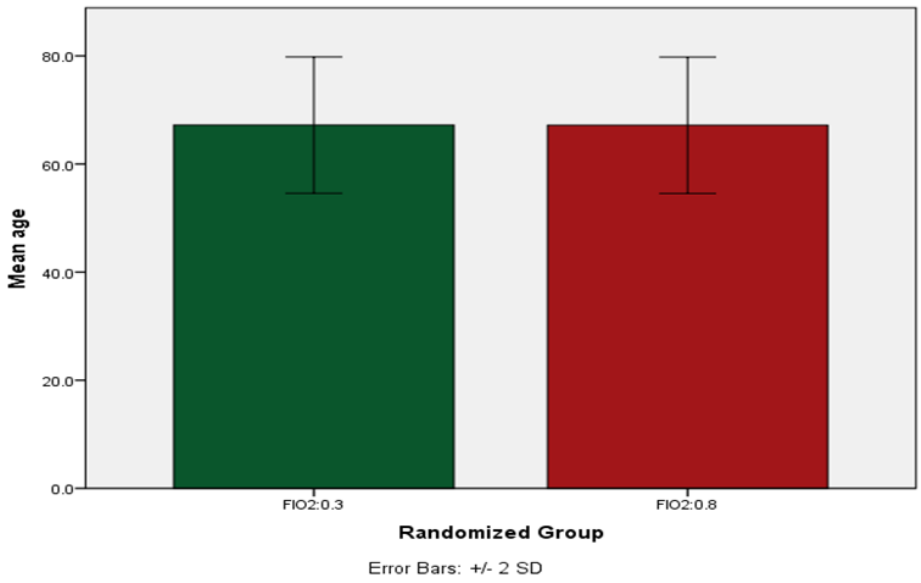

Figure 2: Comparison of mean age between the randomized group

GENDER

TABLE 2: Comparison of gender distribution between the study groups.

Gender	Group I(0.3) N (%)	Group II(0.8) N (%)	χ^2; p-value
Male	10 (40%)	11(50%)	0.473;0.56,
Female	15(60%)	11(50%)	
Total	25	22	

The above table shows the distribution of patients according to gender between the study groups. Total 21 patients belonged to male gender, out of them 10 patients were randomly allocated in group I(0.3) and 11 patients in group II(0.8). Remaining 26 patients belonged to female gender, out of which, 15 patients were randomly enrolled in group I(0.3) and 11 patients in group II(0.8). The chi-square test was applied to compare gender between the study groups which showed a $\chi 2$ value of 0.473. The corresponding p-value was 0.56 which was considered statistically insignificant i.e. both the study groups were comparable with respect to the gender of the patient.

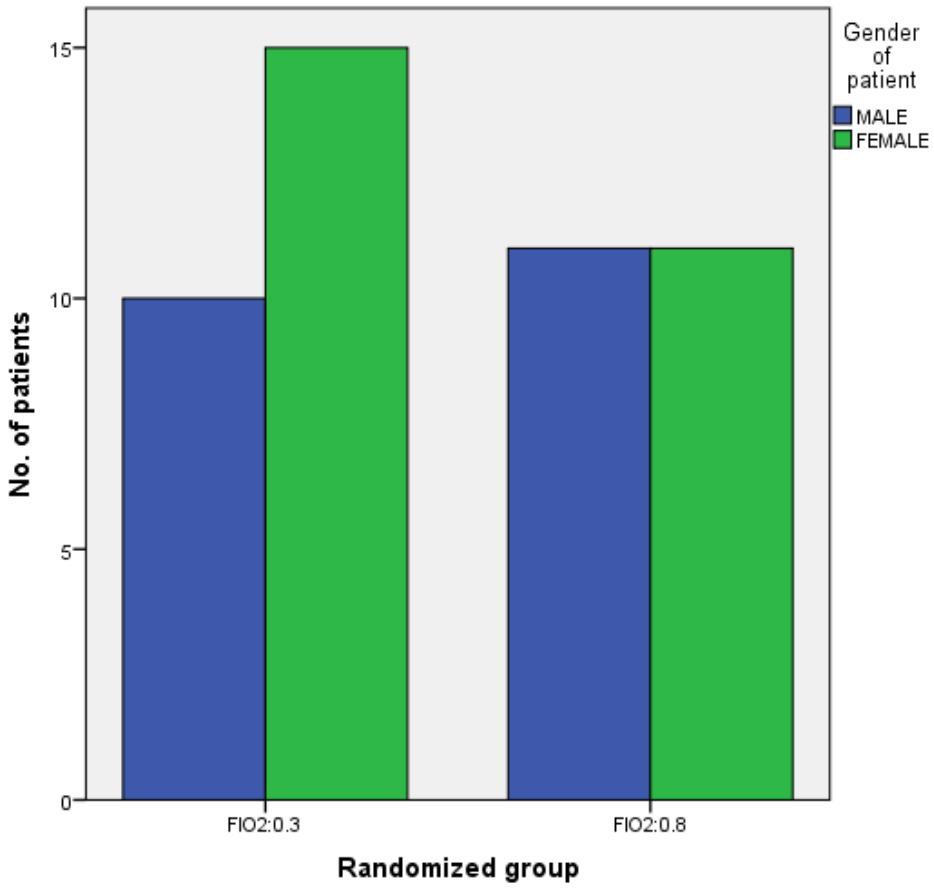

Figure 3: Distribution of gender between randomized group.

WEIGHT OF PATIENT

Table 3: Comparison of mean weight in the randomized group

Weight (Kg)	Group I(0.3)	Group II(0.8)	Mean difference C.I.(95%)	p-value
Mean±SD	62.90 ±10.28	63.20 ±12.44	-0.301 (-6.980 to 6.3779)	0.928

The above table shows comparison of mean± SD weight (kg) between group I(0.3) and group II(0.8). The mean± SD weight(kg) in group I(0.3) and group II(0.8) was 62.90 ±10.28 and 63.20 ± 12.44 respectively. The unpaired Student's t-test was used to compare the weight between the study groups which showed a mean difference (95% CI) of -0.301(-7.08 to 6.47) between groups with corresponding p value of 0.92 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the weight.

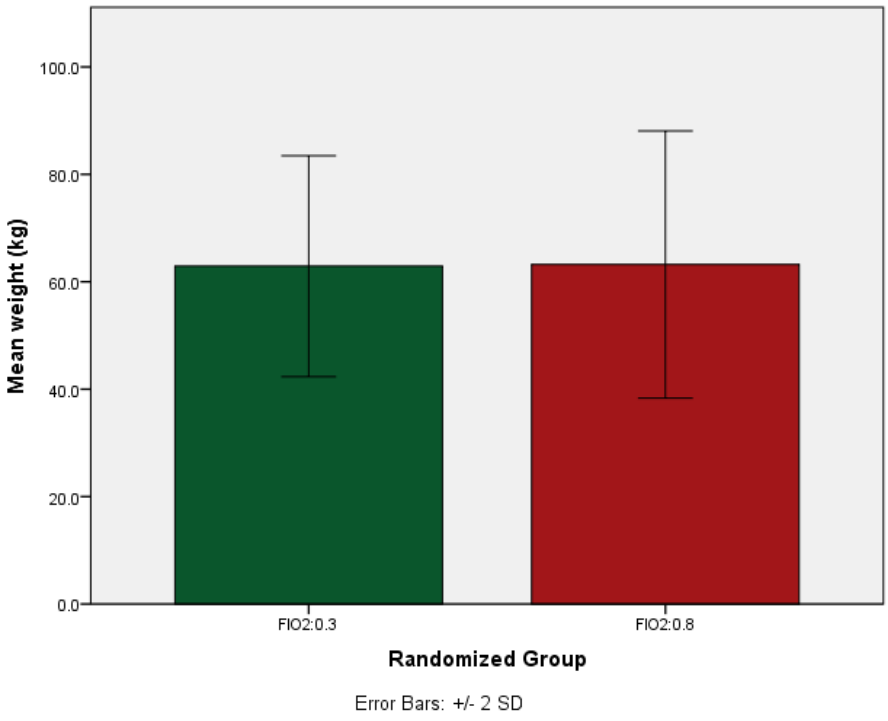

Figure 4: Comparison of mean weight between the randomized group

HEIGHT OF PATIENT

TABLE 4: Comparison of mean height between randomized group

Height (cm)	Group I(0.3)	Group II (0.8)	Mean difference C.I.(95%)	p-value
Mean± SD	166.32 ±6.48	169.50 ±6.80	-3.18(-7.090 to 0.730)	0.108

The above table shows comparison of mean± SD height(cm) between group I(0.3) and group II(0.8). The mean± SD height in group I(0.3) and group II(0.8) was 166.32 ±6.48 and 169.50 ±6.80 respectively. The unpaired Student's t-test was used to compare the height between the study groups which showed a mean difference (95% CI) of -3.18(-7.090 to 0.730) between the groups with corresponding p value of 0.108 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the height.

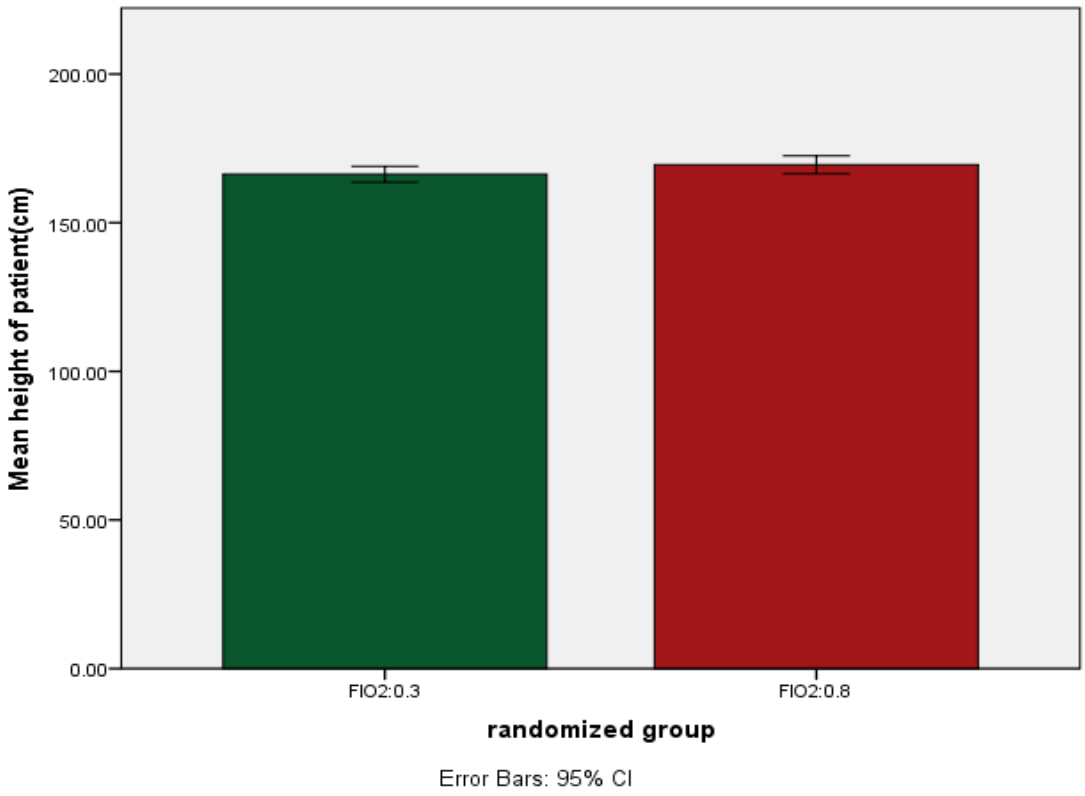

Figure 5: Comparison of mean height between the randomized group.

BMI OF PATIENT

Table 5: Comparison of mean BMI between the randomized group.

BMI(kg/m^2)	Group I(0.3)	Group II(0.8)	Mean difference C.I.(95%)	p-value
Mean±SD	22.63 ±2.80	21.61 ±4.42	1.02(-1.12 to 3.17)	0.34

The above table shows comparison of mean± SD BMI(kg/m^2) between group I(0.3) and group II(0.8). The mean± SD BMI in group I(0.3) and group II(0.8) was 22.63 ±2.80 and 21.61 ±4.42 respectively. The unpaired Student's t-test was used to compare the BMI between the study groups which showed a mean difference (95% CI) of 1.02(-1.12 to 3.17) between groups with corresponding p value of 0.34 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the BMI

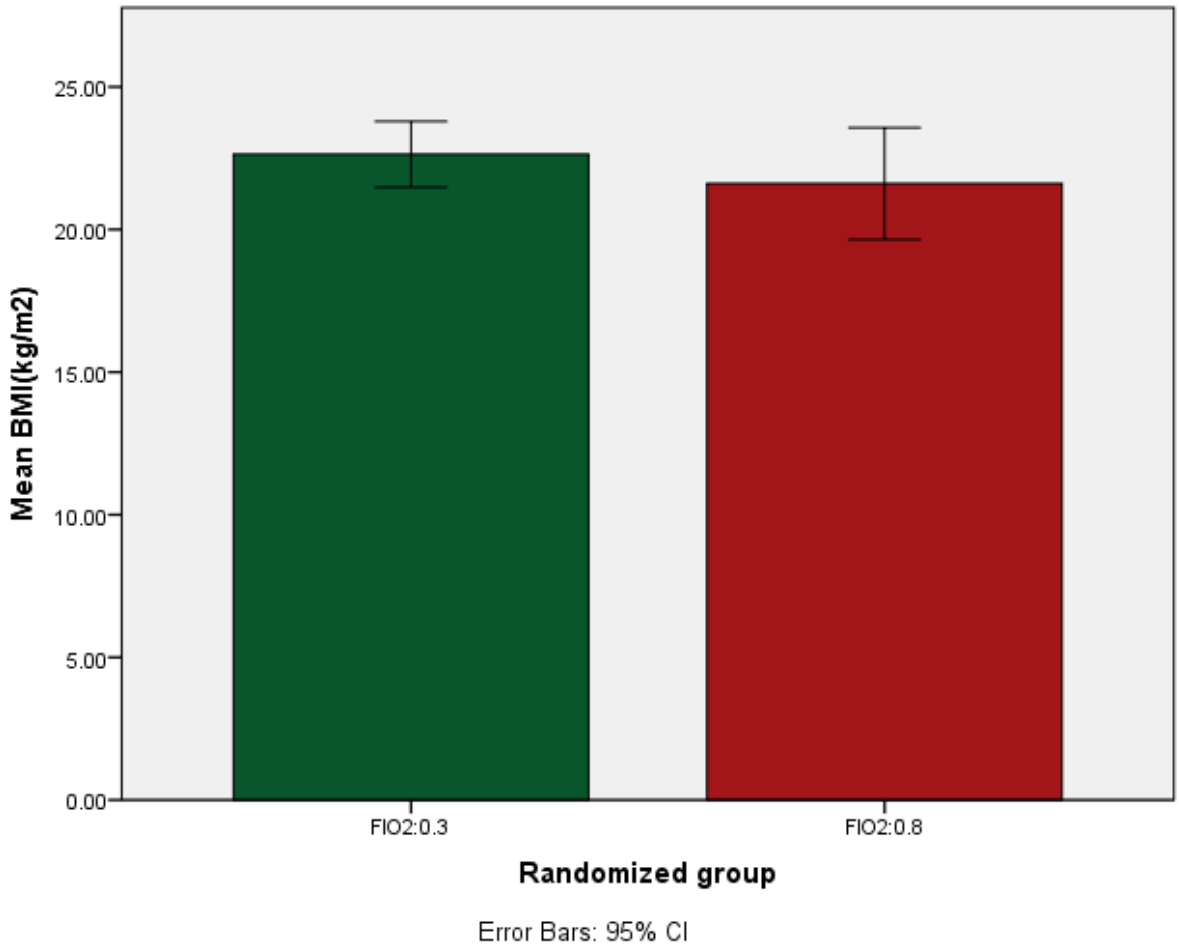

Figure 6: Comparison of mean BMI between the randomized group

PHYSICAL STATUS OF PATIENT

TABLE 6: Distribution of patients in different ASA groups and comparison of ASA grades between the study groups.

ASA	Group I(0.3) (%)	Group II(0.8) (%)	χ^2; p-value
I	9 (36%)	8 (36.3%)	0.0;1.0
II	16(64%)	14 (63.6%)	

The above table shows the distribution of patients according to ASA physical status class between the study groups. All patients enrolled were belonging to either ASA physical status I or II. Total 17 patients belonged to ASA status I, out of which, 9 patients were randomly enrolled in group I(0.3) and 8 patients in group II(0.8). 30 patients belonged to ASA status II, out of them, 16 patients were randomly enrolled in group I(0.3) and 14 patients in group II(0.8). The chi-square statistic was applied to compare ASA status between the study groups which showed a $\chi 2$ value of 0.0. The corresponding p-value was 1.00 considered to be non- significant i.e. both the study groups were comparable with respect to the ASA Status of the patients.

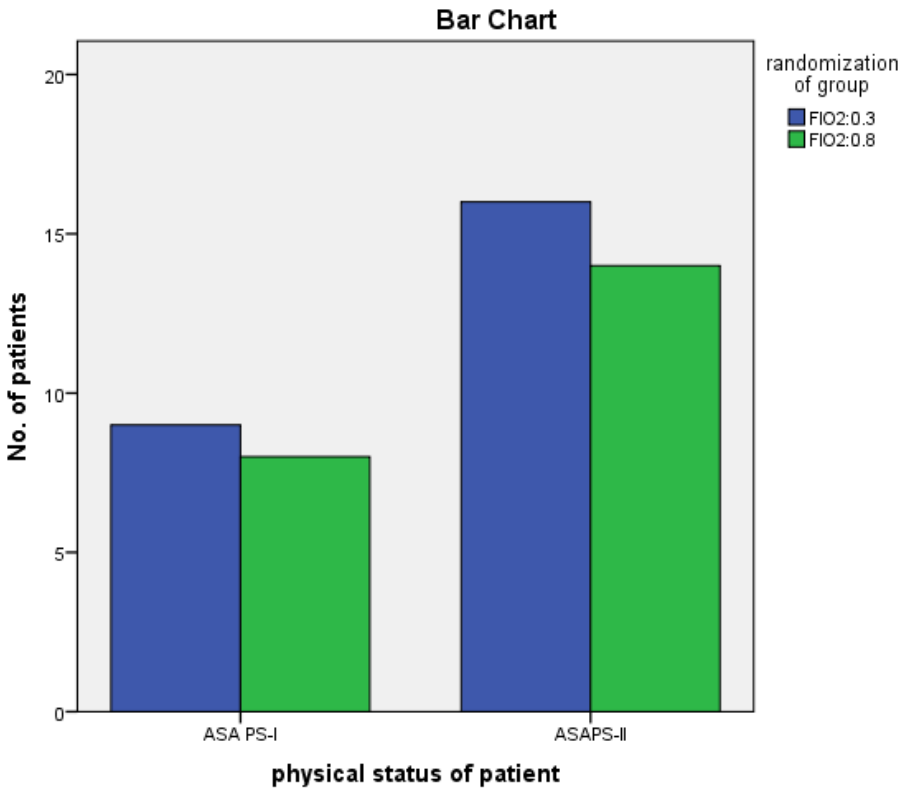

Figure 7: Distribution of patients as per ASA status in randomized group.

DURATION OF SURGERY

Table 7: Comparison of mean duration of surgery between the randomized group.

Duration of surgery (min)	Group I(0.3)	Group II(0.8)	Mean difference (C.I. 95%)	p-value
Mean ±SD	211.80 ±56.51	238.63 ±102.04	-26.83 (-74.53 to 20.85)	0.263

The above table shows the comparison of mean duration of surgery between the study groups. The mean duration of surgery (min) in Group I (0.3) and Group II (0.8) was and 211.80 ±56.51 and 238.63 ±102.045 respectively. The unpaired Student's t-test was used to compare the surgery duration between the study groups which showed a mean difference (95% CI) of 26.83 (-74.53 to 20.85) between groups with corresponding p-value of 0.263 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the duration of surgery.

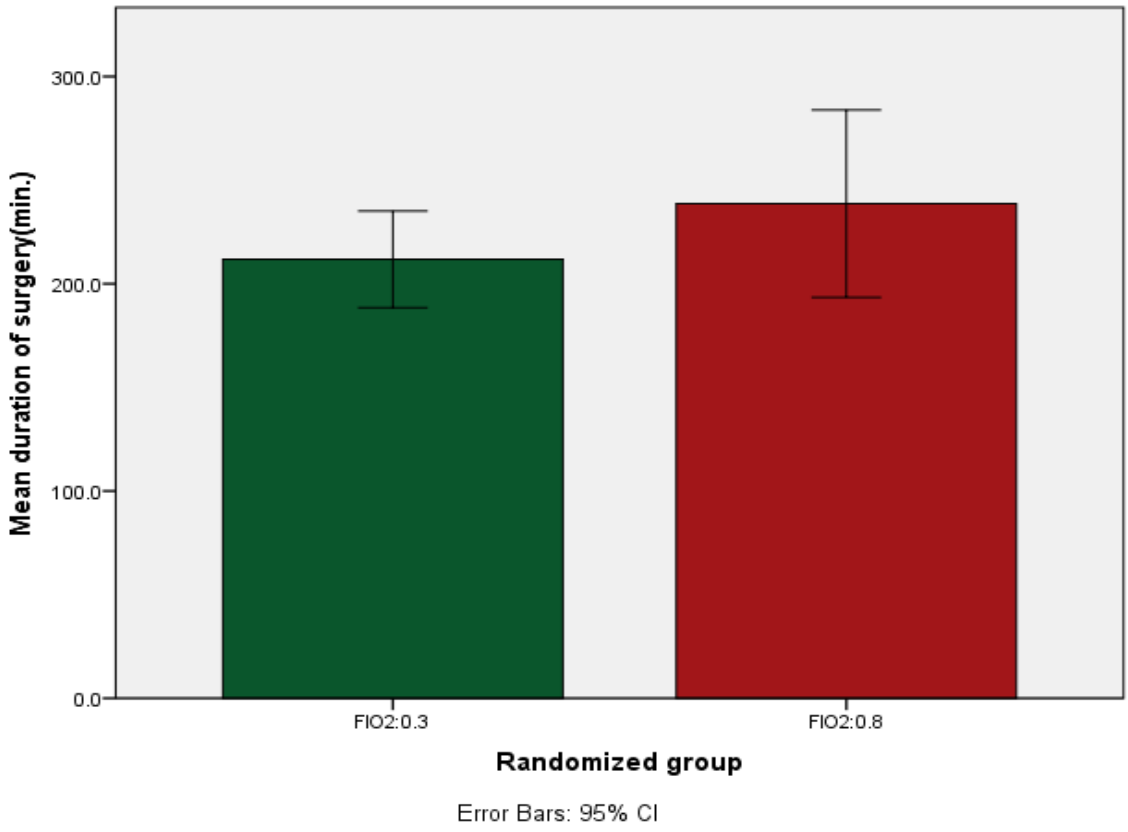

Figure 8: Comparison of mean duration of surgery between the randomized group.

POSITION DURING SURGERY

Table 8: Comparison of positions during surgery

Position during surgery	Group I(0.3)	Group II(0.8)	χ2,p-value
Supine	15	10	8.1; 0.87
Lateral	4	4	
Lithotomy	4	1	
Trendelenburg	1	7	
Prone	1	0	

The above table shows the distribution of patients according to intraoperative positioning during surgery between the study groups.Total 25 patients were placed in supine position out of which 15 were in GroupI(0.3) and 10 were in GroupII(0.8). 8 patients were positioned laterally which were equally distributed between both the groups.8 patients were positioned in lithotomy position out of which 4 were in GroupI(0.3) & 1 of the patient belonged to GroupII(0.8).Total 8 patients were positioned in Trendelenburg position,out of which only 1 belonged to GroupI(0.3) and remaining 7 patients belong to GroupII(0.8). The chi-square statistic was applied to compare position of surgery between the study groups which showed a χ2 value of 8.1. The corresponding p-value was 0.87 which was considered to be non- significant i.e. both the study groups were comparable with respect to the to position of surgery.

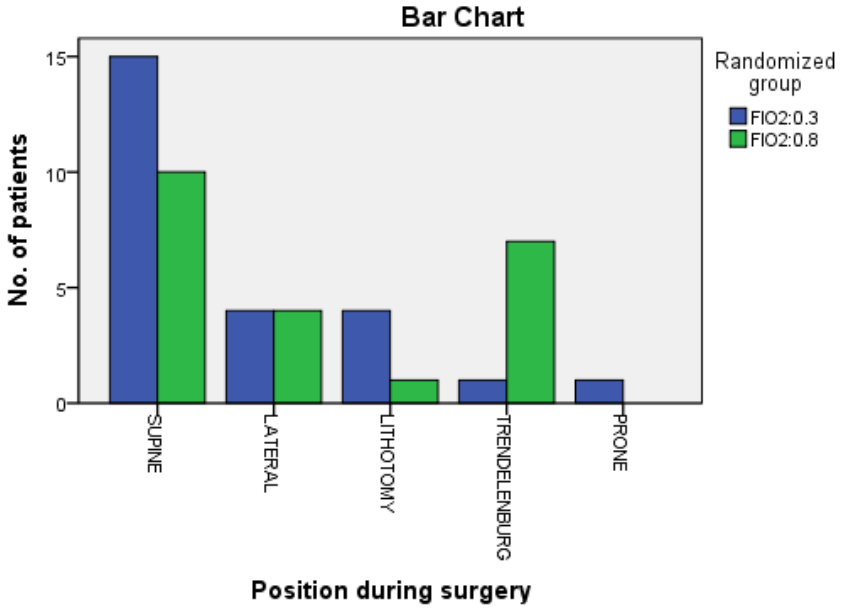

Figure 9: Comparison of positions during surgery between randomized group

APPROACH OF SURGERY

Table 9: Comparison of approach of surgery between the randomized group.

Approach To Surgery	Group I(0.3) N (%)	GroupII(0.8) N (%)	χ2,p-value
Open	19 (76%)	14(63.6%)	0.85;0.52
Laproscopic	6(24%)	8(36.3)	
Total	25	22	

The above table shows the distribution of patients according to approach of surgery between the study groups.Total 33 patients belonged to open surgery, out of which, 19 patients were in group I(0.3) and 14 patients in group II(0.8). 14 patients belonged to class laproscopic , out of them, 6 patients were in group I(0.3) and 8 patients in group II(0.8). The chi-square test was applied to compare the approach of surgery between the study groups which showed a χ2 value of 0.85. The corresponding p-value was 0.52 which was considered to be non-significant i.e. both the study groups were comparable with respect to the approach of surgery.

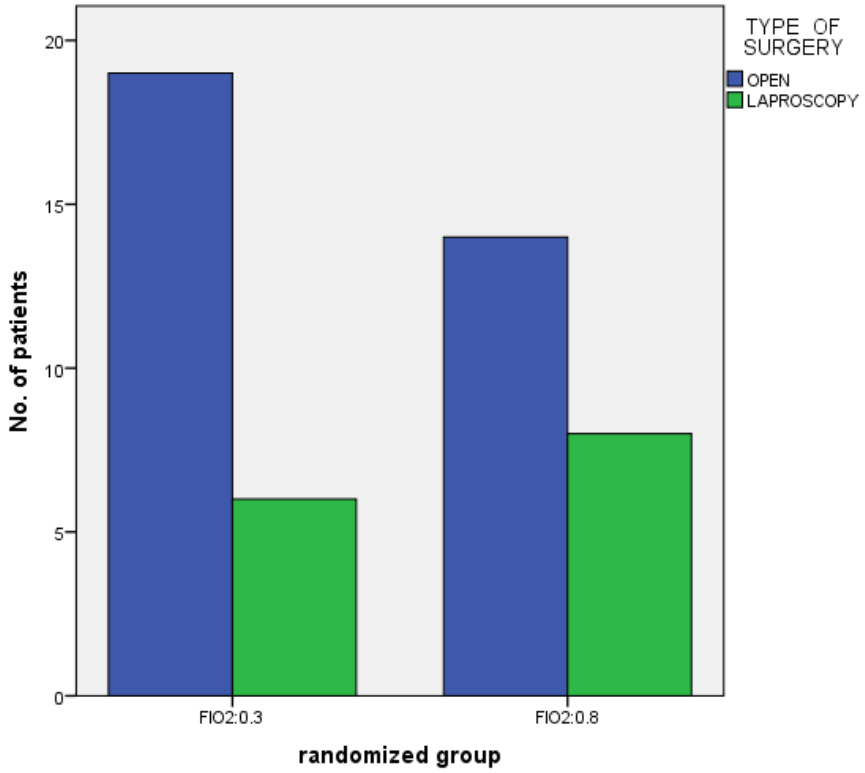

Figure 10: Distribution & comparison of approach of surgery between the randomized group.

DURATION OF ANAESTHESIA

Table 10: Comparison of mean duration of anaesthesia between the randomized groups.

Duration Of anaesthesia(min.)	Group I(0.3)	Group II(0.8)	Mean difference C.I.	p-value
Mean ±SD	245.20 ±52.17	281.59 ±103.99	-36.390 (-83.854 to 11.073)	0.13

The above table shows the comparison of mean duration of anaesthesia between the study groups. The mean duration of anaesthesia (minutes) in group I(0.3) and group II(0.8) was 245.20 ±52.17 and 281.59 ±103.99 respectively. The unpaired Student's t-test was used to compare the age between the study groups which showed a mean difference (95% CI) of -36.390 (-83.854 to 11.073) between groups with corresponding p-value of 0.13 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the duration of anaesthesia.

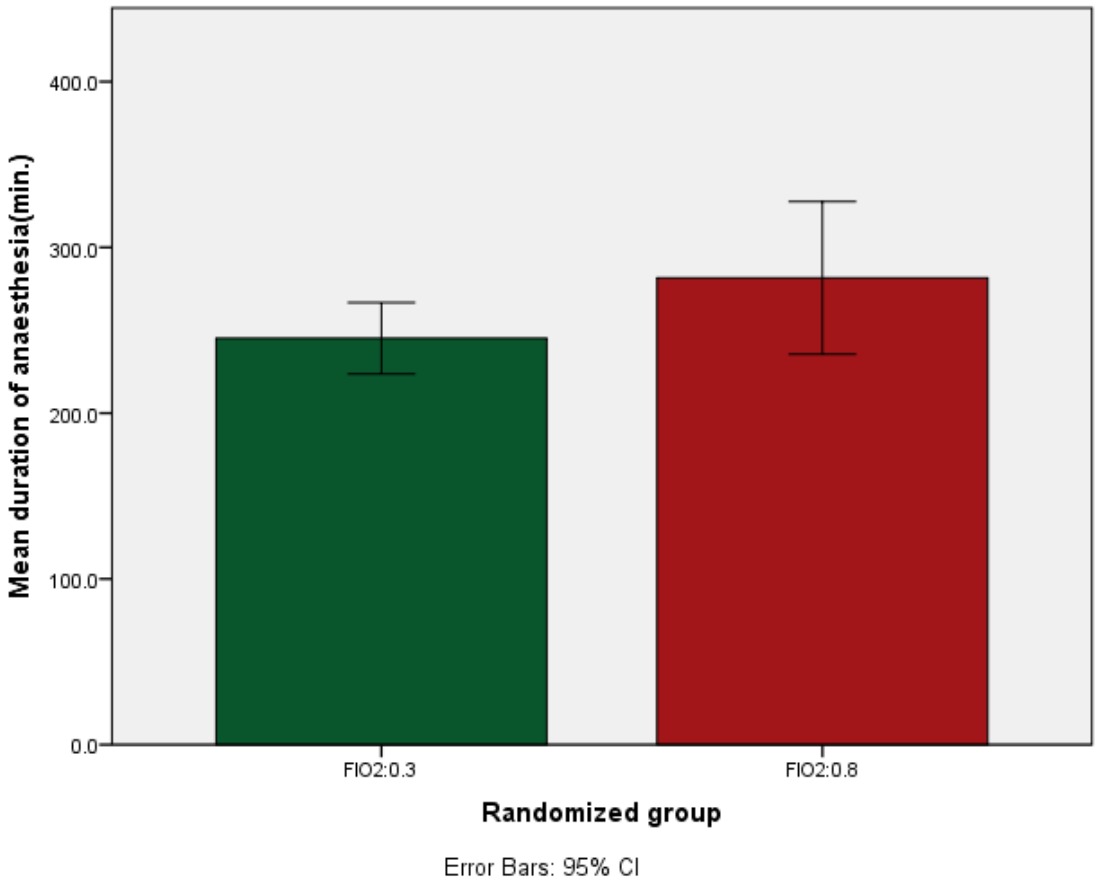

Figure 11: Comparison of mean duration of anaesthesia between the randomized groups.

Partial pressure of arterial oxygen (PaO_2)

Table 11: Comparison of mean PaO_2 at different time intervals between the enrolled groups.

PaO_2 (mmHg)	Group I(0.3)	Group II(0.8) (0.8)	Mean difference C.I(95%)	p-value
Preoperative	85.50 ±6.60	86.28 ±4.77	-0.77 (-4.20 to 2.64)	0.850
Postoperative 1 hr	88.73 ±4.89	94.59 ±5.76	-5.85 (-0.8.99 to -2.72)	**0.001**
Postoperative 6 hr	84.44 ±3.16	84.16 ±3.84	0.271(-1.789 to 2.33)	0.792
Postoperative 12 hr	84.35 ±4.67	84.17 ±2.95	0.180(-2.170 to 2.53)	0.878

The above table shows the comparison of mean PaO_2 of patients at baseline and postoperatively at 1hr ,6 hr and 12 hr between the study groups. The mean baseline PaO_2 in group I(0.3) and group II(0.8) was 85.50 ±6.60 and 86.28 ±4.77 respectively. The unpaired Student's t-test was used to compare the PaO2 between the study groups which showed a mean difference (95% CI) of -0.77 (-4.20 to 2.64) between groups with corresponding p-value of 0.850 which was not found to be statistically significant.

The mean post-operative PaO_2 at 1 hr in group I(0.3) & group II(0.8) was 88.73 ±4.89 and 94.59 ±5.76 respectively. The unpaired Student's t-test was used to compare mean PaO_2 which showed a mean difference (95% CI) of -5.85 (-0.8.99 to -2.72) between groups with corresponding p-value of 0.001 which was statistically significant.

The mean post-operative PaO_2 at 6 hr and 12 hr in group I(0.3) & group II(0.8) were 84.44 ±3.16; 84.35 ±4.67 and 84.16 ±3.84; 84.17 ±2.95 respectively. The unpaired Student's t-test was used to compare mean PaO_2 which showed a mean difference (95% CI) of 0.271(-1.789 to 2.33) and 0.180(-2.170 to 2.53) between groups with corresponding p-value of 0.792 and 0.878 respectively, which was not found to be statistically significant i.e., both the study groups were comparable with respect to the trend of PaO_2 postoperatively.

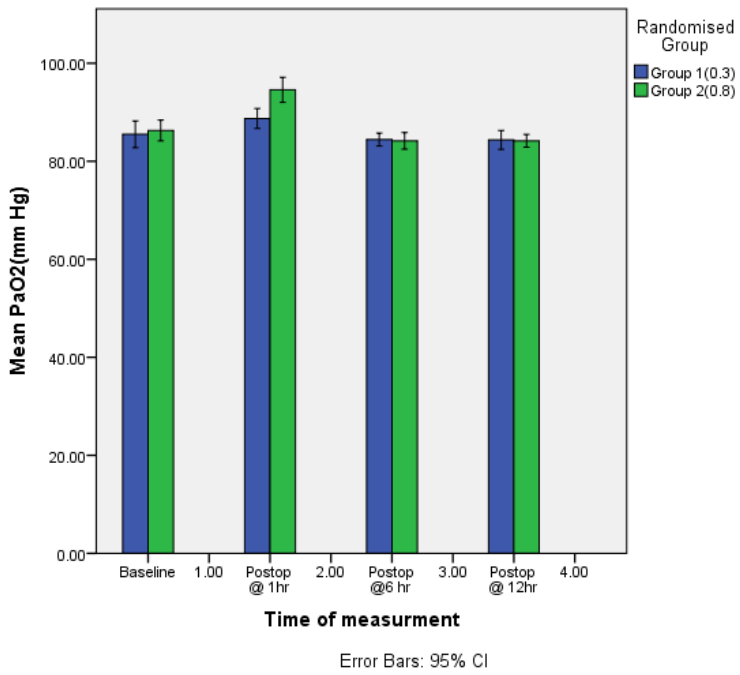

Figure 12: Comparison of mean of PaO_2 at different time intervals between the randomized groups.

P/F RATIO

Table 12: Comparison of mean P/F ratio at different time intervals between the randomized group

P/F	Group I(0.3)	Group II(0.8)	Mean difference C.I.(95%)	p-value
Preoperative	407.43 ±28.45	412.71 ±21.28	-3.83 (-18.77 to 11.09)	0.607
Postoperative 1 hr	420.51 ±22.43	448.48 ±24.82	-27.989 (-41.85 to -14.08)	**0.001**
Postoperative 6 hr	401.98 ±14.91	400.54 ±18.18	1.442 (-8.285 to 11.16)	0.767
Postoperative 12 hr	402.68 ±22.26	400.81 ±14.08	1.873 (-9.306 to 13.05)	0.737

The above table shows the comparison of mean P/F ratio of patients at baseline and postoperatively at 1hr ,6 hr and 12 hr between the study groups. The mean baseline P/F ratio in group I(0.3) and group II(0.8) was 407.43 ±28.45 and 412.71 ±21.28 respectively. The unpaired Student's t-test was used to compare the mean P/F ratio between the study groups which showed a mean difference (95% CI) of -3.83 (-18.77 to 11.09) between

groups with corresponding p-value of 0.607 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the baseline P/F ratio.

The mean post-operative P/F ratio in group I (0.3) and group II(0.8) at 1 hr was 420.51 ±22.43 & 448.48 ±24.82 respectively. The unpaired Student's t-test was used to compare the mean P/F ratio between the study groups which showed a mean difference (95% CI) of -27.989 (-41.85 to-14.08) between groups with corresponding p-value of 0.001 which was statistically significant .

The mean post -operative P/F ratio at 6 hr and 12 hr in group I(0.3) & group II(0.8) were 401.98 ±14.91; 402.68 ±22.26 and 400.54 ±18.18 ; 400.81 ±14.08 respectively.The unpaired Student's t-test was used to compare mean difference (95% CI) of 1.442 (-8.285 to 11.16) and 1.873 (-9.306 to 13.05) between groups with corresponding p-value of 0.767 and 0.737 respectively which was not found to be statistically significant i.e. both the study groups were comparable with respect to the trend of P/F ratio postoperatively.

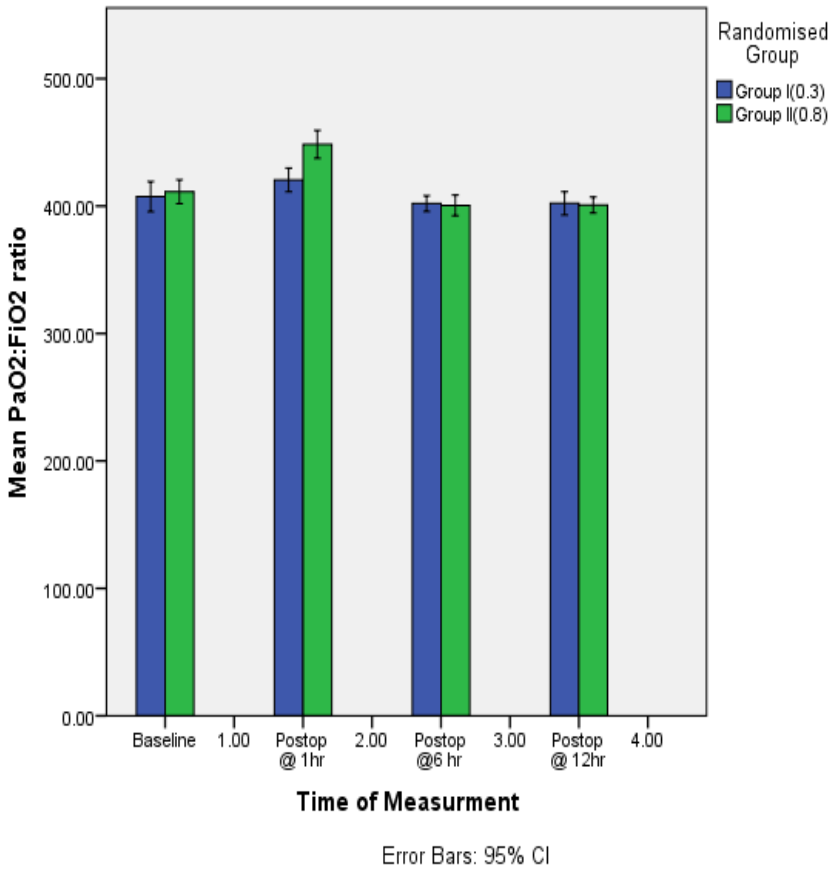

Figure 13: Comparison of mean P/F ratio at different time intervals between the randomized group

ATELECTASIS PERCENT

Table 13: Comparison of median of atelectasis area in percent of lung volume between the randomized group.

Atelectasis (percent of lung volume)	Group I(0.3)	Group II(0.8)	Mean difference C.I (95%)	p-value
Median± IQR	1.40(1.20-1.7)	1.45 (1.20-1.75)	-0.635 to 0.248	0.7

The above table shows the comparison of median of atelectasis percent of total lung volume post operatively via CT thorax between both the study groups. The median (IQR) of atelectasis percent in group I(0.3) & group II(0.8) was 1.40 (1.20-1.7) and 1.45(1.20-1.75) respectively. The Mann-Whitney U test was used to compare atelectasis percent between the study groups that showed corresponding p- value of 0.7, which was not found to be statistically significant, i.e. both the study groups were comparable with respect to the percent of atelectasis in lung.

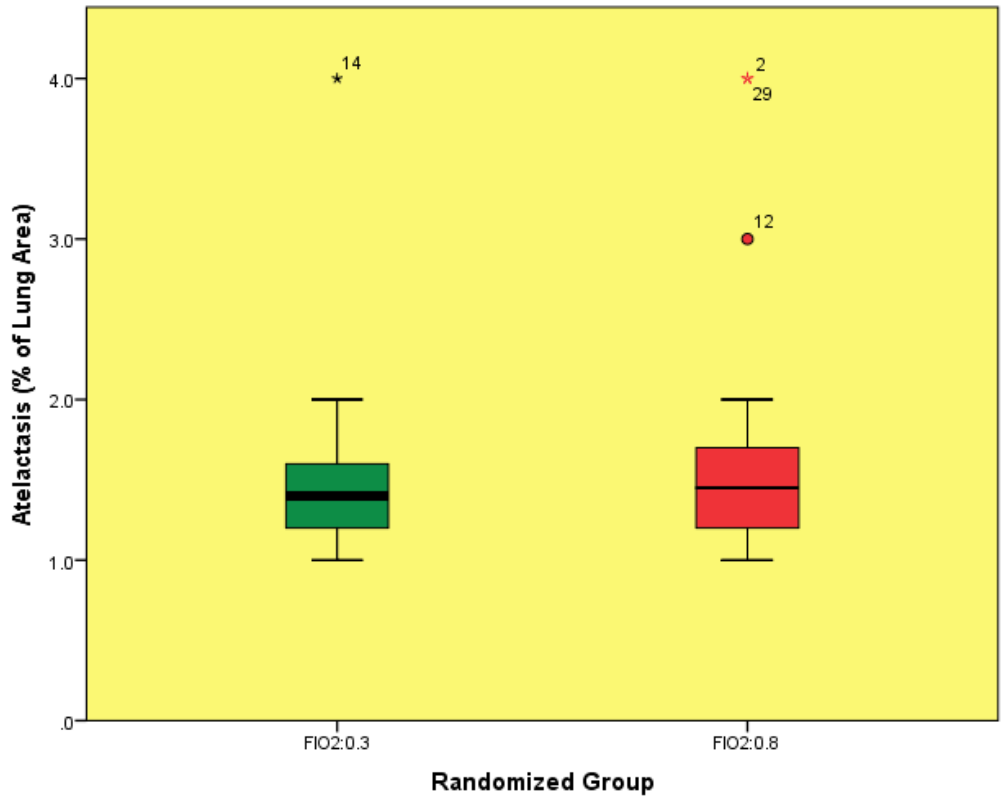

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Figure 14: Comparison of median of atelectasis percent of lung between the randomized group.

Analysis of patients having significant atelectasis

Group	Surgery	Approach to Surgery	Position during surgery	Duration of surgery (Min)	Atelectasis percent (% of Total lung volume)
I(0.3)	WLE of tumor+ segmental mandibulectomy+ PMMC flap reconstruction	open	supine	285	4
II(0.8)	Robotic assisted TAH+ BSO+ pelvic dissection	laproscopic	steep trendelenburg	300	4
II(0.8)	Robotic assisted whipple's procedure	laproscopic	steep trendelenburg	480	4
II(0.8)	Robotic assisted APR	laproscopic	Steep trendelenburg	210	3

On analysis of patients with significant atelectasis, it was observed that 1 patient in group I(0.3) who had atelectasis underwent open surgery in supine position with duration of surgery 280 min. However, all the 3 patients in group II(0.8) who had atelectasis underwent robotic assisted surgery in steep Trendelenburg position with duration of surgery ranging from 210-300 minutes.

NEUROMUSCULAR RECOVERY

Table 14: Distribution & Comparison of Neuromuscular recovery between the randomized groups.

Neuromuscular recovery	Group I(0.3) (%)	Group II(0.8) (%)	$\chi 2$,p-value
Clinically	23(92%)	18(81%)	1.08;0.39
NMT monitoring	2(8%)	4(19%)	

The above table shows the distribution of patients according to neuromuscular monitoring used between the study groups. Out of 25 patients belonging to group I (0.3), in 23 patients neuromuscular recovery was assessed clinically and in 2 patients by NMT monitoring. Out of 22 patients belonging to group II (0.8),18 patients were clinically assessed for neuromuscular recovery & in 4 patients NMT monitoring was done. The chi-square statistic was applied to compare neuromuscular recovery between the study groups which showed a $\chi 2$ value of 1.08. The corresponding p-value was 0.39 which was not found to be statistically significant i.e. both the study groups were comparable with respect to the neuromuscular monitoring of the patients.

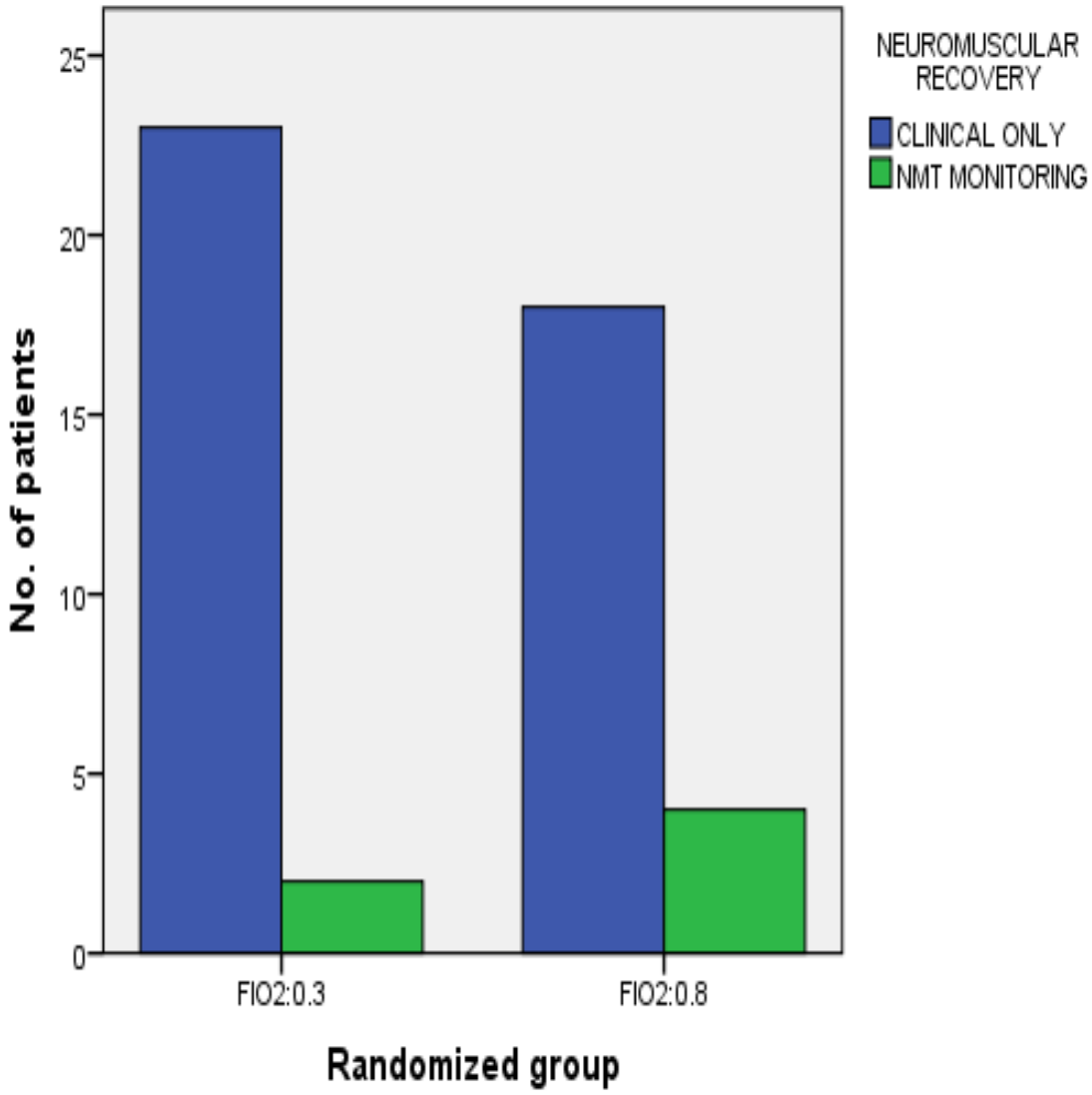

Figure 15: Distribution & Comparison of Neuromuscular recovery between the randomized groups.

POST OPERATIVE ANALGESIA

Table 15: Distribution & Comparison of post-operative analgesia between the randomized groups.

Post-operative analgesia	Group I(0.3) (%)	Group II(0.8) (%)	χ2,p-value
Paracetamol	10(40%)	11(50%)	1.042;0.594
Neuraxial blockade	12(48%)	10(45%)	
Peripheral nerve block	3(12%)	1(4.5%)	

The above table shows the distribution of patients according to post-operative analgesia used between the study groups. In group I (0.3), postoperative analgesia was managed with IV paracetamol in 10 patients, neuraxial blocks in 12 patients and peripheral nerve blocks in 3 patients. In group II (0.8), postoperative analgesia was managed with IV paracetamol in 11 patients, neuraxial blocks in 10 patients and peripheral nerve block in 1 patient. The chi-square statistic was applied to compare postoperative analgesia between the study groups which showed a χ2 value of 1.042. The corresponding p-value was 0.59 which was considered non- significant i.e., both the study groups were comparable with respect to the postoperative analgesia management of the patients.

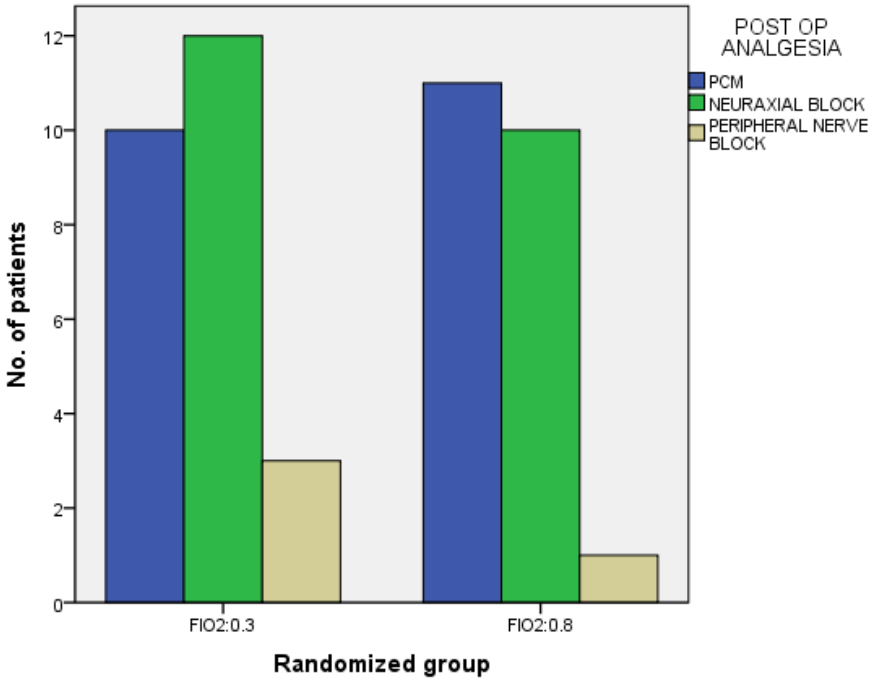

Figure 16: Distribution & Comparison of post-operative analgesia between the randomized groups.

Postoperative Pulmonary Complication, PONV, Postoperative SSI

None of the patients in either group required post-operative oxygen supplementation in PACU. As atelectasis predisposes patients to pulmonary complications, patients were assessed clinically every day till post op day 3, complete blood count and Chest X –ray were done to look for any pulmonary complication(pneumonia). But in our study, none of the patients of either group had the features of pneumonia. Postoperatively, patients were assessed for postoperative nausea and vomiting (PONV) for 24 hours and none of the patients in either group had PONV. The patients were followed till postoperative day 5 for evaluation of SSI, which was not present in any of the patients of either group

DISCUSSION

The choice of inspired oxygen concentration given intraoperatively during general anaesthesia varies among different anaesthetist & there is no ideal optimal inspired oxygen concentration. A higher inspired oxygen fraction is known to alter the lung physiology and raises the possibility of pulmonary complications such as postoperative atelectasis. [1-3] However, according to the most recent WHO recommendations, higher FiO2 (0.8) lowers the incidence of surgical site infection and postoperative nausea & vomiting without added risk of pulmonary complications. [6-7] Application of PEEP decreases the incidence of atelectasis even in the presence of high inspired oxygen concentration. [4] Most of studies in past literature have been done on healthy young adults and there are no studies exclusively on geriatric patients, who are more prone to postoperative atelectasis because of altered respiratory physiology. So, present study was planned to compare the effect of high inspired oxygen (FiO_2 0.8) and low inspired oxygen (FiO_2 0.3) on postoperative pulmonary atelectasis, PONV, SSI in elderly patients undergoing elective surgery.

In present randomized control trial conducted at AIIMS Jodhpur, 50 patients were enrolled & randomly assigned to group I who received 30% FiO2 & group II who received 80% FiO2.The study showed that intraoperative administration of 80% FiO2 had no significant difference as compared to 30% FiO2, on incidence and severity of postoperative atelectasis and postoperative gas exchange in geriatric patients undergoing elective surgery under general anesthesia.

The median (IQR) percentage of atelectasis area as assessed by HRCT thorax was comparable between group I [1.40 (1.20-1.7)] and group II [1.45 (1.20-1.75)] (p-value-0.7). The gaseous exchange as assessed by the P/F ratio at different time intervals showed no statistically significant difference in both the groups (p-value >0.05). None of the patients in either group experienced PONV, SSI or pneumonia. No postoperative pulmonary complications (pneumonia) or requirement of oxygen or mechanical ventilation was seen in any of the patient of either group.

In our study, both groups were comparable for demographic variables (age, weight, height, BMI and physical status). Enrolled patients belong to age group of 67-72 years in both the groups. Our study was exclusively done on geriatric age group as geriatric patients are more prone for postoperative atelectasis. With increase in age, the compliance of respiratory system decreases which affects the gaseous exchange. Their response to hypoxia &

hypercapnia is also reduced that increases the risk of postoperative pulmonary complications.[5] Hedenstierna et al [15] conducted a prospective study in adults aged between 18-78 years posted for surgery under general anaesthesia. Intraoperatively, patients were administered 30% and higher oxygen. Their results showed that atelectasis increases upto 50 years of age and decreases after that.

In our study, patients of both groups were comparable with respect to BMI & physical status of patients. The patients enrolled had BMI in the range of 21-24 kg/m2. The study conducted by Cohen et al [11] and Ostberg et al [24] included patients with BMI of 21-33 kg/m^2 & 21-29 kg/m^2 respectively which showed similar results, but contemplating results were noted with respect to BMI in the study done by Hedenstierna et al. [15] In that study, it was shown that BMI>30 kg/m2 further limit the formation of atelectasis. The study conducted by Fernandez, [20] included patients with ASA status 3 had increased risk of postoperative complications, since our study included only ASA 1 and ASA 2 patients, our results cannot be extrapolated to high risk groups.

In our study, the mean duration of surgery (min) in group I (211.80 ±56.51) and group II (238.63 ±102.04) was comparable. Similar to our study, the study conducted by Akca et al [8] had mean duration of surgery (hr) in group 30% and group 80%, as 2.86 ± 1.0 & 3.3 ±1.0 respectively. In contrast to our study, Patel et al [21] conducted a study in adult patients posted for laproscopic cholecystectomy. Authors found that duration of surgery was significant factor in the formation of atelectasis.

Primary outcome of our study was to compare postoperative atelectasis using CT thorax, between the two groups. In our study, CT thorax was done postoperatively within 24 hours to look for atelectasis. It was expressed as percentage of atelectasis to total lung volume and area more than 2% was considered significant. The volume of atelectasis in group I (0.3) & group II(0.8) was 1.40(1.20-1.7) & 1.45 (1.20-1.75) respectively, which was statistically insignificant. Our results were similar to study conducted by Akca et al [8] who observed the effect of inspired oxygen concentration on patients posted for colon resection surgeries. The percentage of atelectasis as assessed by HRCT thorax on postoperative day 1 (mean ±SD) in group 30% and group 80% was 2.5 ±3.2 and 3.0 ±1.8 respectively which was statistically insignificant. In the study conducted by Hedenstierna et al [15] patients posted for surgery under general anaesthesia were induced in CT suite and preoperative and after induction HRCT thorax was done to assess atelectasis. They found that administration of high oxygen result in atelectasis but the percent of atelectasis decreased beyond 50 years of age. Patel et al

[21] conducted a study in patients posted for laproscopic cholecystectomy and assessed postoperative atelectasis with the help of lung ultrasound. They found significant loss of aeration in basal area after induction of anaesthesia and further increase in the amount of atelectasis after introduction of pneumoperitoneum. Similarly, study done by Lena et al [25] on patients posted for laproscopic cholecystectomy, showed an increase in atelectic lung volume after introduction of pneumoperitoneum, as assessed by CT chest. Yano et al [26] did a retrospective cohort study in 84 patients posted for robotic assisted partial nephrectomy lasting for duration 180-300 minutes. They found that incidence of atelectasis was more with longer duration of surgery. Similar results were found in our study, on analyzing all 4 patients who developed significant postoperative atelectasis, it was found that all 3 patients of group 2 (0.8) who developed significant atelectasis were posted for robotic surgery. Robotic surgeries involve pneumoperitoneum, steep trendelenburg position with long duration of surgery, which possibly explains the development of postoperative atelectasis.

Secondary outcome of our study was to compare gaseous exchange by analyzing PaO_2 and P/F ratio at 1st hr, 6th hr & 12th hr postoperatively. In our study, the PaO_2 & P/F ratio was comparable between the randomized groups at postoperative 6 and 12 hr.

Postoperatively at 1 hr, the Pao2 and P/F ratio in group I (0.3) & group II (0.8) was 420.51 ±22.43 and 448.48 ±24.82 respectively. The difference was statistically significant. However, there was no clinically significant difference in the gas exchange in the two groups as the saturation in both the groups was 100% in PACU and none of the patients in either group required postoperative oxygen supplementation or ventilator support and also none of the patients have any postoperative respiratory complication like pneumonia. At 6th hr & 12th hr postoperatively, PaO_2 & P/F ratio was comparable between the randomized groups indicating no effect of intraoperatively administered lower or higher inspired oxygen concentration on postoperative gas exchange. Similar results were found in the study conducted by Akca et al [8] where they assessed P/F ratio intraoperatively and postoperatively at 2 hr. The mean of PaO2 at 2 hrs post-surgery in group 30% & group 80% were 78.00 ± 6.14 &74.0 ± 6.8 respectively, which was statistically non-significant. Staehr et al [9] assessed the effect of high oxygen concentration on gaseous exchange using P/F ratio in patients posted for ovarian surgeries. They found that P/F ratio was 435 mmHg [300-525.04] and 427 mm Hg [345.02-502.5] in the 30%- and 80% group, respectively, which was statistically significant.

In our study, another outcome was to assess and compare the incidence of postoperative nausea & vomiting for 24 hours. None of the patients in either randomized group experienced

PONV. Our results were similar to the study conducted by Izadi et al[27] on patients posted for tonsillectomy and Simurina et al [28] on patients posted for laproscopic gynaecological surgery, which showed that the incidence of PONV was statistically non-significant in hyperoxic group as compared to control group which was assessed for 24 hours. However, they found that supplementation of higher concentration of oxygen decreases the incidence of PONV in first 2 hours post-surgery.

Surgical site infection (SSI) was also assessed and compared between both the groups. In our study, none of the patients in the randomized group had SSI as assessed clinically for 5 days. The meta-analysis conducted by Yang et al [16] also found that SSI rates were 13.11% in the control group and 11.53% in the hyperoxic group, which was clinically non-significant, however, the patients with colorectal surgery was benefitted with hyperoxia. However, in our study none of the 6 patients who underwent colorectal surgery experienced SSI. Hovaguimian et al [10] did a meta-analysis including 22 trials comparing intraoperative high oxygen with normal FiO2 and reporting the incidence of SSI, nausea & vomiting and pulmonary complications. Their study concluded that high FiO2 decreased the incidence of SSI from 19.3% to 15.2%, the incidence of nausea & vomiting decreased from 24.8% to 19.5%. The discrepancy of results can be because of different follow up period to see for SSI. In our study all patients were followed only for 5 days and in all patient's prophylactic antibiotic was administered. As per recent WHO recommendations higher FiO2 (80%) lowers the incidence of Surgical site infection and Postoperative nausea & vomiting without added risk of pulmonary complications. [6-7] However, from our study we found no beneficial effect of higher FiO2 (80%) compared to lower FiO2 (30%) in reducing incidence of PONV and SSI.

We also compared postoperative pulmonary complications between both the study group. In our study, we found that none of the patients in either group, required postoperative oxygen supplementation. As atelectasis is a risk factor for postoperative pneumonia, patients were assessed clinically till postoperative day 3 to look for symptoms of pneumonia and none of the patient in either group developed pneumonia. The meta-analysis conducted by Lim et al [18] to study the effect of low & high inspired fraction of oxygen showed no difference in the incidence of pneumonia, respiratory failure and ICU admission, however, 30 days mortality rate was higher with hyperoxia group. In our study only immediate postoperative pulmonary complications and postoperative pneumonia till day 3 was seen, which was not observed in any of the patients of either group.

Residual muscle paralysis or severe postoperative pain can contribute to immediate postoperative pulmonary complications. In our study adequate reversal of muscle relaxation was ensured in all the patients using clinical parameters & by using NMT monitoring in certain cases. Residual paralysis impairs the functioning of intercostal muscles, resulting in atelectasis, however, none of the patients in our study had residual paralysis and respiratory complications in immediate postoperative period.

Pain is another important factor in formation of atelectasis. In our study we assured that adequate analgesia was provided to all patients intraoperatively as well as postoperatively. Epidural analgesia was given to patients posted for abdominal surgery. IV analgesics and nerve blocks were given wherever required for pain management. Postoperatively, VAS score was used to assess the pain severity (by the Acute Pain Care team), which was found to be comparable between the randomized groups. In the study conducted by Akca et al[8], IV analgesic were used for postoperative pain management & the pain score was found to be comparable between the study groups. Shea et al [29] conducted a study to determine the association of pain intensity and postoperative pulmonary complication in geriatric patients posted for abdominal surgery. He found that adequate pain management decreases the incidence of postoperative pulmonary complications.

STRENGTH OF STUDY

1. The study was done exclusively in geriatric patients, who are at increased risk of atelectasis compared to young adults.
2. Our study is a randomized control trial.
3. In our study two methods, HRCT thorax which is consider to be gold standard method and PaO2 /FiO2 ratio was used to detect postoperative atelectasis.

LIMITATIONS OF STUDY

1. This was a single center study done in a small group of patients. More studies with multicentric design and large sample size are required to confirm the findings of our study on secondary outcomes like PONV, SSI.
2.Only ASA status 1 & 2 posted for elective surgeries were enrolled in the study, so the results observed cannot be extrapolated to high-risk patients.
3.In our study only patients posted for elective, non-cardiac surgeries were included. So, our results cannot be extrapolated for patients posted for emergency and cardiothoracic surgery.
4.Preoperative HRCT thorax was not done in all the cases.

CONCLUSION

No difference between higher FiO_2 (0.8) and lower FiO_2 (0.3) was seen in terms of postoperative atelectasis, gaseous exchange, post-operative pulmonary complications, PONV and SSI in geriatric patients posted for elective surgeries. High fraction of oxygen can be safely administrated to geriatric population without the added risk of postoperative pulmonary complication. None of the patients in either group experienced PONV, SSI suggesting a weaker association of hyperoxia in preventing PONV & SSI.

To conclude higher FiO2 (0.8) has no harmful effect on postoperative atelectasis and no beneficial effect in reducing incidence of PONV and SSI compared to lower FiO2 (30%) in geriatric patients undergoing elective surgery under general anaesthesia

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ANNEXURES

अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर
All India Institute of Medical Sciences, Jodhpur
संस्थागत नैतिकता समिति
Institutional Ethics Committee

No. AIIMS/IEC/2021/ 3587 **Date:** 31/03/2021

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: **AIIMS/IEC/2021/** 3460

Project title: **"The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anesthesia: a randomized-controlled trial"**

Nature of Project:	**Research Project Submitted for Expedited Review**
Submitted as:	**M.D. Dissertation**
Student Name:	**Dr. Chitra Prabha Saun**
Guide:	**Dr. Pradeep Bhatia**
Co-Guide:	**Dr. Pushpinder S Khera, Dr. Kamlesh Kumari & Dr. Sadik Mohammed**

Institutional Ethics Committee after thorough consideration accorded its approval on above project.

The investigator may therefore commence the research from the date of this certificate, using the reference number indicated above.

Please note that the AIIMS IEC must be informed immediately of:

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.
- In case of any issue related to compensation, the responsibility lies with the Investigator and Co-Investigators.

The Principal Investigator must report to the AIIMS IEC in the prescribed format, where applicable, bi-annually, and at the end of the project, in respect of ethical compliance.

AIIMS IEC retains the right to withdraw or amend this if:

- Any unethical principle or practices are revealed or suspected
- Relevant information has been withheld or misrepresented

AIIMS IEC shall have an access to any information or data at any time during the course or after completion of the project.

Please Note that this approval will be rectified whenever it is possible to hold a meeting in person of the Institutional Ethics Committee. It is possible that the PI may be asked to give more clarifications or the Institutional Ethics Committee may withhold the project. The Institutional Ethics Committee is adopting this procedure due to COVID-19 (Corona Virus) situation.

If the Institutional Ethics Committee does not get back to you, this means your project has been cleared by the IEC. On behalf of Ethics Committee, I wish you success in your research.

Dr. Pradeep Sharma
Member Secretary
Member secretary
Institutional Ethics Committee
AIIMS,Jodhpur

Basni Phase-2, Jodhpur, Rajasthan-342005; **Website:** www.aiimsjodhpur.edu.in; **Phone:** 0291-2740741 Extn. 3109
E-mail : ethicscommittee@aiimsjodhpur.edu.in; ethicscommitteeaiimsjdh@gmail.com

ANNEXURE 1 (Informed Consent Form)

TITLE: The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial.

Name of PG Student: Dr. Chitra Prabha Saun

Telephone no: 95577822699 Patient Identification No: _____

I,_____,g/o,r/o,s/o/d/o,_____r/o

_____ _____ give

my full, free, voluntary consent for my patient to be a part of the study "**The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial ''** the procedure and nature of which has been explained to me in my own language to my full satisfaction. I confirm that I have the opportunity to ask questions. I understand that my patient's participation is voluntary, and I am aware of my right to opt out of the study at any time without giving any reason.

I understand that the information collected about my patient and any of my patient's medical records may be looked at by responsible individuals from AIIMS Jodhpur or from regulatory authorities. I give permission for these individuals to have access to my patient's records. I also give my consent for publication of my medical data for scientific and academic purposes.

Date: _____ _____

Place: _____ Signature/Left thumb impression

This to certify that the above consent has been obtained in my presence.

Date : _____ _____

Place : _____ Signature of PG Student

1. Witness 1
   Signature
   Name: _____
   Address: _____

2. Witness 2
   Signature
   Name:_____
   Address: _____

अ खल भारतीय च कत्सा वज्ञान संस्थान, जोधपुर, राजस्थान

सू चत सहमतिप्रपत्र

थी सस / निबंधकाशीर्षक:**The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial**

पीजी छात्र का नाम: Dr. Chitra Prabha Saun

रोगी / स्वयंसेवकपहचानसंख्या: _____ नं..9557782699

मैं,_____एस/ओयाडी/ओ_____आर/ओ_____

_____मेरे मरीज़ के लए **"The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial"** अध्ययन का हिस्सा बनने के लए मेरी पूर्ण, नि: शुल्क, स्वैच्छिक सहमति देता/देती हूँ।

मेरी पूर्ण संतुष्टि के लए मेरी भाषा में प्र क्रया और प्रकृति को मुझे समझाया गया है।मैं पुष्टि करता हूं क मुझे प्रश्न पूछने का अवसर मला है। मैं समझता हूं क मेरी मेरे मरीज़ की भागीदारी स्वैच्छिक है और मुझे कसी भी कारण दिए बिना कसी भी समय मेरे मरीज़ को अध्ययन से बाहर निकलने के मेरे अ धकार की जानकारी है। मैं समझता हूं क मेरे मरीज़ के मे डकल रिकॉर्ड के बारे में एकत्रित की गई जानकारी को _____ (कंपनी नाम) या वनियामक प्रा धकरणों से जिम्मेदार व्यक्ति द्वारा देखा जा सकता है। मैं इन लोगों के लए मेरे मरीज़ के रिकॉर्डों तक पहुंच की अनुमति देता हूं l मैं इस बात की अनुमति देता हु की मेरे मे डकल रिकाई्स को वैज्ञानिक और शै क्षक प्रयोजनों के लए इस्तेमाल कया जा सकता है

तारीख : _____.

जगह: _____ हस्ताक्षर / बाएं अंगूठे का छाप

यह प्रमा णत करने के लए क मेरी उपस्थिति में उपरोक्त सहमति प्राप्त की गई है

तारीख : _____

जगह: _____ पी जी छात्र के हस्ताक्षर

गवाह 1 गवाह 2

ANNEXURE 2 (<u>Participant information sheet)</u>

All India Institute of Medical Sciences Jodhpur, Rajasthan

All India Institute of Medical Sciences

Jodhpur, Rajasthan

Patient name:

Patient id:

<u>Title of study</u>: The effect of two different intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial

Purpose of study: The purpose of this study is to evaluate the effect of high inspired oxygen in postoperative atelectasis in geriatric patients.

Study design: Randomized Control Trial

I have been explained in my own understanding language by the Principal Investigator that they are doing this study and the risk and benefits associated with it.

I have been informed that I can withdraw my patient from the study at any time.

The data obtained from my patient will be used for the purpose of the study only. All records will be kept confidential.

Any potential risks to the participants: No additional risks

Details of the candidate with phone number: Dr. Chitra Prabha Saun
Post Graduate, Anaesthesiology & Critical Care, AIIMS Jodhpur
9557782699

रोगी सूचना पत्रक

रोगी का नाम:

रोगी आईडी:

अध्ययन का शीर्षक: **The effect of intraoperative inspired oxygen concentration on postoperative pulmonary atelectasis in Geriatric patients undergoing elective surgery under general anaesthesia: a randomized-controlled trial**

अध्ययन डजाइन: Randomized control trial

प्रं सपल अन्वेषक द्वारा मुझे अपनी समझ भाषा में समझाया गया है क वे"ये अध्ययन कर रहे हैं और इसके साथ जुड़े जो खमों और लाभों को भी समझाया गया है। मुझे सू चत कया गया है क मैं कसी भी समय अध्ययन से मेरे मरीज़ को हटा सकता हूं। मेरे मरीज़ से प्राप्त आंकड़ों का उपयोग केवल अध्ययन के उद्देश्य के लए कया जाएगा मेरे मरीज़ के सभी रिकॉर्ड गोपनीय रखा जाएगा।

मरीजों के अध्ययन के लाभ:

प्रतिभा गयों को कोई भी संभा वत जो खम: कोई अतिरिक्त जो खम नहीं

Dr. Chitra Prabha Saun

पीजी

अनैथी सओलॉजी और क्रटिकल केयर

एम्स जोधपुर

PROFORMA

Patient Sticker

Weight: Height:

Phone No.

ASA Grading:

Preoperative Vitals: H.R - _____; R.R - _____; NIBP-_____SPO_{2}- _____

Surgical procedure:

Patient position during Surgery:

Duration of surgery (skin incision to skin closure):

Duration of Anaesthesia (Administration of inducing agents to switching off Vapourizer):

Adequate Neuromuscular recovery Ensured: Clinically- YES/NO TOF Ratio : YES/ NO

Postoperative analgesia-

Postoperative Vitals: H.R - _____; R.R - _____; NIBP-_____SPO_{2}- _____

Postoperative O_2 requirement (For$SpO_2 \geq 94$ %): Concentration_____; Duration_____

Requirement of postoperative Mechanical Ventilation: Yes/No

	Preoperatively	**Postoperatively 1hr**	**Postoperatively 6 hr**	**Postoperatively 12 hr**
PaO2				
PaO2/FiO2				

Postoperative CT-findings-

	YES	**NO**
Postoperative nausea and vomiting (Till 24 hours Postop)		
Surgical site infection (Post op Day 5)		
Postoperative pneumonia (Post op Day 3)		

Email address	Group	NAME	ASA	AGE	SEX	WEIGHT	REGISTRATION ID	DIAGISIS	PROCEDURE	PREOP SBP	PREOP DBP	PREOP PULSE	PREOP SPO2	POSITION DURING SURGERY	PREMEDICATION	INDUCTION AGENT	MAINTANENCE AGENT	VENTILATOR (MODE)	TV(ML/KG)	TV	PEEP	DURATION OF SURGERY	DURATION OF ANAESTHESIA	NEUROMUSCULAR RECOVERY	PREOP PAO2	PREOP P/F	POST OP HR	POST OP SBP	POST OP DBP	POST OP SPO2	PAO2@1 HR	P/F @ 1 HR	PAO2 @ 6 HR	(PAO2 /P/F @6 HR	atelectasis percent	POST OP ANALGESIA	POST OP OXYGEN	POST OP PONV	SSI @ 5TH DAY	POST OP PNEUMONIA	PAO2 @ 12 HR	P/F @12 HR
CHITRASAUN2696@GMAIL.COM	0.8	RENVATRAM	1	72	M	60	2018/10/006852	B/L INGUINAL HERNIA	ROBOTIC ASSISTED HERNIOPLASTY	140	78	82	99	TRENDELENBURG	MIDAZ,LOX,FENTA	PROPOFOL	ISOFLURANE	VC	6	360	5	120	180	CLINICALLY ONLY	85.1	405.2	94	130	66	100	98.4	468.5	84.9	404.2	1	PCM	NO	NO	NO	NO	83.6	398
CHITRANAESTHESIA@GMAIL.COM	0.8	Gopal kanwar	2	60	F	86	2021/08/018573	Endometrial cancer	Robotic TAH with BSO with pelvic ln dissection	138	68	90	100	TRENDELENBURG	Midaz, fenta	Propofol150 mg	Iso	Vc	6	300	5	300	360	CLINICALLY ONLY	89.2	424.7	98	122	58	100	92.1	438.6	78.8	375.23	4	NEURAXIAL	NO	NO	NO	NO	80.7	384.3
CHITRANAESTHESIA@GMAIL.COM	0.8	Deepa bulchandani	2	64	F	79	2021/06/005984	Rt. Rotator cuff injury	Arthroscopic rotator cuff repair	148	88	54	100	LATERAL	Midaz, fenta	Propofol	Sevo	Vc	7	420	5	120	165	CLINICALLY ONLY	85.8	408.5	65	110	78	100	90.6	431.4	82.1	390.9	1.3	PCM	NO	NO	NO	NO	84.1	400.5
CHITRANAESTHESIA@GMAIL.COM	0.3	Madha ram	2	60	M	48	2022/02/014515	Goo with antral ca	Diag1stic lap and proceed	132	74	70	100	TRENDELENBURG	Midaz, fenta	Propofol(70mg)	Iso	Vc	6	350	5	270	300	CLINICALLY ONLY	92.1	438.5	68	102	55	100	92.4	440	90.2	429.5	1.2	NEURAXIAL	NO	NO	NO	NO	88..6	421.9
CHITRANAESTHESIA@GMAIL.COM	0.8	Shiv devi	1	62	F	48	2019/02/014969	CBD stricture with post hepatolithiesis stent status	Roux-en-y with hepaticojejulstomy	110	58	65	100	TRENDELENBURG	Midaz, lox, fenta	Propofol	Iso	Vc	6	300	5	240	240	CLINICALLY ONLY	80.4	402	90	100	52	100	85.1	405.3	83.4	397.1	1.5	NEURAXIAL	NO	NO	NO	NO	81.9	390
CHITRANAESTHESIA@GMAIL.COM	0.3	Puro devi	2	80	F	64	2021/12/001113	Rt. Renal mass	Rt. Open nephrectomy	150	84	56	100	LATERAL	Midaz, fenta	Propofol(110mg)	Iso	Vc	6	400	5	180	225	NMT MONITORING	84.8	403.8	63	140	73	100	86.6	412.4	86.3	410.9	1.5	PERIPHERAL NERVE BLOCK	NO	NO	NO	NO	82.2	391.4
CHITRANAESTHESIA@GMAIL.COM	0.8	Aman Bhati	2	71	M	70	2020/02/010810	Ca larynx	Laryngectomy with pmmc flap reconstruction	124	77	73	100	SUPINE	Midaz, fenta	Propofol(120mg)	Iso	Vc	6	420	5	360	390	NMT MONITORING	85.7	408	84	138	70	98	94.6	450.5	82.2	391.4	1.6	PCM	NO	NO	NO	NO	84.1	400.5
CHITRANAESTHESIA@GMAIL.COM	0.8	Ram Bishnoi	1	60	M	82	2022/03/000301	Incisional hernia	TAR	160	84	66	100	SUPINE	Midaz, fenta, dexa, lox	Propofol(140mg)	Sevo	Vc	6	420	5	120	140	CLINICALLY ONLY	90	460	64	120	78	100	100.1	467	90.6	431.2	1.2	PCM	NO	NO	NO	NO	88.6	421.9
CHITRANAESTHESIA@GMAIL.COM	0.3	Laxmi	1	65	F	58	2020/09/007242	Rt. Renal mass with hematuria	Open nephrectomy	152	73	78	99	LATERAL	Midaz, lox, dexa, fenta	Etomidate(12mg)	Iso	Vc	6	320	5	210	240	CLINICALLY ONLY	82	414	80	104	59	100	85.4	406.6	84.4	400.9	1	PERIPHERAL NERVE BLOCK	NO	NO	NO	NO	83.3	396.6
CHITRANAESTHESIA@GMAIL.COM	0.8	Kana Ram	2	68	M	68	2021/03/011622	Recurrent Ca Gingivobuccal mucosa	Excision of tumor with pmmc flap reconstruction	130	68	70	99	SUPINE	Midaz, fentanyl, lox	Propofol(140mg)	Iso	Vc	6	420	5	240	300	CLINICALLY ONLY	90	420	82	136	78	100	106.3	480	86.2	410.5	1.2	PCM	NO	NO	NO	NO	85.9	409.1
CHITRANAESTHESIA@GMAIL.COM	0.8	HARI SINGH	2	71	M	80	2022/03/003228	BLADDER MASS WITH HEMATURIA	TURBT	140	82	88	98	LITHOTOMY	MIDAZ,FENTA,LOX	ETIOMIDATE(16 MG)	SEVO	Vc	6	400	5	120	180	CLINICALLY ONLY	100	450	83	120	59	100	94.2	446.8	86.6	412.4	1.7	PCM	NO	NO	NO	NO	85.8	408.5
CHITRANAESTHESIA@GMAIL.COM	0.8	kadar khan	2	68	F	48	2021/04/010780	renal cell carcinoma	robotic assisted rt.nephrectomy	135	64	90	99	LATERAL	midaz,fenta,lox	propofol(100mg)	sevo	vc	6	350	5	180	240	NMT MONITORING	84	396.8	95	110	68	100	96.7	458.4	88.8	422.8	3	PERIPHERAL NERVE BLOCK	NO	NO	NO	NO	82.6	393.3
CHITRANAESTHESIA@GMAIL.COM	0.3	Jamna devi	2	66	F	78	2022/03/003018	Lt. Breast carcinoma	Lt. BCS with LD flap reconstruction	120	73	74	100	SUPINE	Midaz, fenta	Propofol(140mg)	Sevo	Vc	6.5	380	5	180	210	CLINICALLY ONLY	103.6	468.2	94	108	62	100	100.1	476.6	94.8	450.8	1.2	PERIPHERAL NERVE BLOCK	NO	NO	NO	NO	95.9	456.7
CHITRANAESTHESIA@GMAIL.COM	0.3	Chagan singh	2	63	M	53.5	2022/02/005694	Ca buccal mucosa	Wle+ pmmc flap reconstruction	136	77	80	100	SUPINE	Midaz, fenta, lox	Etomidate (14mg)	Iso	Vc	7	420	5	285	300	NMT MONITORING	100	476.1	88	144	80	100	85.4	406.6	83.4	397.2	4	PCM	NO	NO	NO	NO	97.1	462.4
CHITRANAESTHESIA@GMAIL.COM	0.8	Harku devi	2	60	F	57	2020/03/013720	Renal mass with hematuria	Left radical nephrectomy	142	75	69	100	LATERAL	Midaz, fenta, lox	Propofol(140mg)	Iso	Vc	6	350	5	300	330	CLINICALLY ONLY	83	399.1	72	131	56	100	88.4	420.9	85.2	402.5	1.2	PCM	NO	NO	NO	NO	85.1	405.3
CHITRANAESTHESIA@GMAIL.COM	0.8	Bhola ram	2	77	M	68	2022/02/003764	Renal carcinoma	Lap. Nephrectomy	130	66	77	99	LATERAL	Midaz, lox	Propofol	Iso	VC	7	400	5	270	300	CLINICALLY ONLY	83.4	392.4	79	131	64	100	88.8	422.8	81.6	388.6	1	PCM	NO	NO	NO	NO	84.4	402
CHITRANAESTHESIA@GMAIL.COM	0.3	Shobha jain	2	61	F	71	2021/05/007846	Rt. Adnexal mass	Staging laprotomy	124	64	78	99	SUPINE	Midaz, lox, fenta	Propofol	Iso	VC	6	400	5	300	330	CLINICALLY ONLY	80.9	385.2	73	100	58	100	86.7	412.8	80.9	385.3	1.4	NEURAXIAL	NO	NO	NO	NO	80.8	384.8
chitrasaun2696@gmail.com	0.8	Daku	2	70	F	50	2022/04/008350	CA gall bladder	Radical cholecystectomy	110	64	88	100	SUPINE	Midaz,fenta	Propofol	Iso	Vc	6	400	5	240	285	NMT MONITORING	85.2	404.7	92	104	62	100	88.8	422.7	84.4	401.9	1.5	NEURAXIAL	NO	NO	NO	NO	84.8	403.8
chitrasaun2696@gmail.com	0.3	Renuka bhambhani	2	68	F	80	2022/03/017355	CA colon	LAR	112	66	87	100	LITHOTOMY	Midaz,fenta	Propofol	Iso	Vc	6	380	5	240	270	CLINICALLY ONLY	81.9	390	100	102	66	100	84.8	403.8	82.1	391.2	1.3	NEURAXIAL	NO	NO	NO	NO	85.2	405.7
chitrasaun2696@gmail.com	0.8	Bhati	2	64	F	71.6	2022/05/001947	CA ascending colon	Open left hemicolectomy	117	58	92	100	SUPINE	Midaz,fenta	Propofol	Iso	Vc	6	420	5	180	220	CLINICALLY ONLY	80.9	385.2	56	134	76	100	86.9	413.8	80.6	383.8	1.2	NEURAXIAL	NO	NO	NO	NO	78.8	375.3
CHITRANAESTHESIA@GMAIL.COM	0.3	Kayshalya devi	2	65	F	69	2022/08/021474	Rt. Orbital tumor	Craniotomy and tumor excision	109	70	64	100	SUPINE	Midaz, fenta	Propofol	Iso	VC	6	370	5	300	345	CLINICALLY ONLY	80.2	380.9	73	94	68	100	94.4	449.5	84.1	400.5	1.6	PCM	NO	NO	NO	NO	80.1	394
chitrasaun2696@gmail.com	0.3	Teejo devi	1	67	F	67	2022/06/013146	Cystadenocarcinoma	Staging laparotomy	110	70	80	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	7	420	5	180	200	CLINICALLY ONLY	70.2	335.4	66	133	80	100	81.4	387.6	79.7	379.5	1.5	NEURAXIAL	NO	NO	NO	NO	74.8	356.1
chitrasaun2696@gmail.com	0.8	Vimla	2	65	F	60	2022/06/001234	Carcinoma ovary	Staging laparotomy	120	74	82	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	Vc	6	380	5	240	255	CLINICALLY ONLY	82.2	391.5	78	136	71	99	96.8	460.1	80.5	382.6	1.2	NEURAXIAL	NO	NO	NO	NO	84.1	400.5
chitrasaun2696@gmail.com	0.8	Harish Dutt vyas	1	61	M	75	2022/04/000756	CA prostate	Robotic assisted prostectomy	134	72	84	100	TRENDELENBURG	Midaz,fenta	Propofol	Desflurane	VC	6	420	5	330	390	NMT MONITORING	94	448.2	70	143	70	100	104.6	498	94.7	450	1	PCM	NO	NO	NO	NO	90.6	431.3
chitrasaun2696@gmail.com	0.3	Nisha bhati	1	64	F	77	2022/05/001947	CA ascending colon	Right hemicolectomy	126	65	90	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	400	5	240	280	CLINICALLY ONLY	92.1	438.5	88	124	64	100	94.4	449.5	85.3	405	1.8	NEURAXIAL	NO	NO	NO	NO	89	423.8
chitrasaun2696@gmail.com	0.8	Panne singh	2	66	M	61.6	2022/03/008055	CA rectum	robotic assisted ARM	137	74	76	100	TRENDELENBURG	Midaz,fenta	Propofol	Isoflurane	CMV	6	360	5	210	240	CLINICALLY ONLY	89.2	424.7	90	110	64	100	100.2	477.1	80	380.95	2	NEURAXIAL	NO	NO	NO	NO	86.4	411.4
chitrasaun2696@gmail.com	0.3	Dhapu devi	2	72	F	71	2022/06/002602	CA recto sigmoid	LAR	124	78	66	100	LITHOTOMY	Midaz,fenta	Propofol	Isoflurane	VC	6.5	380	5	300	330	CLINICALLY ONLY	89.7	429.1	74	112	66	100	92.7	441.4	82.6	393.3	1.7	NEURAXIAL	NO	NO	NO	NO	85	404.7
chitrasaun2696@gmail.com	0.3	KHOJA RAM	2	64	M	42	2022/02/011722	Right 1n functioning kidney	Laparoscopic nephrectomy	144	77	59	100	LATERAL	Midaz,fenta	Propofol	Isoflurane	CMV	6	300	5	210	240	CLINICALLY ONLY	88.1	419.6	80	117	58	100	96.2	458	86.4	411.4	1.8	NEURAXIAL	NO	NO	NO	NO	87.4	416.1
chitrasaun2696@gmail.com	0.8	Dhanki	1	74	F	43	2022/03/014250	CA pancreas	Robotic assisted Whipple procedure	100	62	84	100	TRENDELENBURG	Midaz,fenta	Propofol	Isoflurane	CMV	6	300	5	480	560	CLINICALLY ONLY	90.2	429.5	69	109	70	100	102.6	486.8	80.9	385.2	4	NEURAXIAL	NO	NO	NO	NO	84.1	400.4
chitrasaun2696@gmail.com	0.3	Indra devi	2	68	F	52	2021/01/016004	CA ovary	Interval cytoreduction	120	59	88	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	6.5	380	5	240	265	CLINICALLY ONLY	83.4	397.1	77	110	70	100	88.4	420.9	85.2	404.7	1	NEURAXIAL	NO	NO	NO	NO	84.6	402.8
chitrasaun2696@gmail.com	0.3	Bhola ram	2	77	M	57	2022/02/003764	Lt.non functioning kidney	Laparoscopic lt.nephrectomy	138	76	73	100	LATERAL	Midaz,fenta	Propofol	Isoflurane	CMV	6	400	5	180	210	CLINICALLY ONLY	82.4	390.4	78	120	74	100	90.1	429	81.9	390	1.2	PCM	NO	NO	NO	NO	81.6	388.5
chitrasaun2696@gmail.com	0.8	Tikam Chand jain	1	72	M	60.4	2022/07/019514	CA prostrate	Robotic assisted radical prostatectomy	144	71	63	100	TRENDELENBURG	Midaz,fenta	Propofol	Isoflurane	VC	6.5	380	5	240	300	CLINICALLY ONLY	86.1	410	88	134	72	100	94.4	449.5	80.9	385.2	1.4	PCM	NO	NO	NO	NO	84.8	403.8
chitrasaun2696@gmail.com	0.3	Savitri	2	70	F	66.7	2021/03/016633	CA cervix	ROBOTIC ASSISTED HYSTERECTOMY	131	64	90	100	LITHOTOMY	Midaz,fenta	Propofol	Isoflurane	CMV	7	420	5	210	240	CLINICALLY ONLY	87.7	417.6	87	126	65	100	95.8	406.6	85.4	406.6	1.6	NEURAXIAL	NO	NO	NO	NO	81.8	389.5
chitrasaun2696@gmail.com	0.3	Shakuntala agarwal	1	87	F	59	2016/11/006120	CA transverse colon	Extended hemicolectomy	100	58	94	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	7	420	5	240	270	CLINICALLY ONLY	85.3	406.1	92	100	69	100	90.2	429.5	81.7	389	1.3	NEURAXIAL	NO	NO	NO	NO	83.4	397.1
chitrasaun2696@gmail.com	0.3	ranjita ram	2	64	M	70	2022/09/017087	right buccal mucosa ca	wle+ pmmc flap reconstruction	104	62	84	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	420	5	240	270	CLINICALLY ONLY	86.3	410.8	77	120	76	100	87.7	417.61	83.1	395.7	1.8	PCM	NO	NO	NO	NO	85.1	405.2
chitrasaun2696@gmail.com	0.8	manbhari	2	60	F	68	2022/09/008689	pancreatitis with hilar mass	exploratory lap and proceed	102	66	95	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	400	5	420	440	CLINICALLY ONLY	88.1	419.5	80	127	67	98	94.1	448.09	86.2	410.4	1.4	NEURAXIAL	NO	NO	NO	NO	89.2	424.7
chitrasaun2696@gmail.com	0.3	Jeta Ram	2	60	M	55.5	2022/09/004789	Soft tissue sarcoma of abdomen	WLE+ flap coverage	134	76	65	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	6	380	5	180	200	CLINICALLY ONLY	85.6	407.6	82	110	58	100	88.4	420.9	86.6	412.4	1.5	NEURAXIAL	NO	NO	NO	NO	85.8	408.5
chitrasaun2696@gmail.com	0.8	Harja ram	1	84	M	50	2022/10/011736	Anterior abdomen wall raw area s/p mesh laprostomy	anterior abdominal wall stsg	94	68	80	98	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	300	5	120	210	CLINICALLY ONLY	82.4	392.3	84	104	67	100	90	428.5	81.8	389.5	1.7	NEURAXIAL	NO	NO	NO	NO	80.2	381.9
chitrasaun2696@gmail.com	0.8	ucchab	1	67	F	54	2019/02/002851	Incisional hernia	ipom	143	70	58	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	320	5	120	140	CLINICALLY ONLY	80.9	385.4	66	129	60	100	96.1	457.6	84.6	402.8	1.9	NEURAXIAL	NO	NO	NO	NO	81.1	386.2
chitrasaun2696@gmail.com	0.8	bhanwar	2	62	M	51	2015/07/008355	ca pancreas	exploratory lap and proceed	114	63	66	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	6.5	320	5	300	330	CLINICALLY ONLY	82.4	390.3	80	130	68	100	91.2	434.3	86.7	412.8	1.7	PCM	NO	NO	NO	NO	80.9	385.2
chitrasaun2696@gmail.com	0.3	mohd.khan	2	61	M	58	2022/08/011094	ca left buccal mucosa	wle +marginal mandibulectomy+subme ntal falp	141	84	73	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	360	5	210	240	CLINICALLY ONLY	83.5	397.6	74	137	64	100	88	419.1	82.6	393.3	1.8	PCM	NO	NO	NO	NO	81.6	388.5
chitrasaun2696@gmail.com	0.3	parvati devi soni	1	65	F	63	2022/07/001515	ca left breast	mrm	130	70	70	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	360	5	120	140	CLINICALLY ONLY	84.6	402.8	88	123	76	100	85.9	409	84.1	400.4	1.5	PCM	NO	NO	NO	NO	82.5	392.8
chitrasaun2696@gmail.com	0.3	duda ram	1	70	M	51	2017/08/009457	CA URINARY BLADDER	RADICAL CYSTECTOMY	120	80	83	100	LITHOTOMY	Midaz,fenta	Propofol	Isoflurane	cmv	6	325	5	120	180	CLINICALLY ONLY	85.1	405.2	84	140	77	100	87.2	415.2	86.8	413.3	1.4	NEURAXIAL	NO	NO	NO	NO	84.6	394.4
	0.3	Gavari devi	1	63	F	50	2021/01/012006	O/o/o exploratory laprotomy	Ileostomy closure	100	69	84	100	SUPINE	Midaz, fenta	Propofol(70mg)	Sevoflurane	Vc	6	300	5	120	165	CLINICALLY ONLY	80.2	381.9	83	98	58	100	84.2	400.9	83.4	397.1	1.2	PCM	NO	NO	NO	NO	82.1	390.9
	0.3	Jaipura ram	1	66	M	71	2021/05/006872	Rt. Renal stone	PCNL	120	76	68	100	PRONE	Midaz, fenta	Etomidate(20 mg)	Iso	Vc	6.5	380	5	120	210	CLINICALLY ONLY	80	390	70	110	56	99	78.8	375.2	81.1	387	1	PCM	NO	NO	NO	NO	81.1	386.1
	0.3	jagmal singh	1	67	M	65	2022/08/010804	B/L INGUINAL HERNIA	lap.hernioplasty	133	80	75	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	CMV	6	380	5	240	260	CLINICALLY ONLY	83.2	396.2	90	124	77	100	85.4	406.6	83.1	396.1	1.1	PCM	NO	NO	NO	NO	84.4	401.9
	0.3	shashikala	2	67	F	76	2016/05/002691	ventral hernia	ipom	136	71	67	100	SUPINE	Midaz,fenta	Propofol	Isoflurane	VC	6	420	5	180	210	CLINICALLY ONLY	84.7	403.3	76	155	82	100	87.7	417.6	85.8	408.57	1.3	PCM	NO	NO	NO	NO	83.7	398.5