"EFFECT OF POSITIVE END-EXPIRATORY PRESSURE ON POSTOPERATIVE ATELECTASIS FOR OPEN ABDOMINAL SURGERY: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY"

By

Dr. SYED HAZARATH NABI

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

Under the Guidance of

Dr. SURESH KUMAR N

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PRIOR PERMISSION TO START OF STUDY

The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled **"Effect of positive end expiratory pressure on post operative atelectasis for open abdominal surgery : A prospective randomized controlled study"** being investigated by **Dr.Syed Hazarath Nabi** & Dr.Suresh Kumar N in the Department of Anaesthesiology at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

Sujatha.M.P

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Last Modified On	29/06/2024
Post Graduate Thesis	Yes
Type of Trial	Interventional
Type of Study	Surgical/Anesthesia
Study Design	Randomized, Parallel Group, Active Controlled Trial
Public Title of Study	positive end pressure ventilation effects on lungs during abdominal surgery
Scientific Title of Study	EFFECT OF POSITVE END EXPIRATORY PRESSURE ON POST OPERATIVE ATELECTASIS FOR OPEN ABDOMINAL SURGERY : A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

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Sites of Study	Name of Principal Investigator	Name of Site	Site Address	Phone/Fax/Email
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Details of Ethics Committee	Name of Committee	Approval Status	Date of Approval	Is Independent Ethics Committee?
	INSTITUTIONAL ETHICS COMMITTEE	Approved	20/07/2022	Yes

Regulatory Clearance Status from DCGI	Status	Date
	Not Applicable	No Date Specified

Health Condition / Problems Studied	Health Type	Condition
	Patients	Medical and Surgical

Intervention / Comparator Agent	Type	Name	Details
	Intervention	POSITIVE END EXPIRATORY PRESSURE(PEEP)	PEEP IS KEPT AT 4 CM OF H20 OR 8 CM OF H20.
	Comparator Agent	POST OPERATIVE ATELECTASIS	BY USING INTERVENTION, DEVELOPMENT OF POST OPERATIVE ATELECTASIS IN PATIENTS UNDERGOING OPEN ABDOMINAL SURGERIES UNDER GENERAL ANAESTHESIA ARE ASSESSED USING THE ULTRASOUND IN THE PRE OP AND 30 MINUTES AFTER THE SURGERY IN BOTH LUNGS , WHERE EACH LUNG IS DIVIDED INTO 6 QUADRENTS.

Inclusion Criteria

Inclusion Criteria	
Age From	18.00 Year(s)
Age To	99.00 Year(s)
Gender	Both
Details	PATIENT OLDER THAN 18 YRS OF AGE AND UNDERGOING OPEN ABDOMINAL SURGERY OF EXPECTED DURATION MORE THAN 2 HOURS. PATIENTS WITH AMERICAN SOCIETY OF ANAESTHESIOLOGISTS(ASA) PHYSICAL STATUS 1 - 3 AND BODY MASS INDEX LESS THAN 35Kg/meter2.

Exclusion Criteria

Exclusion Criteria	
Details	LAPAROSCOPIC SURGERIES PREVIOUS LUNG OR THORACIC SURGERIES PERSISTANT HAEMODYNAMIC INSTABILITY HISTORY OF COPD SYSTEMIC CORTICOSTERIOD THERAPY RECENT IMMUNOSUPPRESSIVE MEDICATION AND RADIOTHERAPY SEVERE CARDIAC DISEASE AS NYHA CLASS 3 -4 PREGNANCY ACUTE LUNG INJURY OR ARDS

Method of Generating Random Sequence	Computer generated randomization
Method of Concealment	Not Applicable
Blinding/Masking	Participant and Investigator Blinded

Primary Outcome

Outcome	Timepoints
TO COMPARE THE EFFECT OF POSITIVE END EXPIRATORY PRESSURE UNDER GENERAL ANAESTHESIA FOR OPEN ABDOMINAL SURGERIES MORE THAN 2 HOURS OF DURATION ON POST OPERATIVE ATELECTASIS	LUNG ULTRASOUND IS PERFORMED IN PREOPERATIVE ROOM BEFORE SURGERY AND 30 MINUTES AFTER THE SURGERY

Secondary Outcome

Outcome	Timepoints
TO DETERMINE THE DEGREE AND INCIDENCE OF HYPOTENSION DURING THE INTRAOPERATIVE MECHANICAL VENTILATION TO DETERMINE THE INCIDENCE OF INCREASED AIRWAY PRESSURES AND BAROTRAUMA DURING INTRAOPERATIVE MECHANICAL VENTILATION	ASSESSMENT WILL BE DONE INITIALLY FOR EVERY 5 MINUTES FOR 30 MINUTES INTIALLY FOLLOWED BY EVERY 15 MINUTES TILL THE END OF SURGERY.

Target Sample Size	**Total Sample Size=**50 **Sample Size from India=**50 **Final Enrollment numbers achieved (Total)=**50 **Final Enrollment numbers achieved (India)=**50
Phase of Trial	N/A
Date of First Enrollment (India)	10/11/2023
Date of First Enrollment (Global)	10/11/2023
Estimated Duration of Trial	**Years=**1 **Months=**10 **Days=**0
Recruitment Status of	Other (Terminated)

Trial (Global)	
Recruitment Status of Trial (India)	Completed
Publication Details	NOT YET
Brief Summary	PURPOSE OF THE STUDY:- Patients undergoing mechanical ventilation during the surgery are prone to lung atelectasis postoperatively. application of appropriate levels of PEEP and using lung protective ventilation strategies not only reduces post operative atelectasis but also decreases post operative pulmonary complications like barotrauma, ateletrauma and acute lung injury. So, we intended to study the effects of different levels of PEEP application during intraoperative ventilation on the incidence of postoperative atelectasis. in our study, we found that patients intervened with PEEP 4 or PEEP 8 did not have any postoperative atelectasis. but there was a significant hypotension, increased peak pressures, plateau pressures in the group B i.e., PEEP 8 than Group A PEEP 4.

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Abstract

Introduction: Patients undergoing general anesthesia, especially for thoracic and upper abdominal procedures, are at increased risk for developing pulmonary atelectasis in the postoperative period. In patients who are at high risk for atelectasis, PEEP is an essential method for prevention. Though PEEP offers benefits, its use is not without potential drawbacks.

Objectives: The main goal was to evaluate the impact of PEEP on postoperative atelectasis in patients having open abdominal operations under general anesthesia. In addition to estimating the frequency of barotrauma and elevated airway pressures during intraoperative mechanical ventilation, the research sought to ascertain the frequency and severity of hypotension during this procedure.

Methods: A prospective randomized controlled trial was conducted in the Department of Anaesthesiology, in Sri Devaraj urs Medical College, Tamaka, Kolar in Karnataka between January 2023 and May 2024 among adult patients (>18 years) who were posted for open abdominal surgeries as per inclusion and exclusion criteria. A total of 50 patients were randomized equally into two groups- one group (PEEP 4) received PEEP of 4cm of H2O & the other group (PEEP 8) received PEEP of 8 cm of H2O.

Results: The mean age of participants was 41.7 years. The two groups' baseline characteristics were similar. None of the two groups developed post-operative atelectasis in 30 minutes of the postoperative anaesthesia care unit (PACU) in our

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Date:

Place: Kolar **Dr. SYED HAZARATH NABI**

TABLE OF CONTENTS

ABBREVIATIONS

PEEP	Positive End Expiratory Pressure
POCUS	Point-of-care lung Ultrasound
NIV	Non- Invasive Ventilation
ZEEP	Zero cm of H2O PEEP
GA	General Anaesthesia
FRC	Functional Residual Capacity
ALI	Acute Lung Injury
ΔP	Driving Pressure
PPCs	Postoperative Pulmonary Complications
ICU	intensive care patients
ARDS	Acute Respiratory Distress Syndrome
EIT	electrical impedance tomography
iPEEP	individualized positive end-expiratory pressure
ASA	American Society of Anaesthesiologists
CTRI	Clinical Trails Registry – India
HR	Heart Rate

MAP	**MEAN ARTERIAL PRESSURE**
ETCO2	**END-TIDAL CARBON DIOXIDE**
RR	**RESPIRATORY RATE**
SPO2	**PERIPHERAL CAPILLARY OXYGEN SATURATION**
PACU	**POST ANAESTHESIA CARE UNIT**
LUS	**LUNG ULTRASOUND**
SBP	**SYSTOLIC BLOOD PRESSURE**
DBP	**DIASTOLIC BLOOD PRESSURE**
ARISCAT	**ASSESS RESPIRATORY RISK IN SURGICAL PATIENTS IN CATALONIA SCORE**
EELV	**END EXPIRATORY LUNG VOLUME**
TV	**TIDAL VOLUME**

EFFECT OF POSITIVE END-EXPIRATORY PRESSURE ON POST-OPERATIVE ATELECTASIS FOR OPEN ABDOMINAL SURGERY: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

ABSTRACT

Introduction:

Lung atelectasis is a commonly encountered post-operative problem in patients who undergo general anaesthesia, particularly for upper abdominal and thoracic surgeries. Positive end-expiratory pressure (PEEP) is a crucial strategy for preventing atelectasis, particularly in high-risk patients. Though PEEP offers benefits, its use is not without potential drawbacks.

Objectives:

The primary objective was to compare the effect of PEEP in patients undergoing general anaesthesia for open abdominal surgeries on postoperative atelectasis. The study also aimed to determine the incidence and degree of hypotension during intraoperative mechanical ventilation and estimated the incidence of barotrauma and increased airway pressures during intraoperative mechanical ventilation.

Methods:

A prospective randomized controlled trial was conducted in the Department of Anaesthesiology, in Sri Devaraj urs Medical College, Tamaka, Kolar in Karnataka between January 2023 and May 2024 among adult patients (>18 years) who were posted for open abdominal surgeries per inclusion and exclusion criteria. A total of 50 patients were randomized equally into two groups- one group (PEEP 4) received PEEP of 4cm of H_2O & the other group (PEEP 8) received PEEP of 8 cm of H_2O.

Results:

The mean age of participants was 41.7 years. The two groups' baseline characteristics were similar. None of the two groups developed post-operative atelectasis in our study's 30 minutes in the postoperative anaesthesia care unit (PACU). The two groups were comparable in terms of Duration of Surgery, Duration of Anaesthesia, Fluid requirement, and tidal volume. We observed that PEEP 8 was associated with more hypotension than PEEP 4 (24% vs 4%, $p<0.05$). Only one patient in the PEEP 8 group required a blood transfusion, whereas no blood transfusion was required in the PEEP 4 group.

Conclusion:

PEEP might have a direct role in preventing postoperative atelectasis. PEEP 4 has a greater hemodynamic advantage than PEEP 8. Individual pre-operative assessment is important while deciding between PEEP 4 and PEEP 8

Keywords: PEEP, postoperative atelectasis, hypotension, lung ultrasound, POCUS

LIST OF TABLES

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INTRODUCTION

Lung atelectasis is a commonly encountered post-operative problem in patients who underwent general anaesthesia, particularly for upper abdominal and thoracic surgeries. Open abdominal surgeries are major procedures often requiring general anaesthesia for pain management and muscle relaxation. While these surgeries are essential for various conditions, they can lead to postoperative complications, including atelectasis. Atelectasis is the partial or complete collapse of lung units, hindering gas exchange and potentially leading to serious respiratory problems. Several strategies can be implemented to prevent postoperative atelectasis:

- Pain management
- Incentive spirometry
- Chest physiotherapy
- Positive end-expiratory pressure (PEEP)

The Role of PEEP

PEEP is a crucial strategy for preventing atelectasis, particularly in high-risk patients. By applying a small amount of pressure to the airway at the end of exhalation, PEEP:

- Maintains alveolar recruitment, keeping alveoli open and preventing collapse.
- Improves ventilation distribution, ensuring that air reaches all lung regions.
- Reduces atelectasis formation and promotes gas exchange.
- PEEP reduces the pressure difference between the alveoli and the surrounding tissues (transpulmonary pressure). This helps prevent alveoli's collapse, especially in dependent lung regions (areas of the lung that are lower down). [1]

Controversies and Considerations with PEEP

While PEEP offers benefits, its use is not without potential drawbacks:

- **Barotrauma:** High PEEP levels can increase pressure in the airways, potentially causing barotrauma, a condition where air leaks from the alveoli into surrounding tissues.
- **Hemodynamic effects:** PEEP may elevate intrathoracic pressure, potentially hindering venous return and impacting cardiac output.

Determining the optimal PEEP level requires careful consideration of individual patient factors and lung mechanics.

Postoperative atelectasis, the collapse of lung units, is a frequent complication following surgery, particularly after procedures like open abdominal surgeries. Diagnosing atelectasis traditionally relies on chest X-rays, but these have limitations. There are several benefits associated with the use of lung ultrasonography at the point of care, which has become an important instrument for diagnosing postoperative atelectasis.

Limitations of Chest X-ray:

- **Sensitivity:** Chest X-rays can miss small or early atelectasis formations. [2]
- **Specificity:** Chest X-rays may not differentiate atelectasis from other conditions like pleural effusion.
- **Radiation exposure:** Repeated X-rays pose a cumulative radiation burden on patients.

Advantages of Point-of-Care Lung Ultrasound:

- **High Sensitivity and Specificity:** POCUS has been shown to be highly accurate in detecting atelectasis, with sensitivity and specificity exceeding 90% in some studies.
- **Real-time bedside assessment:** POCUS allows for dynamic evaluation and monitoring of lung aeration at the bedside, facilitating early intervention.
- **Non-invasive and radiation-free:** POCUS avoids radiation exposure, making it a patient-friendly and repeatable tool.
- **Cost-effective:** Compared to repeated chest X-rays, POCUS can be a more cost-effective approach.

POCUS Findings in Atelectasis:

Ultrasound findings suggestive of atelectasis include:

- **Absence of the "lung line":** A healthy lung shows a characteristic horizontal gliding pleural line with each breath. In atelectasis, this line disappears due to the absence of an air-tissue interface. [3]
- **Increased pleural sliding:** The normally smooth pleural sliding becomes irregular and fragmented in atelectasis due to the opposition of lung surfaces.
- **Deep pointwise A-lines:** In healthy lungs, ultrasound waves are reflected from the pleura (generating the pleural line) and not visualized further. In atelectasis, deeper reflections from consolidated lung tissue appear as multiple vertical "B-lines." [3]

Clinical Applications of POCUS:

POCUS has several clinical applications in managing postoperative atelectasis:

- **Early detection:** Prompt identification of atelectasis allows for earlier intervention with strategies like incentive spirometry, chest physiotherapy, non-invasive ventilation (NIV), or ventilator setting adjustments.
- **Guiding interventions:** POCUS findings can guide interventions like recruitment manoeuvres to re-expand collapsed lung units.
- **Monitoring response:** POCUS allows for real-time monitoring of treatment response, helping to assess the effectiveness of interventions to improve lung aeration.
- **Serial Monitoring**: POCUS allows for repeated assessments at the bedside, enabling serial monitoring of lung re-expansion post-intervention (e.g., after suctioning or physiotherapy).
- **Reduced Radiation Exposure**: Unlike chest X-rays, POCUS does not expose patients or healthcare providers to ionizing radiation, making it safer for frequent use in the postoperative period

Pulmonary complications following the surgery, particularly post-operative respiratory failure are significant contributors to morbidity and mortality perioperatively. [4,5] GA decreases the lung volume and helps in atelectasis formation. The atelectasis lung is associated with a reduction in both the gas exchange process [6]. Evidence from high-level clinical trials indicates that mechanical ventilation may result in the worsening of the already injured lung among critically ill patients. Research done by Miskovic A. et.al., [7] and Haller G. et.al., [8] have put forward that low tidal volumes benefited the participants who require prolonged mechanical ventilation without having lung injury.

Mechanical ventilation is required for patients who undergo surgeries under GA. Increased tidal volumes can expand non-injured lungs, especially the nondependent lung tissue. These effects may stress the non-injured lung during surgical procedures, causing local inflammation and coagulation. (9) Prospective and retrospective research have indicated the potential benefits of low tidal volumes for patients on mechanical ventilation for shorter duration due to surgery. (10,11) The positive effects of intraoperative mechanical ventilation for shorter duration with low tidal volumes on pulmonary integrity remain unclear. (12) Additionally, PEEP with zero cm of H_2O (ZEEP) or lower levels of PEEP may cause atelectasis. This leads to repetitive reopening and collapse of dependent lung tissue. [13-15]

PEEP directly influences the oxygenation in the airway. It also has an indirect influence on ventilation. PEEP has the following advantages-

- Increase in oxygenation- PEEP enhances oxygenation based on Henry's law; it increases the oxygen partial pressure in the alveoli and thereby, the dissolved oxygen. Therefore, the pressure of the gas on the surface of the solution is precisely proportional to the solubility of a gas in a liquid, according to this theory. As a similar point of reference, a rise in PEEP causes an increase in the pressure inside the system, which in turn causes an increase in the solubility of oxygen. Therefore, the diffusion of oxygen through the alveolocapillary membrane becomes larger and there is an increase in the oxygen carried in the blood. (16)
- PEEP also helps to minimize or eradicate the VQ mismatches. PEEP on the airway can also stent or "prop" airways that are otherwise occluded by decreasing atelectasis, improving alveolar ventilation, and thus decreasing VQ mismatch. (17)

- Extrinsic positive end-expiratory pressure (PEEP) also decreases the amount of effort required to breathe in a very substantial way. The fact that this is indicated in equations studies (18 and 19) is of great significance for individuals who have lungs that are rigid and have poor compliance. In patients who are intubated and have limited compliance, the effort required to breathe may often constitute a large portion of their overall energy consumption. At most it may rise to 30% In very rare circumstances however it may reach up to 30%. This increases the effort and hence leads to high production of CO_2 and lactate. Therefore, by lessening the work through PEEP, one can lessen the production of both CO_2 and lactate.

OBJECTIVES OF THE STUDY

Primary objective

The primary objective was to compare the effect of PEEP in patients undergoing general anaesthesia for open abdominal surgeries on postoperative atelectasis in the PACU 30-minute period.

Secondary objectives

1. To determine the incidence and degree of hypotension during intraoperative mechanical ventilation.
2. To estimate the incidence of barotrauma and increased airway pressures during intraoperative mechanical ventilation.

REVIEW OF LITERATURE

The term "atelectasis," which originates from the Greek terms "ateles" and "ektasis," refers to inadequate expansion and is characterized by the collapse of lung tissue. It is characterized by a decrease in lung volume, which may impact either the whole lung or a section of the lung, and it may or may not be accompanied by a shift in the mediastinum. It differs from consolidation, in which lung volume remains normal.

In clinical scenarios, a combination of both atelectasis and consolidation is often observed. Atelectasis often shows up in anaesthesia and critical care settings. It comes in two types: "obstructive" and "non-obstructive," each with its own distinct radiological patterns. Among these, obstructive atelectasis is a common reason for lung collapse in all age groups. Atelectasis occurs due to the following mechanisms

- Compression of lung tissue which is known as “compressive atelectasis”
- Air absorption in the alveolus – “resorptive atelectasis”
- An Impaired production/functioning of surfactant.

Types of atelectasis **(16)**

Obstructive atelectasis commonly arises from bronchial obstruction, often attributed to factors such as neoplasms, mucus plugs, or foreign bodies, leading to progressive collapse of the airways distal to the blockage. Conversely, non-obstructive atelectasis encompasses various subtypes, notably compressive atelectasis, where peripheral tumours, bullae, or air trapping such as emphysema exert pressure on the adjacent healthy lung.

Passive atelectasis which is also familiar as relaxation atelectasis, occurs due to the separation between the parietal and visceral pleura, typically induced by conditions like pneumothorax, pleural effusion, or pleural malignancies. Adhesive atelectasis, caused by surfactant deficiency or inactivation, is seen in conditions like radiation pneumonitis, neonatal respiratory distress syndrome, and severe acute lung injury. Atelectasis which arises from scar tissue formation due to conditions such as granulomatous disease or necrotizing pneumonia known as cicatrizing atelectasis.

In this article, we aim to provide information on mechanisms, diagnosis, pathophysiology, and care of pulmonary atelectasis within the contexts of GA and critical care.

Atelectasis in Relation with General Anaesthesia

Atelectasis is one of the issues that is often observed in patients who underwent general anaesthesia and is one of the most widespread complications among critically ill patients with different diseases. [17, 18] The collapse of the lung tissue of about 10–15% approximately can be developed following uneventful anaesthesia. Several mechanisms contribute to atelectasis during GA.

One such mechanism is compression atelectasis, where the functional residual capacity (FRC) decreases as patients transition from an upright to a supine position. Anaesthesia-induced abdominal pressure transmission to the thoracic cavity further reduces FRC. Surgical manipulations during procedures like thoraco-abdominal surgeries can worsen atelectasis. Factors such as morbid obesity, laparoscopic procedures, and specific patient positions also contribute, along with deliberate lung collapse during one-lung anaesthesia.

Absorptive atelectasis can occur through two mechanisms:

1. Complete airway occlusion can happen due to factors like accidental bronchial intubation or mucus plugging, leading to the collapse of lung zones with less ventilation relative to perfusion. Collapse arises due to increased inspired oxygen concentrations leading to greater oxygen flux from alveoli to capillaries, causing progressive alveolar shrinkage.

Atelectasis occurs due to impaired gas exchange and lung opacification on X-rays, particularly in immobile patients or those with previously existing lung disease, obesity, or advanced age in critical care settings. The pathophysiology of critical care-related atelectasis often involves multiple factors, including obstructive, non-obstructive, or combined mechanisms, with prolonged immobility and infections being common contributors.

Acute lung injury (ALI) presents unique challenges, as atelectasis occurs alongside inflammatory fluid accumulation in alveoli. This cyclical collapse event contributes to distant organ dysfunction by inducing a localized inflammatory response and systemic release of inflammatory mediators in conjunction with enhanced neutrophil activation.

2. Surfactant depletion is another critical factor, as surfactant deficiency impairs alveolar stability, increasing the likelihood of atelectasis. [19] Surfactant which is secreted by Type II alveolar cells helps in reducing the surface tension in alveoli, thereby preventing collapse. Impaired surfactant function, often due to factors like lung infection or inflammation, can increase the effort of breathing and respiratory failure.

Pathophysiological consequences of atelectasis

Reduced compliance: Atelectasis leads to a reduction in lung compliance, resulting in decreased lung volume. This alteration in breathing dynamics causes inspiration and expiration to initiate from a lower Functional Residual Capacity (FRC). As a result, respiratory cycles operate less efficiently on the pressure-volume curve, necessitating an increase in transpulmonary pressure to achieve a specific tidal volume. This increased pressure requirement adds extra workload to breathing.

Impaired oxygenation: The impact of atelectasis on systemic oxygenation is significant, primarily due to inadequate ventilation of perfused lung units. The effect was initially observed in general anaesthesia (GA) and could be reversed through passive hyperinflation.

Increase in pulmonary vascular resistance: lung regions with regional hypoxia and atelectasis trigger hypoxic pulmonary vasoconstriction, driven by reduced venous oxygen tension and arterial oxygen tension. In severe cases, this response may lead to increased microvascular fluid leak and right ventricular dysfunction in vulnerable patients.

Atelectasis that develops during or after surgery due to anaesthetic complications can present with various clinical manifestations. (20-23) Some common presentations include:

- Hypoxemia: A primary clinical feature of atelectasis is impaired gas exchange, leading to decreased oxygen levels in the blood. Hypoxemia manifests as shortness of breath, confusion and cyanosis.
- Respiratory distress: Patients with atelectasis may experience difficulty breathing, rapid breathing (tachypnoea), and chest tightness or discomfort. Respiratory distress can range from mild to severe depending on the extent of lung collapse.

- Decreased breath sounds: On auscultation of the chest, the healthcare providers may observe decreased or absent breath sounds over the affected lung area. This finding is indicative of diminished air movement in the affected region.
- Reduced chest expansion: Physical examination may reveal a decrease in movement of the chest wall on the affected side during breathing. Reduced chest expansion is a result of lung collapse and can contribute to respiratory compromise.
- Increased heart rate: In response to hypoxemia and respiratory distress, the heart rate may increase as the body attempts to compensate for inadequate oxygenation.
- Coughing: Patients may exhibit a persistent cough, which can be non-productive or produce minimal amounts of sputum. Coughing is a reflexive response to airway irritation and may accompany atelectasis.
- Fever: In some cases, atelectasis-related complications such as infection or inflammation may lead to fever. Increased body temperature indicates the presence of an underlying respiratory complication.

For the mechanics of pulmonary atelectasis in the perioperative period, Zeng et al. (24) have described them. Atelectasis happens when the forces that cause lung collapse: positive pleural pressure, and surface tension overcome the forces that cause lung expansion: alveolar pressure, and lung parenchyma tethering.

This condition reduces the lung's ability to stretch and inhibits adequate oxygen supply to the required levels. Furthermore, it is well appreciated that atelectasis can provoke local tissue reactions including immunoparesis, inflammation, and disruption of the alveolar-capillary membrane. Consequently, this may lead to a reduction in the clearance of fluid from the lungs, an increase in the permeability of proteins, and an increased risk of infection.

Ventilation of a lung with inhomogeneous aeration, for example, if it contains atelectatic tissue, may further harm the lung through biomechanical mechanisms including force concentration, interface transmission, and distant overdistension. Understanding the pathophysiology of atelectasis is critical for clinicians for optimal clinical management.

Xu et al. (25) conducted a randomized trial with 50 patients to explore the utility of driving pressure (ΔP) in guiding ideal ventilatory settings for preventing postoperative pulmonary complications (PPCs), in elderly laparoscopic patients. They showed beneficial effects like superior intraoperative oxygenation, respiratory mechanics and less postoperative pulmonary atelectasis with individualized ΔP guided PEEP. The PEEP titration group (DV) showed lower lung ultrasound scores and better static compliance Cstat as well as ΔP compared to the control ventilation group (CV) when compared with a fixed PEEP level. The DV group showed improved lung static compliance (Cstat) and driving pressure ΔP compared to the control throughout the surgery.

Hartland et al.'s (26) study delves into the significance of sighs as a normal reflex in maintaining lung compliance and reducing atelectasis, a reflex abolished by general anaesthesia, leading to widespread atelectasis in patients. Given the correlation between atelectasis and pulmonary complications postoperatively, which elevate healthcare costs, the alveolar recruitment manoeuvres have emerged as a potential solution to recruit alveoli that are collapsed, improve arterial oxygenation and enhance gas exchange. However, the literature lacks consensus on their benefits, warranting a systematic review to clarify their utility. Their search strategy, encompassing databases like PubMed and the Cochrane Library, along with reference lists up to January 2014, identified six randomized controlled trials meeting inclusion criteria. These trials employed different ARMs, including increasing tidal volume and PEEP stepwise, or performing manual inflations using the anaesthesia reservoir bag. It was observed that subjects in the alveolar recruitment manoeuvre groups had better intraoperative oxygenation and improved lung compliance. Surprisingly, all the different manoeuvres were of fairly similar efficacy, with the added benefit when applied together with PEEP. In conclusion, the study suggests instituting alveolar recruitment manoeuvres followed by PEEP during general anaesthesia induction and maintenance, along with implementation in response to declining oxygen saturation. This approach can help safely lower the patient's inspired oxygen concentration while maintaining acceptable oxygen saturation, which may have positive effects on patient outcomes and postoperative pulmonary morbid events.

Thus, Pettenuzzo et al. (27examined and meta-analyzed randomized controlled trials (RCTs) in order to determine the impact that high PEEP has on death rates in adult intensive care unit patients who are receiving invasive mechanical ventilation. individuals with acute respiratory distress syndrome (ARDS) were not included in the study, but they did take into account individuals who were competent and had a mean age of 59 years. Their electronic search of several databases up to June 16, 2021, plus other sources, found 22 RCTs with 2,225 patients comparing high PEEP (1,007) and low PEEP (991). It was determined that there was no statistically significant connection between high PEEP and hospital mortality; hence, the level of trust in the data was lacking. In spite of this, it has been shown that positive end-tidal pressure (PEEP) may improve oxygenation, increase compliance of the respiratory system, and lower the risk of hypoxemia and acute respiratory distress syndrome (ARDS). Also, no significance was found in barotrauma, hypotension, ventilator days, days in the hospital, and death in the ICU between the two groups of PEEP. Based on the information presented in this study, there was no considerable impact on the mortality rate of the patients who were not diagnosed with ARDS and who required invasive MV, even when the level of PEEP was increased. The authors advised that more high-quality large-scale RCTs should be conducted to support these findings.

Another study conducted by Severgnini et al. (28) was aimed at identifying intraoperative MV in open abdominal surgery; they evaluated the consequence of intraoperative MV on postoperative pulmonary complications. In the course of this prospective randomized clinical trial, which included 56 patients who were scheduled to undergo elective open abdominal surgery lasting more than two hours, patients were assigned to one of two groups: the tidal volume was 9 ml/kg of ideal body weight without PEEP; or the protective ventilation group who intended to be ventilated with a tidal volume of 7 ml/kg of ideal body weight, PEEP of 10 cm H2O and recruitment manoeuvres. Some of the accomplishments of the study that was carried out included; the modified Clinical Pulmonary Infection Score, and the postoperative pulmonary activity of the patients involved. The findings presented revealed that the patients under protective ventilation had better PFTs in the first, third, and up to fifth POD, less chest x-ray changes up to the third POD, and better PaO_2/FiO_2 up to the first, third, and fifth POD. Additionally, the modified CPIS score was considerably lower in the group that received protected ventilation on days 1 and 3. On the other hand, the length of time that both groups spent in the hospital on day 28 after the operation was identical. According to the findings of the research, protective ventilation during open abdominal procedures that lasted for more than two hours improved lung functions and decreased the mean pleural effusion pressure (MCIPS) without affecting the length of time the patient stayed in the hospital.

Pereira et al. (29) examined the effects of using individual PEEP during general anaesthesia for surgery on the patient's lung function and the incidence of PPC in abdominal surgery. Thus, 40 patients of SWLD posted for elective abdominal surgery in this surgery were enrolled in this study. They compared standard (4 cm H2O) institutional PEEP with EIT-guided minimally collapsing and over distending lung simultaneously challenging homogenous ventilation goal for titration of pressure support levels. With a median of 12 cm H2O, the EIT-guided PEEP resulted in considerable variability across subjects. Patients who received EIT-guided PEEP had less postoperative atelectasis and lower intraoperative driving pressure compared with patients on fixed of 4 cm H2O. Moreover, this group achieved better intraoperative oxygenation without hemodynamic adversities. The authors' findings pointed to the fact that individual PEEP mechanically decreased the process of postoperative atelectasis formation in patients after abdominal surgeries.

The researchers Zhu et al. (30) carried out a study that was both prospective and randomized controlled. The purpose of this study was to investigate the efficacy of iPEEP in obese patients who were scheduled to undergo laparoscopic stomach volume reduction. During and after the operation of laparoscopic abdominal surgery, patients who are obese and are under general anaesthesia with mechanical breathing are more likely to have postoperative complications (PPCs). This susceptibility has been discovered by numerous factors. Impact of routine Positive End-Expiratory Pressure and an individually derived 'Best' Low- Airway pressure to prevent intraoperative Lung Injury under General Anaesthesia on a computed tomography scan. Eighty obese patients were enrolled and divided into two groups randomly as follows; control group (PEEP5 group), or iPEEP. The PEEP5 group was treated with a fixed PEEP of 5 cmH2O, and the iPEEP group was given an individualized level of PEEP calculated by taking into account Cstat according to their titration procedure. Both groups underwent standard lung-protective ventilation practices. The primary endpoints were postoperative pulmonary atelectasis detected by chest EIT and intraoperative oxygen index. The secondary outcome consists of serum IL-6, TNF-α and organ dysfunction (MODS), procalcitonin (PCT) dynamics, PPC occurrence after surgery, days in hospital, and hospital cost. This trial was designed to offer data concerning a potentially viable method of PEEP titration based on Cstat during GA in Obese patients to reduce PPCs. Therefore, the authors stressed the fact that varying PEEP levels along with lung protective ventilation should be the protocol for such patients.

RESEARCH QUESTION:

Will PEEP application in patients posted for open abdominal surgeries under GA with mechanical ventilation, decrease the incidence of postoperative atelectasis?

NULL HYPOTHESIS

Application of PEEP in patients who have undergone open abdominal surgeries under GA and mechanical ventilation will not decrease the occurrence of postoperative atelectasis.

HYPOTHESIS

Using PEEP in patients with open abdominal surgeries in general anaesthesia with mechanical ventilation will assist in reducing the incidence of atelectasis in the postoperative period.

METHODS

Study design: A prospective randomized controlled trial

Study setting: The study was conducted in the Department of Anaesthesiology, in Sri Devaraj urs Medical College, Tamaka, Kolar in Karnataka.

Study duration: The study was conducted between 01/01/2023 to 30/05/2024.

Study participants: This study was conducted on patients above 18 years of age posted for open abdominal surgeries at R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar.

INCLUSION CRITERIA:

- Patients aged >18 years
- Patients who underwent open abdominal surgery
- The estimated duration of surgery is > 2 hours.
- Patients with American Society of Anaesthesiologists (ASA) physical status I – III and BMI less than 35kg/m^2.

Exclusion criteria:

- Laparoscopic surgery
- Previous lung or thoracic surgeries
- Persistent hemodynamic instability in patients (systolic blood pressure< 90 mm of Hg)
- Patients with chronic obstructive pulmonary disease history
- Patients on systemic corticosteroid treatment.

- Recent immunosuppressive medication and radiotherapy.
- Patients with Severe cardiac disease is defined as New York Heart Association (NYHA) class III-IV.
- Pregnancy
- Acute lung injury or ARDS

Sample Size: A total of 41 participants were recruited for the study.

Sampling Method: universal sampling was done. Randomization was done in a web-based random number generator available at www.random.org. No stratification factors were considered and block sizes were either unequal or not specified.

The sample size is determined using the G power 3.1.9.6 software [27] by taking the length of anaesthesia in patients with the impact of positive end-expiratory pressure on post-operative atelectasis patients having open abdominal operations. This information was provided in research that was carried out by Xu, Q., et al. (21). The input values taken for the calculation are as follows:

Number of groups: - 2

Calculated mean (as reported in the study) Group A: - 269

Calculated mean (as reported in the study) Group B: - 232

The standard deviation for Group A = 64

The standard deviation for Group B = 58

α error probability = 0.05

Power (1-β power probability) = 0.80

Allocation Ratio = 1: 1

Effect size f = 0.90

The minimum sample size needed for the study amounted to 41

So, for this study, we considered 50 patients in total and divided them into two groups for better statistical representation.

***Sampling procedure*:**

The study was started after Institutional Ethical Clearance (IEC) and registration with the Clinical Trials Registry – India (CTRI).

Patients were recruited after obtaining the written informed consent. The study was conducted on patients who were fit according to the inclusion criteria and were planned to undergo open abdominal surgeries.

Routine investigations such as complete blood count (CBC), serum electrolytes, urea and serum creatinine, prothrombin time, international normalized ratio (INR), and activated partial thromboplastin time were done. Besides, an electrocardiogram (ECG), and chest x-ray (CXR) were done before the surgery.

Intravenous fluids (crystalloids) will be given according to the maintenance requirement calculated according to the body weight of the patient.

Patients were assigned to two groups based on a computer-generated random table.

Group A: Receiving PEEP of 4cm of H_2O.

Group B: Receiving PEEP of 8 cm of H_2O.

Throughout the intraoperative procedure, the following parameters were measured-

- Heart rate (HR),
- Mean arterial pressure (MAP),
- End-tidal carbon dioxide(etco2),
- Respiratory rate (RR),
- Peripheral capillary oxygen saturation (SPO2),
- Blood loss, urine output, plateau pressures, and peak pressures.

Mephentermine and noradrenaline were among the vasopressors that were used intraoperatively to treat hypotension, which was defined as a systolic blood pressure that was below 90 mmHg or 20% below the initial preoperative level.

During the immediate preoperative period and 30 minutes after surgery in the post-anaesthesia care unit (PACU), lung ultrasound was performed using the Philips InnoSight Diagnostic Ultrasound System (REF: 989605460371, FCC ID: VRSAPOLLO) with a 5-6 MHz curvilinear probe to check for any lung pathologies, including lung atelectasis.

A lung ultrasound was performed by dividing the thorax into 12 segments. The lung ultrasound scoring (LUS) is done according to the modified lung ultrasound scoring system for each segment of the thorax is given as follows:

Table 1: Lung ultrasound scoring (LUS) to classify aeration

Sl. no	Normal aeration	Small loss of aeration	Moderate loss of aeration	Severe loss of aeration
Quotation	0	1	2	3
1	0-2 B lines	≥ 3 B lines OR 1 or multiple small subpleural consolidations separated by a normal pleural line	Multiple coalescent B lines OR Multiple small subpleural consolidations separated by a thickened or irregular pleural line	Consolidation OR Small subpleural consolidation of >1×2 cm in diameter

Method of collection of data:

After the informed consent, the clinical, laboratory, and radiological information was abstracted from patients' records in a predesigned proforma.

The following parameters were abstracted from patients' records:

- Heart rate
- Spo2 (Oxygen saturation),
- Mean arterial pressure,
- Respiratory rate,

- Peak airway pressures,
- Plateau pressures,
- Ultrasonography of lung and
- Modified lung ultrasound score

The Statistical analysis:

1. Collected data was coded and entered in an Excel sheet database.
2. All the quantitative measures were presented by (mean + / - Standard Deviation (SD)), qualitative measures like gender, confidence interval, ASA physical status, etc., by proportions and confidence interval (CI).
3. To interpret the findings, it was determined that the Chi-square test or Fisher's exact test was suitable for categorical variables, and the independent sample t-test was appropriate for continuous variables to be distributed normally.
4. A p-value < 0.05 was considered significant statistically for all tests.

Taking into account ethical issues, the Sri Devaraj Urs Medical College's institutional ethics council gave its blessing to the implementation of the research. The enrolment of patients did not take place until after the patients had provided their written informed permission.

RESULTS

We recruited a total of 50 participants, 25 in Group A: Receiving PEEP of 4 cm of H2O, and 25 in Group B: Receiving PEEP of 8 cm of H2O.

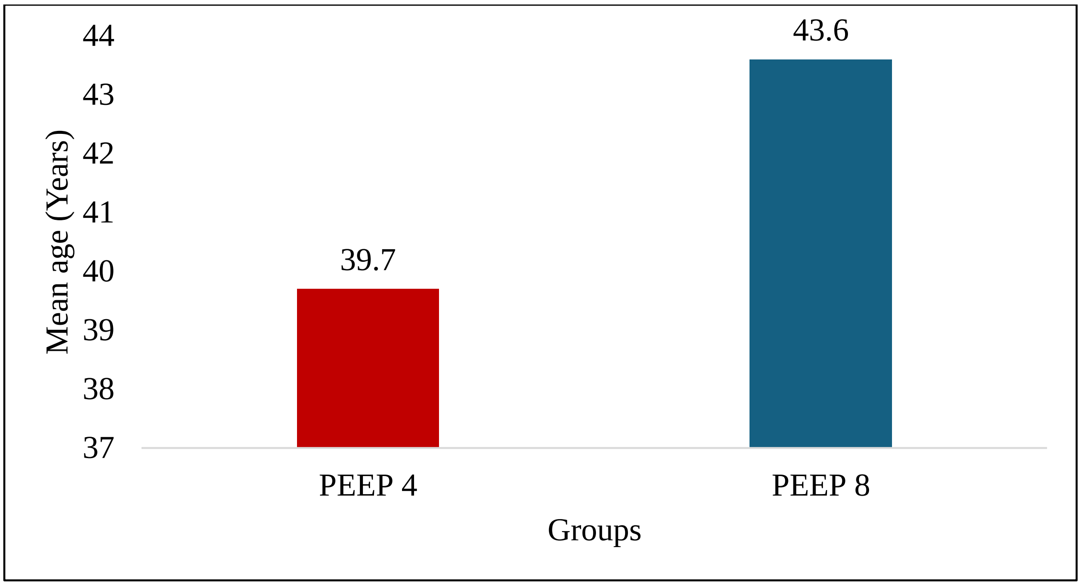
Age distribution:

There was a standard variation of 15.1 years in the participants' ages, and the mean was 41.7. The average age of the PEEP 8 group was 43.6 years, whereas that of the PEEP 4 group was 39.7 years, a little younger. In contrast, this disparity was not statistically significant ($p > 0.05$, t-test) (Table 2, Figure 1).

Table 2: Age distribution of the two groups

Mean age in years (SD)		p-value
PEEP 4	PEEP 8	
39.7 (15.5)	43.6 (14.7)	>0.05

Figure 1: Age distribution of the two groups



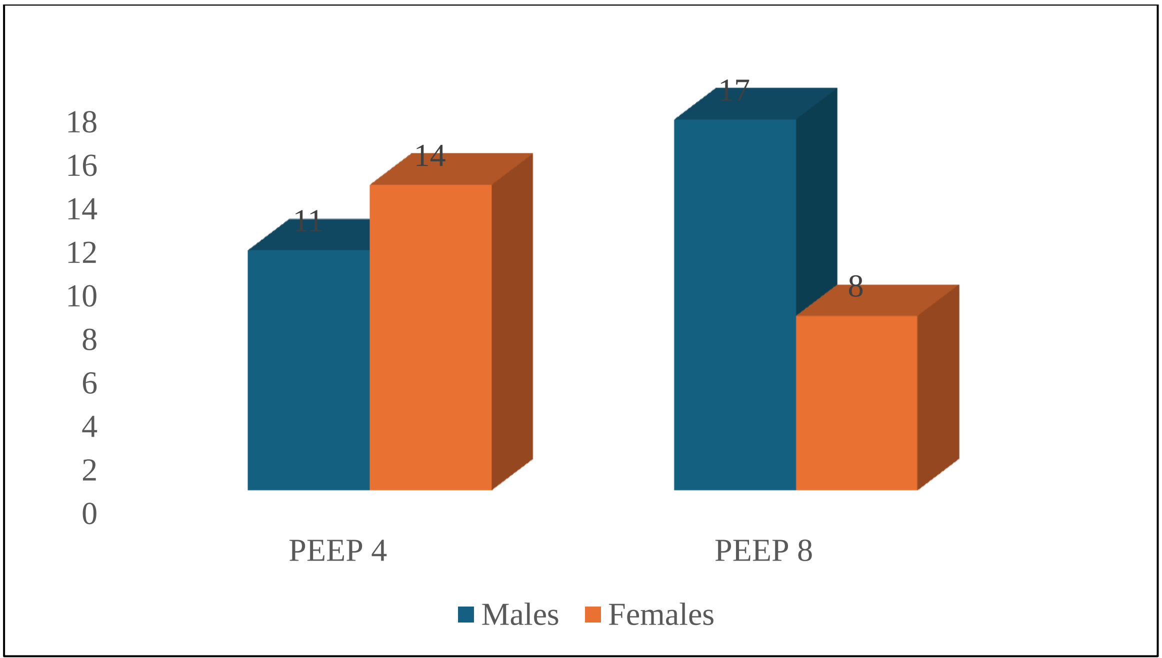
Gender distribution:

While there were 11 (36.4%) males and 14 (63.6%) females in the PEEP 4 group, the number of males and females were 17 (60.7%) and 8 (39.3%) in the PEEP 8 group, respectively. The variance was statistically insignificant (p=0.09, Chi-square test) (Table 3, figure 2)

Table 3: Gender distribution of the two groups

	Frequency (%)		p-value
Gender	PEEP 4	PEEP 8	
Males	11 (36.4)	17 (60.7)	0.09
Females	14 (63.6)	8 (39.3)	

Figure 2: Gender distribution of the two groups



Type of procedures:

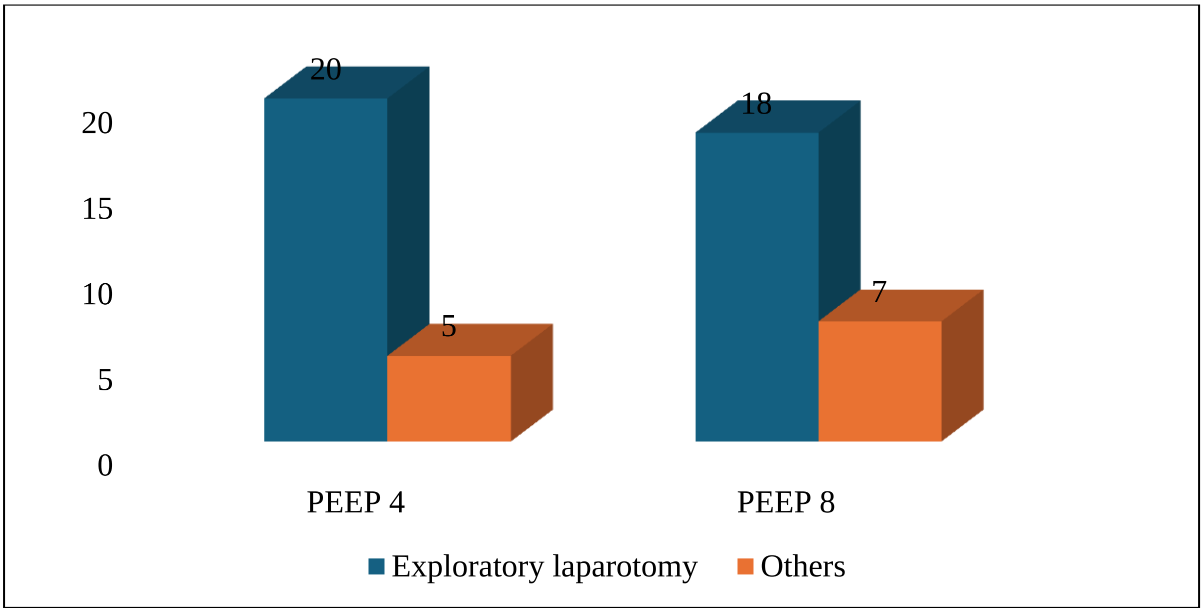
Planned Exploratory laparotomy was the commonest surgery in both the PEEP 4 group (n=20, 80%) and PEEP 8 (n=18, 72%). The variance was not statistically insignificant (p=0.74) (Table 4, Figure 3).

Table 4: Distribution of type of procedure between the two groups

Type of procedure	Frequency (%)		p-value
	PEEP 4	PEEP 8	
Planned laparotomy*	20 (80.0)	18 (72.0)	0.74
Others	5 (20.0)	7 (28.0)	

*Splenectomy etc.

Figure 3: Distribution of type of procedure between the two groups



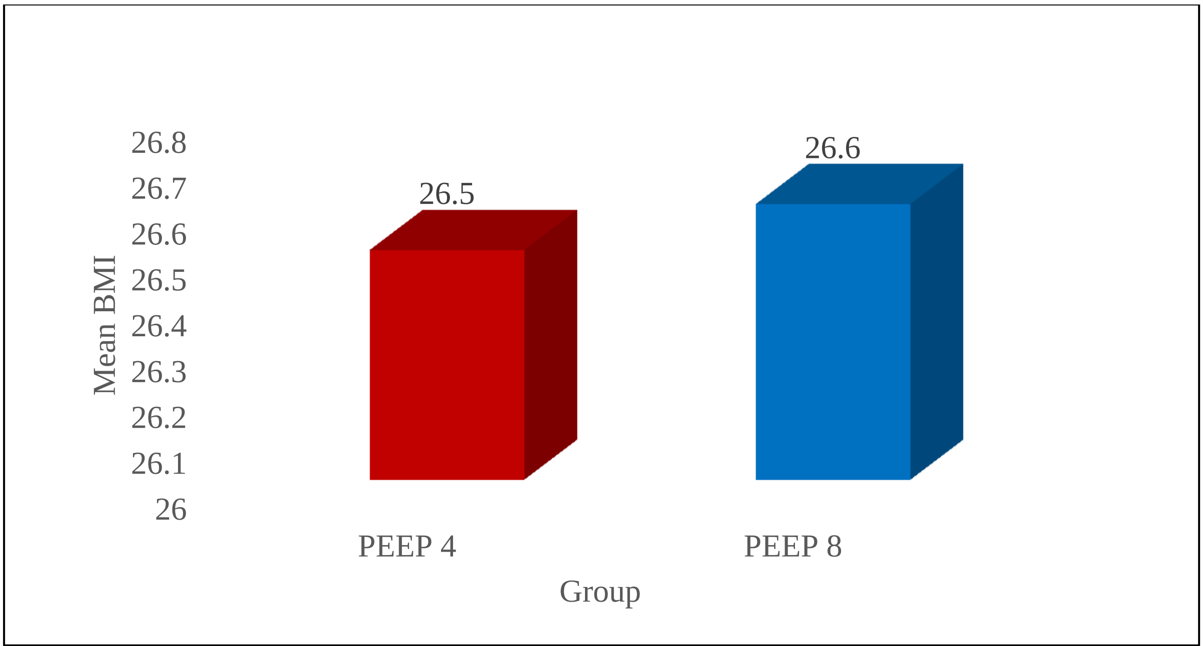
BMI distribution:

The mean BMI was 26.5 (SD 5.8) (PEEP 4 group), while the mean was 26.6 (SD 5.8) for PEEP 8 group. The variance was statistically insignificant (p 0.96, t-test) (Table 5, Figure 4)

Table 5: BMI distribution of the two groups

Mean BMI (SD)		p-value
PEEP 4	PEEP 8	
26.5 (SD 5.8)	26.6 (SD 5.8)	0.96

Figure 4: BMI distribution of the two groups



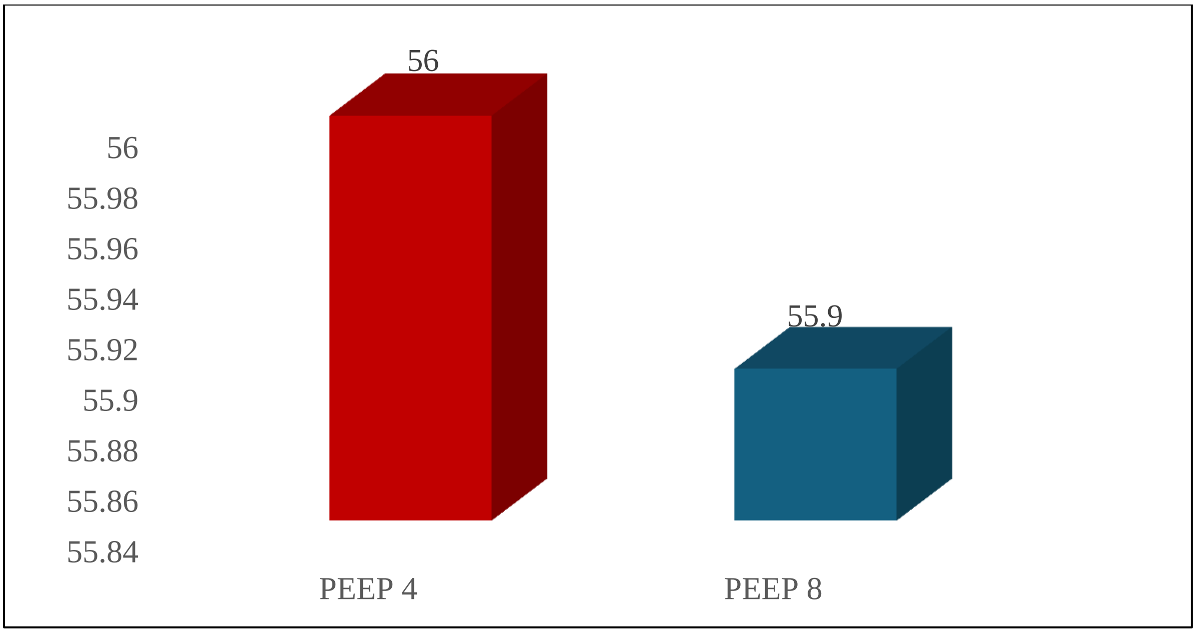
Ideal body-weight distribution:

The mean ideal body weight of the PEEP 4 group participants was 56 kg (SD 12.8 kg), while the mean ideal body weight of the PEEP 8 group was 55.9 kg (SD 13.4 kg) The variance was statistically insignificant (p 0.97, t-test) (Table 6, Figure 5)

Table 6: Ideal body-weight distribution of the two groups

Mean ideal body weight (SD)		p-value
PEEP 4	PEEP 8	
56 kg (SD 12.8 kg)	55.9 kg (SD 13.4 kg)	0.97

Figure 5: Ideal body-weight distribution of the two groups



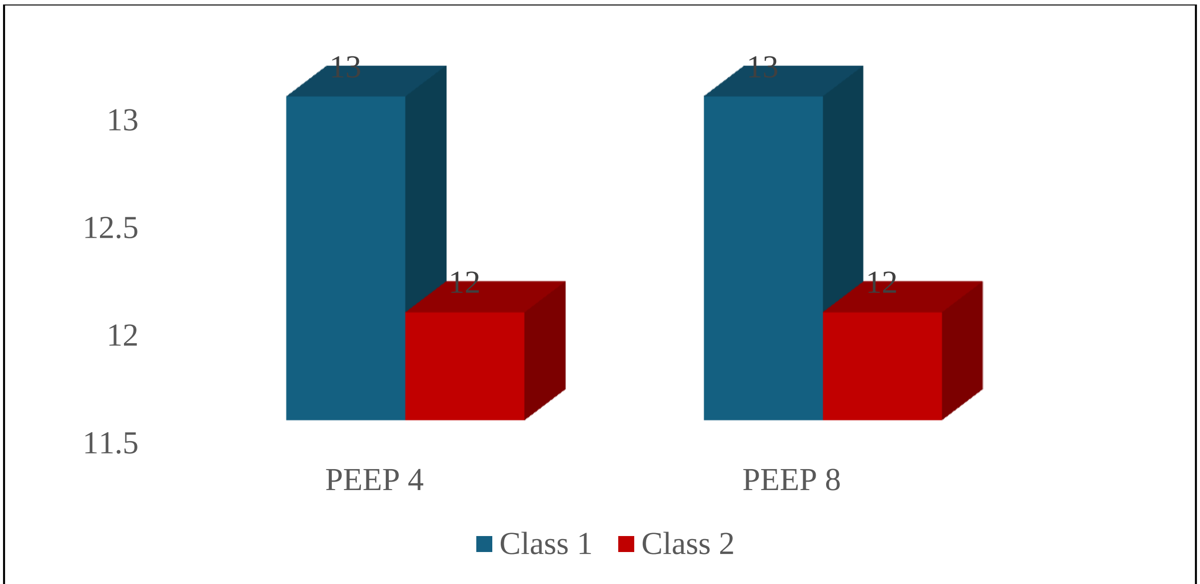
Physical status:

There were 13 participants (52.0%) in ASA class 1 and 12 participants (48%) in ASA class 2 in both groups. Hence, the two groups were statistically similar (p=1.0) (Table 7, Figure 6).

Table 7: Distribution of physical status between the two groups

Physical status	Frequency (%)		p-value
	PEEP 4	PEEP 8	
ASA class 1	13 (25.0)	13 (25.0)	1.0
ASA class 2	12 (48.0)	12 (48.0)	

Figure 6: Distribution of physical status between the two groups



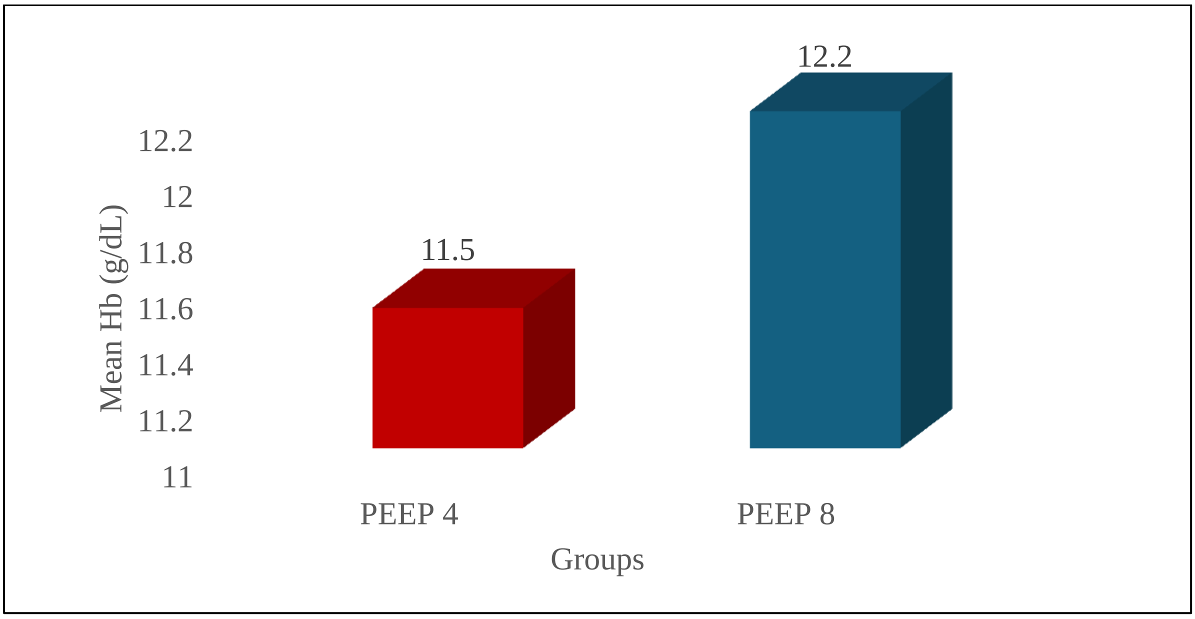
Distribution of pre-op haemoglobin:

The average pre-op Hb of the PEEP 4 group participants was 11.5 g/dL (SD 1.6 g/dL), while the average pre-op Hb of the PEEP 8 group was 12.2 g/dL (SD 1.9 g/dL) The variance was statistically insignificant (p 0.17, t-test) (Table 8, Figure 7)

Table 8: preoperative haemoglobin distribution of the two groups

Mean pre-op Hb (SD)		p-value
PEEP 4	PEEP 8	
11.5 g/dL (SD 1.6 g/dL)	12.2 g/dL (SD 1.9 g/dL)	0.17

Figure 7: Pre-operative haemoglobin distribution of the two groups



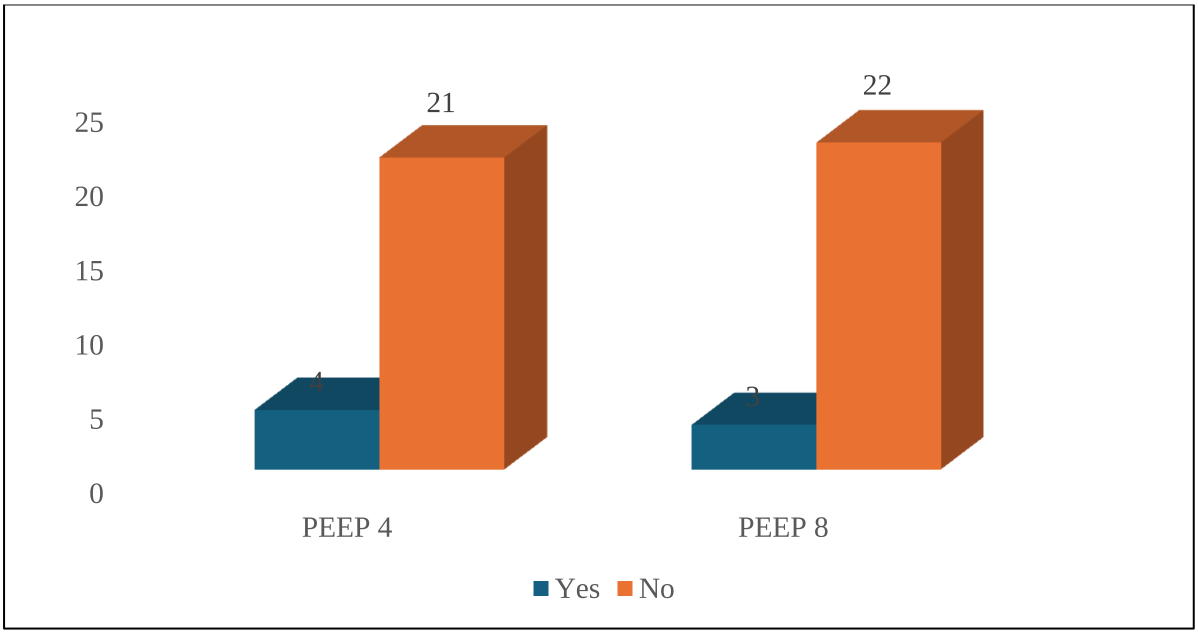
Smoking history:

While four participants (16%) in the PEEP-4 group had a smoking history, three participants (12%) in the PEEP-8 group had a smoking history. The variance was not statistically noteworthy (p=0.68) (Table 9, figure 8)

Table 9: Distribution of smoking status between the two groups

Smoking status	Frequency (%)		p-value
	PEEP 4	PEEP 8	
Yes	4 (16.0)	3 (12.0)	0.68
No	21 (84.0)	22 (88.0)	

Figure 8: Distribution of smoking status between the two groups



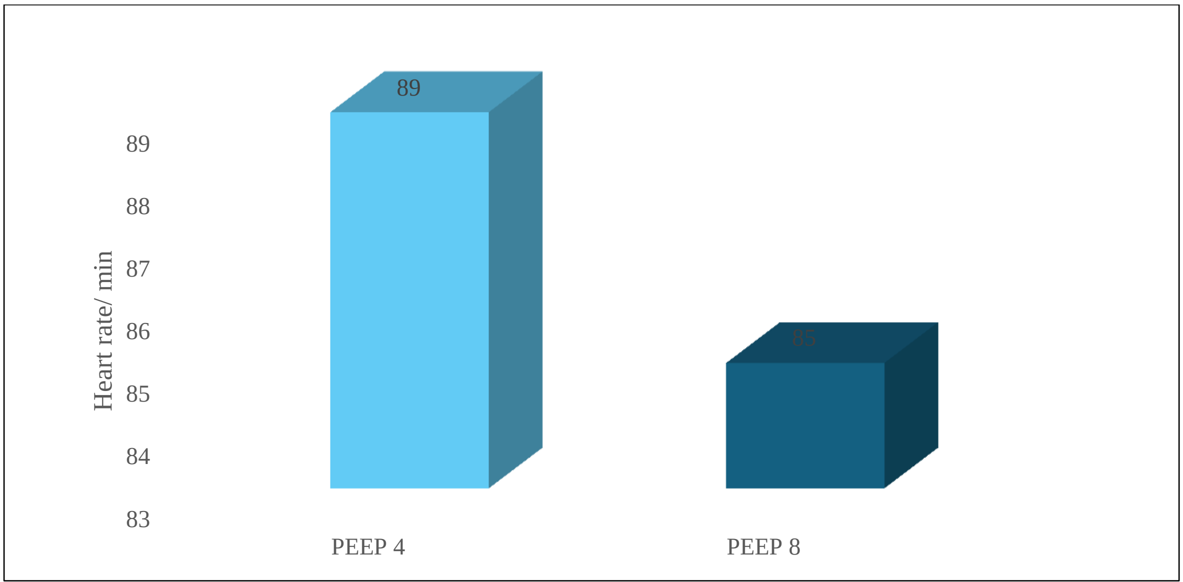
Distribution of pre-operative heart rates:

The average pre-op heart rates were a little higher in the PEEP 4 group (89 beats/min, SD 9 beats/min) than the participants of the PEEP 8 group (85 beats/min, SD 11 beats/min) The variance was statistically insignificant (p 0.14, t-test) (Table 10, Figure 9)

Table 10: Pre-operative heart rates of the two groups

Mean pre-op heart rates (SD)		p-value
PEEP 4	PEEP 8	
89 beats/min (SD 9 beats/min)	85 beats/min (SD 11 beats/min)	0.14

Figure 9: Pre-operative heart rates of the two groups



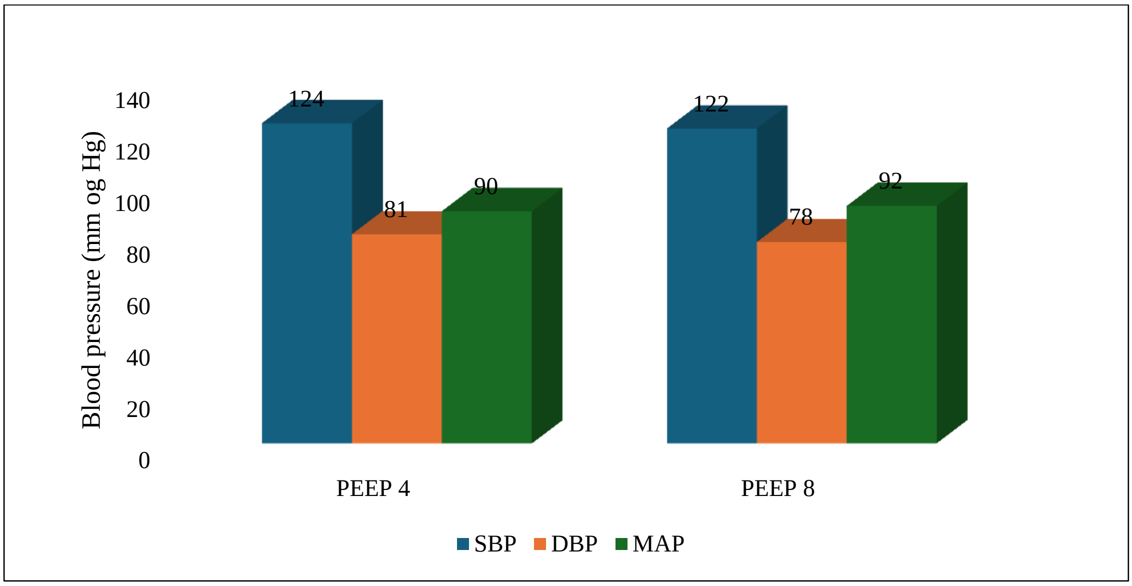
Pre-operative Blood pressure:

The mean SBP, DBP, and MAP were 124 mmHg (SD 7 mmHg), 81 mmHg (SD 7 mmHg), and 90 mmHg (SD 10 mmHg), respectively for the PEEP 4 group. The mean SBP, DBP, and MAP were 122 mmHg (SD 9 mmHg), 78 mmHg (SD 6 mmHg), and 92 mmHg (SD 6 mmHg), respectively for the PEEP 8 group (Table 11, Figure 10).

Table 11: Distribution of pre-op BP in two groups

Mean pre-op BP (SD)			p-value
Blood pressures	PEEP 4	PEEP 8	
SBP	124 mmHg (SD 7 mmHg)	122 mmHg (SD 9 mmHg)	0.4
DBP	81 mmHg (SD 7 mmHg)	78 mmHg (SD 6 mmHg)	0.2
MAP	90 mmHg (SD 10 mmHg)	92 mmHg (SD 6 mmHg)	0.32

Figure 10: Distribution of pre-op BP in two groups



Pre-op SpO2 was 100% in room air for all the participants.

ARISCAT score:

For the purpose of assessing the likelihood of a patient experiencing pulmonary problems after surgery, the ARISCAT score is used as a tool for prediction. In the PEEP 4 group, the mean ARISCAT score was 26.7 (standard deviation: 3.1), whereas in the PEEP 8 group, it was 27.1 (standard deviation: 3.15). The change did not meet the criteria for statistical significance ($p = 0.87$).

Peri-operative clinical differences

Primary outcomes

Post-operative atelectasis: None of the patients developed atelectasis during the 30-minute post-operative period. While in the pre-operative period, none of the patients had an ultrasound score >0. In the postoperative period 30 minutes after shifting to Post operative anaesthesia care unit (PACU) only 2 (4%) patients developed an ultrasound lung score of 1 which signifies only a small loss of aeration. These two patients belonged to group A.

Secondary outcomes:

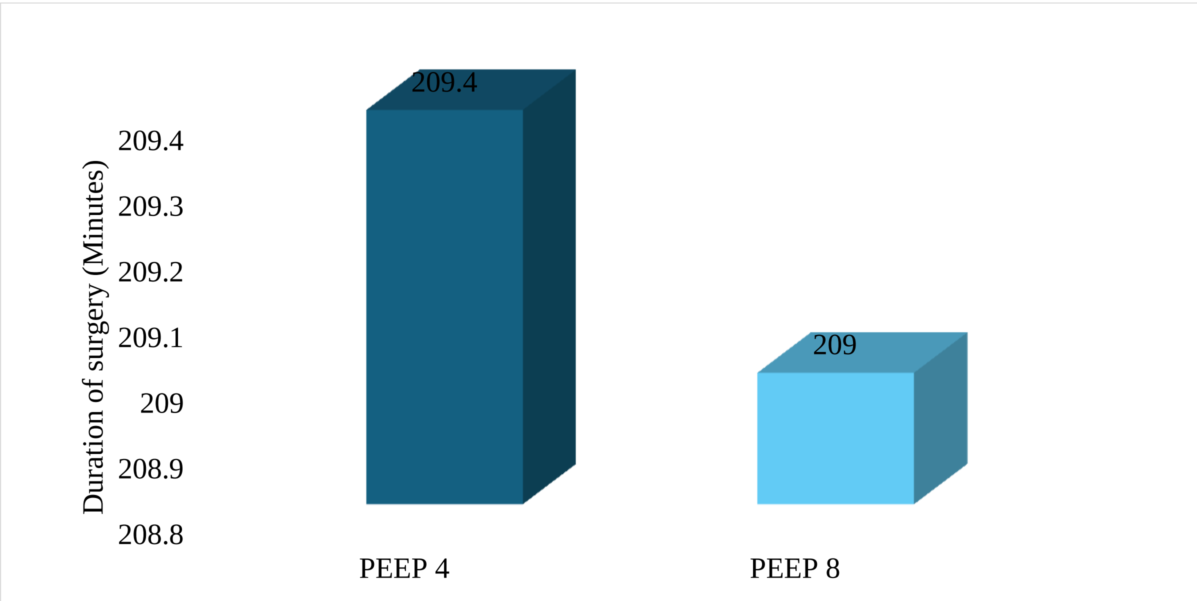
Duration of surgery: -

The participants in the PEEP 4 group had an average duration of surgery that was 209.4 minutes (standard deviation (20.3 minutes)), while the participants in the PEEP 8 group had a mean duration of surgery that was 209 minutes (standard deviation) in length. In terms of statistical significance, the difference was not significant (p = 0.94, t-test). The Table 12 and the Figure 11

Table 12: Duration of surgery of the two groups

Surgery duration (SD)		p-value
PEEP 4	PEEP 8	
209.4 minutes (SD 20.3 minutes)	209 minutes (SD 20 minutes)	0.94

Figure 11: Duration of surgery of the two groups



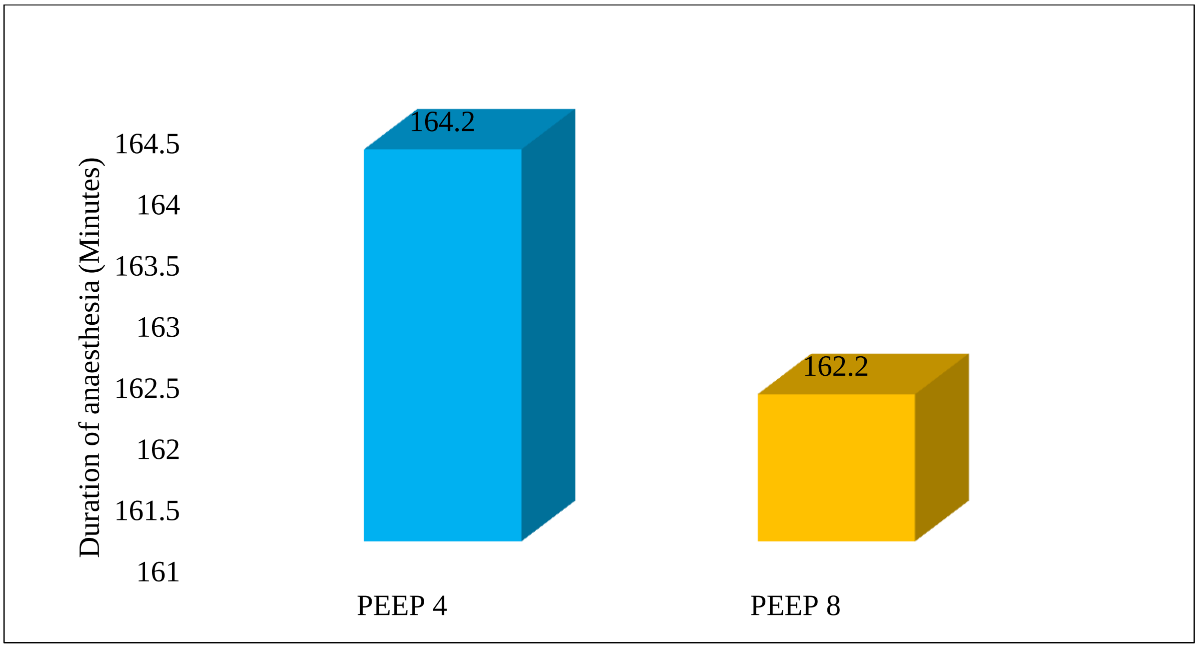
Duration of anaesthesia:

The average duration of anaesthesia in the PEEP 4 group participants was 164.2 minutes (SD 19.0 minutes) while the mean duration of anaesthesia in the PEEP 8 group was 162.2 minutes (SD 19.2 minutes). The difference was statistically insignificant (p 0.71, t-test) (Table 13, Figure 12)

Table 13: Duration of anaesthesia of the two groups

The mean duration of anaesthesia (SD)		p-value
PEEP 4	PEEP 8	
164.2 minutes (SD 19.0 minutes)	162.2 minutes (SD 19.2 minutes)	0.71

Figure 12: Duration of anaesthesia of the two groups



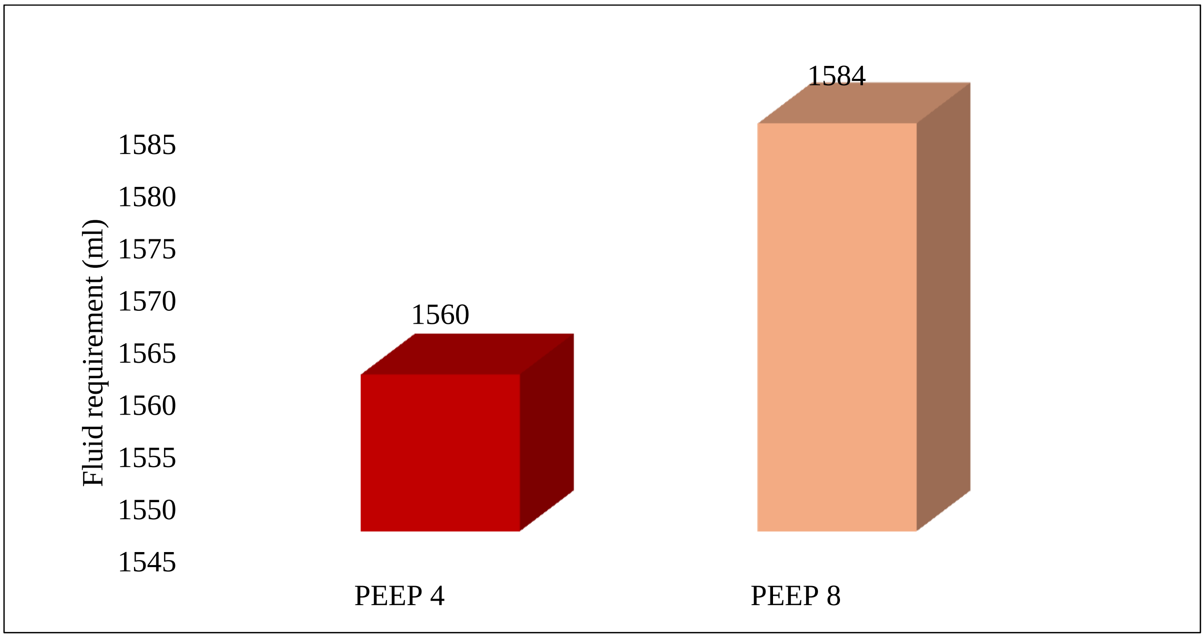
Fluid requirement:

The mean fluid requirement in the PEEP 4 group participants was 1560 ml (SD 225 ml) while the mean fluid requirement in the PEEP 8 group was 1584 (SD 229 ml). The variance was statistically insignificant (p 0.71, t-test) (Table 14, Figure 13)

Table 14: Fluid requirement of the two groups

Mean Fluid requirement (SD)		p-value
PEEP 4	PEEP 8	
1560 ml (SD 225 ml)	1584 (SD 229 ml)	0.71

Figure 13: Fluid requirement of the two groups



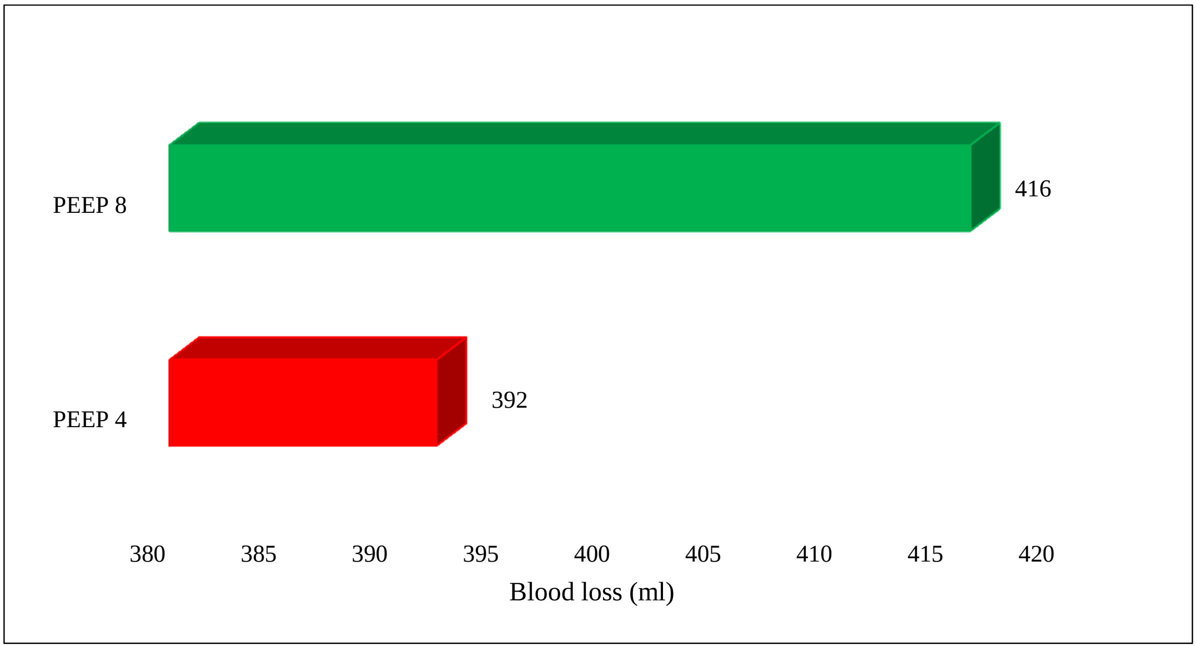
Estimated blood loss:

The average blood loss in the PEEP 4 group participants was 392 ml (SD 180 ml) while the average blood loss in the PEEP 8 group was 416 (SD 184 ml). The variance was statistically insignificant (p 0.64, t-test) (Table 15, Figure 14)

Table 15: Estimated blood loss of the two groups

Mean Estimated blood loss (SD)		p-value
PEEP 4	PEEP 8	
392 ml (SD 180 ml)	416 (SD 184 ml)	0.64

Figure 14: Estimated blood loss of the two groups



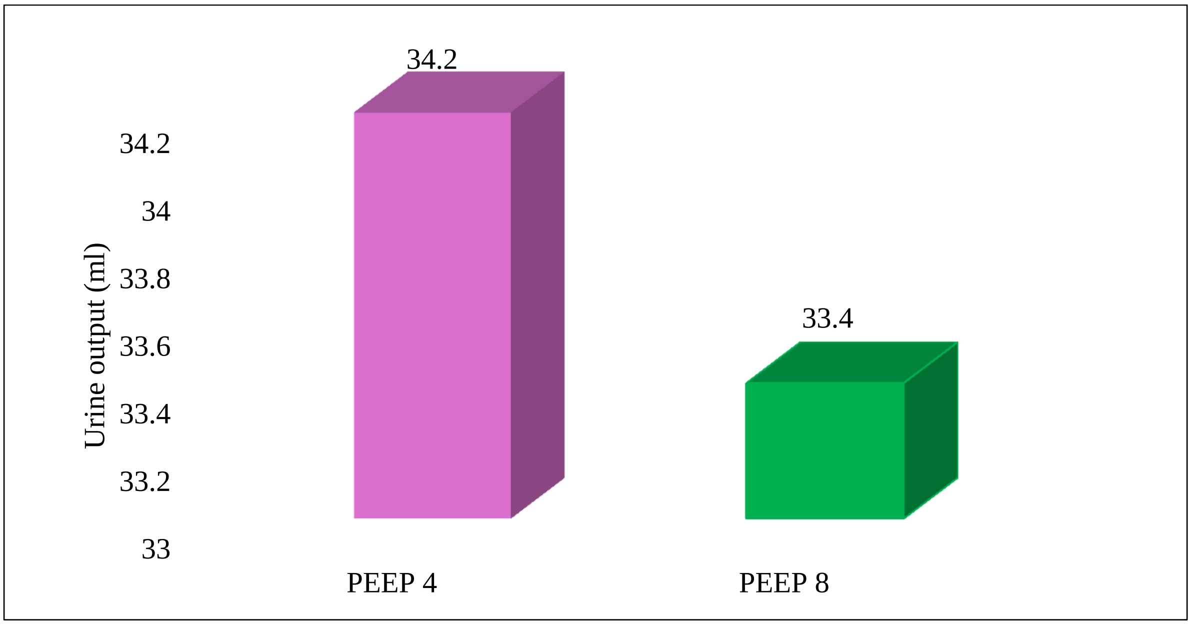
Urine output:

The mean urine output in the PEEP 4 group participants was 34.2 ml (SD 10 ml) while the mean urine output in the PEEP 8 group was 33.4 (SD 10 ml). The variance was not statistically not noteworthy (p 0.78, t-test) (Table 16, Figure 15)

Table 16: Estimated urine output of the two groups

Mean urine output (SD)		p-value
PEEP 4	PEEP 8	
34.2 ml (SD 10 ml)	33.4 (SD 10 ml)	0.78

Figure 15: Urine output of the two groups



Tidal volume (TV):

The mean TV in the PEEP 4 group participants was 448 ml (SD 102.7 ml) while the average TV in the PEEP 8 group was 447 (SD 106.9 ml). The variance was statistically insignificant (p 0.97, t-test) (Table 17, Figure 16)

Table 17: Tidal volume of the two groups

Tidal volume (SD)		p-value
PEEP 4	PEEP 8	
448 ml (SD 102.7 ml)	447 (SD 106.9 ml)	0.97

Figure 16: Tidal volume of the two groups

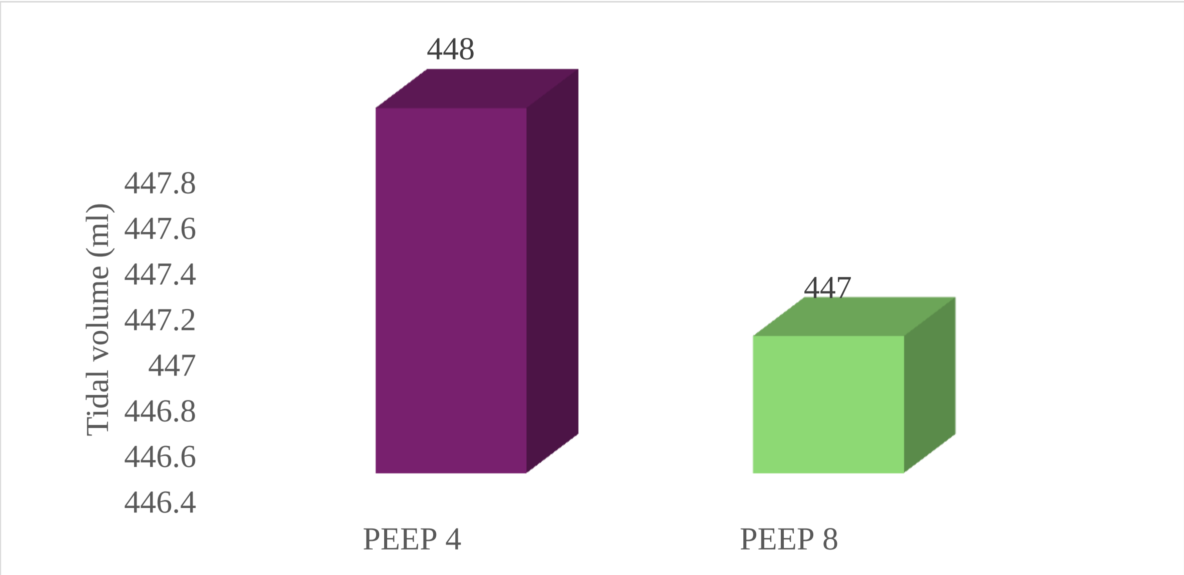


Table 18: Intra-operative parameters distribution of the two groups

Clinical variables	Per-operative clinical status (SD)		p-value
	PEEP 4	PEEP 8	
Duration of surgery	209.4 minutes (SD 20.3 minutes)	209 minutes (SD 20 minutes)	0.94
Duration of anaesthesia	164.2 minutes (SD 19.0 minutes)	162.2 minutes (SD 19.2 minutes)	0.71
Fluid requirement	1560 ml (SD 225 ml)	1584 (SD 229 ml)	0.71
Blood loss	392 ml (SD 180 ml)	416 (SD 184 ml)	0.64
Urine output	34.2 ml (SD 10 ml)	33.4 (SD 10 ml)	0.78
Tidal volume	448 ml (SD 102.7 ml)	447 (SD 106.9 ml)	0.97

Haematological differences:

Blood transfusion: Only one patient in the PEEP-8 group required blood transfusion. None of the patients in the PEEP-4 group required blood transfusion.

Vasoactive drug requirement:

None of the patients required vasoactive drugs in either of the groups.

Hypotension:

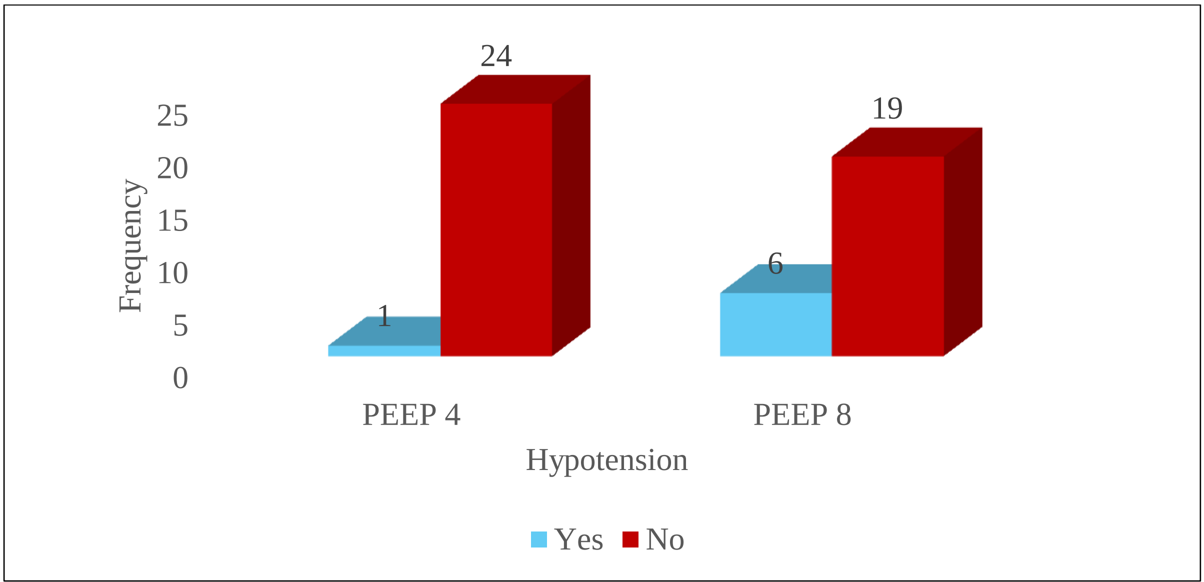
A total number of 7 (14%) participants developed intraoperative hypotension. Out of these, 1 (4%) participant belonged to the PEEP 4 group, and 6 (24%) belonged to the PEEP 8 group. The difference was statistically insignificant (p=0.04) (Table 19, Figure 17)

Table 19: Distribution of intra-operative hypotension between the two groups

Hypotension	Frequency (%)		p-value
	PEEP 4	PEEP 8	
Yes	1 (4.0)	6 (24.0)	0.04*
No	24 (96.0)	19 (76.0)	

*Statistically significant

Figure 17: Distribution of per-operative hypotension between the two groups

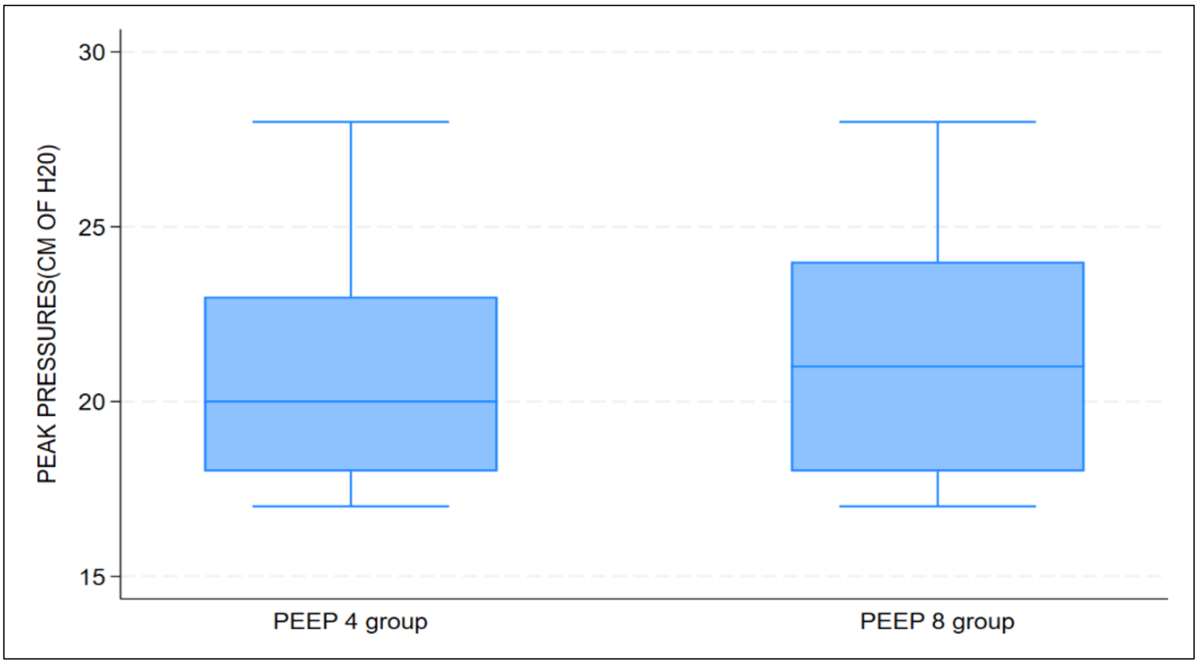


Pressure in the respiratory system:

Peak pressure:

The mean peak pressure of the PEEP 4 group was 20.68 cm of H_2O (SD 3.1 cm of H_2O) and the mean was 21.5 cm of H_2O (SD 3.5 cm of H_2O) in the PEEP 8 group. The difference was -0.84 cm of H_2O (95% CI: -2.7 to 1.1 cm of H_2O) which was statistically insignificant (p=0.38) (table 20, Figure 18).

Figure 18: Distribution of peak pressure between PEEP 4 & PEEP 8 group



Plateau pressure:

The average plateau pressure of the PEEP 4 group was 20.0 cm of H2O (SD 3.7 cm of H2O) and the mean was 23.0 cm of H2O (SD 3.7 cm of H2O) in the PEEP 8 group. The difference was 3.0 cm of H2O (95% CI: -0.34 to 4.86 cm of H2O) which was statistically insignificant (p=0.82) (table 20, Figure 19).

Figure 19: Distribution of plateau pressure between PEEP 4 & PEEP 8 group

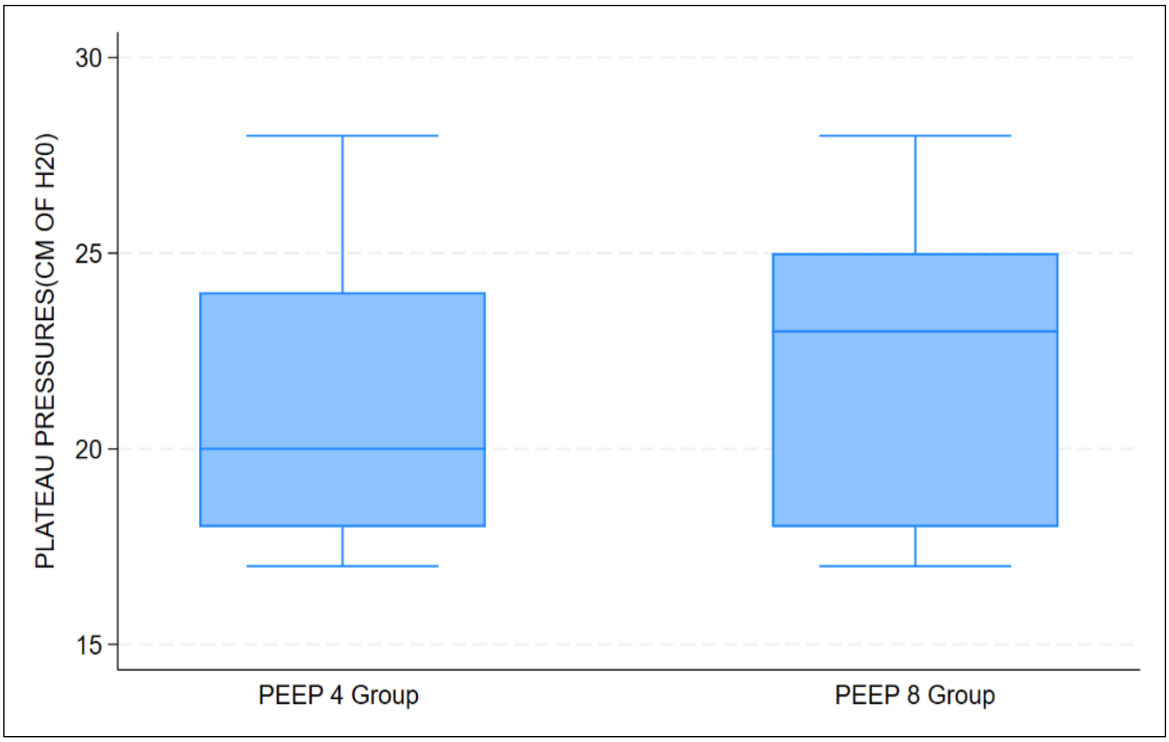


Table 20: Distribution of the various pressures in the respiratory system in GROUP A and GROUP B

Pressure type	Pressure value cm of H2O (SD)		p-value
	PEEP 4	PEEP 8	
Peak pressure	20.68 (3.1)	21.5 (3.5)	0.38
Plateau pressure	21.36 (3.7)	21.6 (3.7)	0.82

DISCUSSION

The research attempted to provide missing information concerning the impact of positive end-expiratory pressure (PEEP) on postoperative atelectasis in mechanically ventilated patients under general anaesthesia. Pneumonia, or the collapse of lung tissue, is a regular occurrence in operative procedures especially those including the use of general anaesthesia and mechanical ventilation. It is worth pointing out that even though PEEP is used in clinical practice very often to enhance oxygenation and prevent lung collapse, the impact of using PEEP to decrease postoperative atelectasis has not been proven. This work aimed at determining the effect of increasing PEEP level during mechanical ventilation under general anaesthesia with either higher PEEP (PEEP 8) or lower PEEP (PEEP 4) in the prevention of postoperative atelectasis.

The study's main aim was to determine the number of patients developing post-op atelectasis in a 30-minute PACU period in patients under PEEP 4 or PEEP 8 under GA for open abdominal surgeries. The study also had the following secondary aims to compare the degree and frequency of intraoperative hypotension, and the frequency of increased airway pressures and barotrauma during mechanical ventilation. Thus, addressing these objectives, the study endeavoured to give a desired evaluation of the advantages and drawbacks of employing PEEP 4 or PEEP 8 in this clinical scenario.

The demographic and clinical data of the patients recruited in this study were also similar between the two groups, PEEP 4 and PEEP 8, which is crucial when comparing the primary and secondary results.

Age Distribution:

In the PEEP 4 group, participants' age was on average 39 years. seven years instead of 43. The patients in the PEEP 8 group had a mean duration of 6 years in the study group; however, it was statistically non-significant (p > 0. 05). This is important because the development of postoperative atelectasis depends on age since the lung compliance and response to mechanical ventilation in a patient varies with age.

Gender Distribution:

The distribution of gender was also fairly equal and 36. 4% males and 63. 6% female and 60% male in the PEEP 4 group. 7% males and 39. 3% female in the PEEP 8 group and 3% female in the control group hence no significant difference (p = 0. 09). Sex-related disparities in respiratory function might affect the results; thus, this near-equity strengthens the analysis.

Type of Procedures:

Planned exploratory laparotomy was the most common procedure in both groups (80% in PEEP 4 and 72% in PEEP 8), with no significant difference (p = 0.74). The type of surgery can affect lung function and the risk of atelectasis, making this a relevant aspect to control between groups.

BMI and Ideal Body Weight Distribution:

The mean BMI and ideal body weight were similar between the groups (mean BMI: 26.5 vs. 26.6, p = 0.96; mean ideal body weight: 56 kg vs. 55.9 kg, p = 0.97). Since postoperative complications, including atelectasis, are common among the obese populations, the similarity further ensures the groups are comparable.

Physical Status (ASA Class):

Both groups had an equal distribution of participants in ASA class 1 (52%) and ASA class 2 (48%), with no significant difference (p = 1.0). ASA classification reflects the preoperative physical status of patients, which is critical in evaluating outcomes post-surgery.

Pre-operative Haemoglobin:

The mean pre-operative haemoglobin levels were 11.5 g/dL in the PEEP 4 group and 12.2 g/dL in the PEEP 8 group, with no significant difference (p = 0.17). Adequate haemoglobin levels are important for oxygen transport, and similar levels indicate that both groups had comparable oxygen-carrying capacities preoperatively.

Smoking History:

The proportion of participants with a smoking history was insignificant. There was non-significantly different between the groups (16% in PEEP 4 vs. 12% in PEEP 8, p = 0.68). Smoking can impair lung function and predispose to atelectasis, so this balance is relevant for the study's outcomes.

Pre-operative Heart Rates/ Blood Pressure:

The average pre-operative heart rates and blood pressure measurements were comparable between the groups (heart rates: 89 beats/min in PEEP 4 vs. 85 beats/min in PEEP 8, p =

0.14; blood pressure: mean SBP, DBP, and MAP were 124/81/90 mmHg in PEEP 4 vs. 122/78/92 mmHg in PEEP 8, $p > 0.05$ for all). Stable cardiovascular parameters are essential for patient safety and can influence intraoperative and postoperative outcomes.

Ensuring similar baseline characteristics between the PEEP 4 and PEEP 8 groups is critical for enhancing the validity and reliability of the study's findings. Comparable baseline characteristics help to ensure that any observed differences in outcomes, such as the incidence of postoperative atelectasis, are attributable to the intervention (PEEP levels) rather than to confounding variables. Thus, rigorous control of baseline characteristics strengthened the internal validity of the study and supported more robust and generalizable conclusions.

some works of literature have reviewed the effects of PEEP on postoperative atelectasis and other related outcomes thus offering a rich background from which the results of the present study can be understood. Barbosa et al. (32) also did a study where they demonstrated that PEEP enhances intraoperative oxygenation and lessens atelectasis which is in line with the merits of PEEP highlighted above. This led them to conclude that the ideal PEEP levels should be in the range of 8 to 10 cm H2O because this level effectively helped to promote lung opening and reduce atelectasis while at the same time reducing the possibilities of barotrauma and hypotension.

Another study by Brower et al. (33) on the subject added to the debate by assessing the impact of PEEP on patients with acute respiratory distress syndrome (ARDS). The authors proved that increased PEEP levels can enhance oxygenation but they also described the dangers of barotrauma and decreased blood pressure. While this study has been carried out on a different patient sample, the results also highlighted the need to consider the benefits and harms of PEEP.

A meta-analysis done by Gildner et al. (34) assessing the effects of various PEEP levels on postoperative pulmonary complications in non-cardiac surgery revealed that the application of high PEEP levels (≥ 8 cm H2O) was likely to decrease the occurrence of atelectasis and enhance the oxygenation of the patient without increasing the adverse effects. This extensive literature review is in favour of the idea that moderate levels of PEEP should be used to help avoid postoperative pulmonary complications.

Comparison of the outcomes

Post-operative atelectasis:

Atelectasis may develop in as many as ninety percent of individuals who are receiving GA. Following surgery, the disease may continue to have variable degrees of persistence, and it is often accompanied by pleural effusion. 34% of the amount of nonaerated lung tissue that is located next to the diaphragm might change based on the surgical treatment that is performed and the features of the patient. There is a possibility that it might be much greater when computed based on the tissue volume, although it is predicted to fall anywhere between 3 and 25 percent. Several processes have been suggested to contribute to atelectasis formation. These include- small airway collapse, lung compression, intra-alveolar gas absorption, and surfactant function compromise. Mechanical ventilation strategies during GA have been significantly shaped by oxygenation and lung compliance reduction. To combat the condition and enhance the end-expiratory lung capacity, it is advised that the tidal volumes be maintained at a maximum of 15 milliliters per kilogram of projected body weight during surgical procedures. Lung recruitment exercise & PEEP, unless contraindicated, may be beneficial to prevent or reverse the loss of EELV. (30) None of the two groups developed post-operative atelectasis in 30-minute PACU in our study. It indicates that PEEP might have a direct role in preventing postoperative atelectasis.

Duration of Surgery

The average duration of surgery was comparable between the PEEP 4 group (209.4 minutes, SD 20.3 minutes) and the PEEP 8 group (209 minutes, SD 20 minutes), with a statistically insignificant difference (p = 0.94).

The similarity in surgery duration between the two groups aligns with findings from other studies that have assessed the impact of different PEEP levels on perioperative outcomes. For example: Almarakbi et al. (2009) (35) conducted a study on the effects of different PEEP levels during laparoscopic surgery and found no significant difference in the duration of surgery between groups receiving different PEEP levels (ASA Pubs). This suggests that the application of varying PEEP levels does not significantly impact the length of surgical procedures. Duggan et al. (2005) (36) examined the impact of PEEP on intraoperative and postoperative outcomes, noting that while PEEP influences lung mechanics and oxygenation, it does not affect the duration of surgery. This aligns with the results of the current study, where the duration was nearly identical across groups.

Duration of Anaesthesia

In the present study, there was no noteworthy variance in the mean duration of satisfactory anaesthesia between PEEP 4 (164.2 minutes, SD19.0) and PEEP 8 (162.2 minutes, SD19.2), p=0.71

While the observation of similar anaesthesia durations between groups is consistent with existing evidence and demonstrates that differing PEEP levels do not influence the overall duration of anaesthesia. The findings of Guldner et al. (34) showed that the baseline PEEP did not affect postoperative pulmonary problems. Furthermore, they observed that there was no significant variation in the length of anaesthesia with the degree of PEEP used. The study concluded that PEEP can improve respiratory function, but does not shorten anaesthesia time for surgical procedures. Talab et al. A study by Perilli et al (2009) (37) examined the impact of intraoperative PEEP on respiratory function in obese patients undergoing laparoscopic surgery. Anaesthesia duration was not significantly different between low and high PEEP groups, supporting the fact that alterations in the management of respiratory mechanics depend on the level of invasive mechanical ventilation applied for each patient respiratory settings changes were more influenced by type/titration than anaesthetic time. A similar study conducted by Hemmes et al. (38) also evaluated the effects of PEEP during anaesthesia and found no significant differences in time to extubation between different levels of PEEP. As the duration of anaesthesia was not affected, it is suggested that PEEP has major effects on respiratory mechanics. Hence, in all these experimental studies, the duration of anaesthesia has been reported to be unchanged in different PEEP levels. Data from the present study confirm and expand this assumption.

Fluid requirement

In our study, there is no statistically noteworthy variance in the fluid requirement of two groups (PEEP 4 group vs PEEP 8 group; p =0.71). As a result, it seems more likely that the differences in fluid requirements observed between these two groups as seen with this data is simply due to chance rather than any direct relationship with the quantity of Positive End-Expiratory Pressure (PEEP) delivered.

To put these results into perspective, it is possible to compare them to the data that is already available in the literature, which investigates how different amounts of PEEP affect fluid management. Researchers have repeatedly explored the effects of positive end-expiratory pressure (PEEP) on hemodynamics and fluid balance. The majority of these investigations have been conducted on patients who are receiving mechanical ventilation for disorders such as acute respiratory distress syndrome (ARDS), but also on patients who are undergoing surgical operations.

Literature suggests that higher PEEP settings may improve oxygenation and respiratory mechanics, however, this can potentially have detrimental effects on cardiovascular function and fluid balance secondary to an increase in intrathoracic pressure. This increase may decrease venous return and cardiac output, which consequently could require changes in fluid management. Nonetheless, fluid management strategies should not only strengthen PEEP levels but instead take a variety of indicators including the detailed hemodynamic assessments into account.

A prospective study demonstrated that in patients with ARDS, the predictive accuracy of PPV (39) for identifying those whose cardiac output increases more than 10% when monitored during a fluid challenge is enhanced by using high PEEP levels up to 15 cm H_2O thereby overcoming one of the limitations previously attributed to low VT ventilation--but even under such condition's optimization was possible only in about two-thirds and approximately half showed worsening indexes post-optimization.

Our findings demonstrate modest differences in fluid requirements between the two PEEP levels and may justify further investigation. Studies that focus on fluid intake or fluid management needs at various levels of PEEP should be examined to determine whether this trend is convergent, and what sorts of discrepancies exist between patient populations or clinical environments if indeed they are present.

In addition, we found that there was a significant difference in the predicted amount of blood loss between the PEEP 4 and PEEP 8 groups. It was discovered that the average amount of blood lost in the PEEP 4 group was 392 ml (standard deviation: 180 ml), but in the PEEP 8 group, it was 416 ml (standard deviation: 184 ml). A p-value of 0.64 indicates that the variance in blood loss that occurred between the two groups did not meet the criteria for statistical significance. Taking into consideration this data, it seems that the variation in PEEP levels did not have a major impact on the volume of blood that was lost throughout the operations that were investigated in our research.

Considering this outcome in conjunction with the previously discussed fluid requirements, it appears that higher PEEP settings—while sometimes associated with changes in cardiovascular physiology that could theoretically influence fluid dynamics and blood loss—do not significantly alter these parameters under the conditions tested in our study. Both the fluid requirement and blood loss results indicate minimal clinical impact from varying PEEP levels from 4 to 8 cm H2O in these specific outcomes.

To contextualize these results within the broader literature, it's important to consider that while some studies suggest higher PEEP can affect hemodynamics by increasing intrathoracic pressure and by re-changing the venous return and cardiac output. However, these changes do not necessarily translate to significant differences in fluid requirements or blood loss. This could be due to the body's compensatory mechanisms or variations in clinical management that mitigate the hemodynamic effects of higher PEEP.

Tidal volume (TV)

In this study, we also examined the results of different PEEP levels on tidal volume, an important parameter for assessing ventilatory management in clinical settings. Our findings revealed that the mean TV was virtually identical in the two groups, with the PEEP 4 group showing a mean tidal volume of 448 ml (SD 102.7 ml) and the PEEP 8 group at 447 ml (SD 106.9 ml). The statistical analysis confirmed that this difference was non-significant, with a p-value of 0.97.

These results suggest that the moderate increase in PEEP value from 4 to 8 cm H_2O does not significantly impact the tidal volume in patients under the specific conditions of our study. This aligns with our previous findings regarding fluid requirements, blood loss, and urine output, where we observed minimal physiological differences between the two PEEP levels.

The animal model suggests that the relationship between PEEP and tidal volume is directly proportional to each other up to a level of PEEP. (40) However, the literature indicates that ventilation with low TV does not improve postoperative lung function for abdominal surgeries. (41)

Given that TV is a crucial factor in mechanical ventilation in preventing lung injury due to the ventilator by avoiding both volutrauma and atelectrauma, our results indicate that within this range of PEEP settings, lung compliance and the mechanical aspects of breathing are not substantially altered. (42) This stability in tidal volume across slightly different PEEP settings suggests that patient ventilation can be effectively managed without significant adjustments to tidal volume when modestly varying PEEP levels. Although higher PEEP levels are often associated with improved oxygenation and reduced atelectasis, our study suggests that these benefits can be achieved without significant alterations to tidal volume, thereby potentially reducing the risk of lung stress or injury.

In our study, we also investigated additional clinical outcomes related to the management of patients under different PEEP settings, including blood transfusion requirements, the use of vasoactive drugs, and the incidence of per-operative hypotension.

Blood Transfusion:

Interestingly, only one patient in the PEEP 8 group required a blood transfusion, whereas none of the patients required a blood transfusion in the PEEP 4 group. Due to the low total incidence of blood transfusions in both groups, this data, although suggestive of a probable trend, is not adequate to make conclusive conclusions. This is something that has to be taken into consideration.

Vasoactive Drug Requirement:

In neither of the PEEP 4 or PEEP 8 groups did we find any indication of a need for vasoactive medicines. This suggests that within the controlled settings of our study, moderate variations in PEEP did not necessitate pharmacological support for maintaining vascular tone or blood pressure, aligning with our other findings of minimal physiological disruption between the two groups.

Intra operative Hypotension:

More notably, our findings regarding hypotension showed a considerable difference among the group groups. A total of 7 participants (14%) developed per-operative hypotension; however, the distribution was uneven, with only 1 participant (4%) in the PEEP 4 group and 6 participants (24%) in the PEEP 8 group experiencing this complication. This significant difference (p=0.04) suggests that higher PEEP levels could be related to an enhanced risk of hypotension, likely due to the increased intrathoracic pressure affecting cardiac output and vascular resistance.

This association between higher PEEP and increased hypotension is particularly relevant in clinical practice. It underscores the need for careful monitoring and potentially more cautious management of fluid and hemodynamic status in patients receiving higher PEEP levels, especially in settings where patients may be at a higher risk for cardiovascular complications.

For hemodynamics, the impact of high PEEP on MAP and hypotension development has been debated. Some evidence suggested that high PPEP ventilation might reduce MAP and promote hypotension in patients without ARDS. (43)

However, a large meta-analysis found no significant changes in hospital mortality, ventilation duration, pulmonary complications, and overall hemodynamics between different levels of PEEP. (44)

The findings of a retrospective cohort research revealed that moderate positive end-tidal pressure (PEEP) did not negatively alter arterial systolic blood pressure in trauma patients who need mechanical breathing, adding another layer of complication to the situation. Vulnerable patients who are ventilated with moderate positive end-expiratory pressure (PEEP) were shown to exhibit hemodynamic stability, which is an interesting finding. Consequently, this indicates that a modest PEEP may have a protective impact on the hemodynamics in such circumstances. (45)

A prospective cohort research, on the other hand, found that high levels of positive end-tidal pressure (PEEP) may have a considerable effect on changes in blood pressure and cardiac function, especially in older individuals who diagnosed themselves with hypertension (46).

From the findings of this research, it is clear that high PEEP has the potential to have a more significant impact on the dynamics of the cardiovascular system in particular patient groups.

These findings collectively illustrate the nuanced and context-dependent effects of PEEP on hemodynamics, necessitating careful consideration of individual patient characteristics and conditions when applying PEEP in clinical settings.

LIMITATIONS:

With a small sample, it's challenging to generalize findings to a broader population. A study on a larger population could have generated more accurate results. We haven't done any recruitment manoeuvrers in our study before the application of PEEP.

CONCLUSION

PEEP might have a direct role in preventing postoperative atelectasis. In our study patients who underwent general anaesthesia in either group A or group B did not show any development of atelectasis in the 30-minute postoperative period in PACU. PEEP 4 has a greater hemodynamic advantage than PEEP 8. Individual pre-operative assessment is important while deciding between PEEP 4 and PEEP 8.

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ANNEXURES

INFORMATION SHEET

TITLE: EFFECT OF POSITIVE END EXPIRATORY PRESSURE ON POST OPERATIVE ATELECTASIS FOR OPEN ABDOMINAL SURGERY: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

I, **DR. SYED HAZARATH NABI** Post graduate in the department of Anesthesiology, Sri Devaraj Urs Medical College, Kolar. We are carrying out above mentioned study at RLJH, Tamaka, Kolar. The study has been reviewed and approved by the institutional ethical review board. We will be comparing the effects of positive expiratory end pressure (PEEP) on post operative atelectasis in patients undergoing open abdominal surgery using lung ultrasonography. PEEP is the pressure in the lungs above atmospheric pressure that is present at end of expiration

Participation in this study doesn't involve any added cost to the patient. There is no compulsion to participate in this study and you will not be affected with regard to patient care, if you wish not to be part of this study.

All the information collected from the patient will be kept confidential and will not be disclosed to any outsider, unless compelled by the law. The information collected will be used only for this study. I request your kind self to give consent for the above-mentioned research project.

For any further clarification you are free to contact,

Dr. SYED HAZARATH NABI

PRINCIPAL INVESTIGATOR,

PHONE NUMBER: - 8553652356

ಮಾಹಿತಿ ಹಾಳೆ

ಶೀರ್ಷಿಕೆ: ತೆರೆದ ಕಿಬ್ಬೊಟ್ಟೆಯ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗಾಗಿ ಪೋಸ್ಟ್ ಆಪರೇಟಿವ್ ಎಟೆಲೆಕ್ಟಾಸಿಸ್ ಮೇಲೆ ಧನಾತ್ಮಕ ಅಂತ್ಯದ ಎಕ್ಸ್‌ಪೈರೇಟರಿ ಒತ್ತಡದ ಪರಿಣಾಮ: ನಿರೀಕ್ಷಿತ ಯಾದೃಚ್ಛಿಕ ನಿಯಂತ್ರಿತ ಅಧ್ಯಯನ

ನಾನು, **DR.** ಸೈಯದ್ ಹಜರತ್ ನಬಿ ಕೋಲಾರದ ಶ್ರೀ ದೇವರಾಜ್ ಅರ್ಸ್ ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿನ ಅರಿವಳಿಕೆ ವಿಭಾಗದಲ್ಲಿ ಸ್ನಾತಕೋತ್ತರ ಪದವಿ. ನಾವು ಮೇಲೆ ತಿಳಿಸಿದ ಅಧ್ಯಯನವನ್ನು **RLJH,** ಟಮಕ, ಕೋಲಾರದಲ್ಲಿ ನಡೆಸುತ್ತಿದ್ದೇವೆ. ಅಧ್ಯಯನವನ್ನು ಸಾಂಸ್ಥಿಕ ನೈತಿಕ ಪರಿಶೀಲನಾ ಮಂಡಳಿಯು ಪರಿಶೀಲಿಸಿದೆ ಮತ್ತು ಅನುಮೋದಿಸಿದೆ. ಶ್ವಾಸಕೋಶದ ಅಲ್ಟ್ರಾಸೋನೋಗ್ರಫಿಯನ್ನು ಬಳಸಿಕೊಂಡು ತೆರೆದ ಕಿಬ್ಬೊಟ್ಟೆಯ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಒಳಗಾಗುವ ರೋಗಿಗಳಲ್ಲಿ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರದ ಎಟೆಲೆಕ್ಟಾಸಿಸ್‌ನಲ್ಲಿ ಧನಾತ್ಮಕ ಎಕ್ಸ್‌ಪಿರೇಟರಿ ಎಂಡ್ ಪ್ರೆಶರ್ (ಪಿಇಇಪಿ) ಪರಿಣಾಮಗಳನ್ನು ನಾವು ಹೋಲಿಸುತ್ತೇವೆ. **PEEP** ಎಂದರೆ ಶ್ವಾಸಕೋಶದ ಒತ್ತಡವು ವಾಯುಮಂಡಲದ ಒತ್ತಡದ ಮೇಲೆ ಮುಕ್ತಾಯದ ಕೊನೆಯಲ್ಲಿ ಇರುತ್ತದೆ

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆಯು ರೋಗಿಗೆ ಯಾವುದೇ ಹೆಚ್ಚುವರಿ ವೆಚ್ಚವನ್ನು ಒಳಗೊಂಡಿರುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಯಾವುದೇ ಬಲವಂತವಿಲ್ಲ ಮತ್ತು ನೀವು ಈ ಅಧ್ಯಯನದ ಭಾಗವಾಗದಿರಲು ಬಯಸಿದರೆ ರೋಗಿಗಳ ಆರೈಕೆಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಪರಿಣಾಮ ಬೀರುವುದಿಲ್ಲ.

ರೋಗಿಯಿಂದ ಸಂಗ್ರಹಿಸಿದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿ ಇರಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಕಾನೂನಿನಿಂದ ಒತ್ತಾಯಿಸದ ಹೊರತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಈ ಅಧ್ಯಯನಕ್ಕಾಗಿ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ. ಮೇಲೆ ತಿಳಿಸಿದ ಸಂಶೋಧನಾ ಯೋಜನೆಗೆ ಒಪ್ಪಿಗೆ ನೀಡುವಂತೆ ನಿಮ್ಮ ಆತ್ಮೀಯರನ್ನು ನಾನು ವಿನಂತಿಸುತ್ತೇನೆ.

ಯಾವುದೇ ಹೆಚ್ಚಿನ ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ನೀವು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ,

ಡಾ. ಸೈಯದ್ ಹಜರತ್ ನಬಿ

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ,

ದೂರವಾಣಿ ಸಂಖ್ಯೆ: - **8553652356**

INFORMED CONSENT FORM

EFFECT OF POSITIVE END EXPIRATORY PRESSURE ON POST OPERATIVE ATELECTASIS FOR OPEN ABDOMINAL SURGERY: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

Date:

I, ____ aged _____________, after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for performing above mentioned study. The nature and risks involved have been explained to me to my satisfaction. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate in this research. I hereby give consent to provide my history, undergo physical examination, the procedure, investigations and provide its results and documents to the doctor / institute. For academic and scientific purpose, the operation / procedure e may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute responsible for any untoward consequences during the procedure / study.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

_________________ ___________________

(Signature & Name of Pt. Attendant) (Signature/Thumb impression & Name of patient)

(Relation with patient)

Witness 1:

Witness 2:

____

(Signature & Name of Research person /doctor)

ಮಾಹಿತಿ ನೀಡಿದ ಒಪ್ಪಿಗೆ ನಮೂನೆ

ತೆರೆದ ಕಿಬ್ಬೊಟ್ಟೆಯ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗಾಗಿ ಪೋಸ್ಟ್ ಆಪರೇಟಿವ್ ಎಟೆಲೆಕ್ಟಾಸಿಸ್ ಮೇಲೆ ಧನಾತ್ಮಕ ಅಂತ್ಯದ ಎಕ್ಸ್‌ಪೈರೇಟರಿ ಒತ್ತಡದ ಪರಿಣಾಮ: ನಿರೀಕ್ಷಿತ ಯಾದೃಚ್ಛಿಕ ನಿಯಂತ್ರಿತ ಅಧ್ಯಯನ

ದಿನಾಂಕ:

I, ___________________________ ______________, ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಮತ್ತು ಕಾರ್ಯವಿಧಾನದ ಅಪಾಯಗಳು ಮತ್ತು ತೊಡಕುಗಳ ಬಗ್ಗೆ ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಿದ ನಂತರ, ಮೇಲೆ ತಿಳಿಸಿದ ಅಧ್ಯಯನವನ್ನು ನಡೆಸಲು ಯಾವುದೇ ಶಕ್ತಿ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯ ಒಪ್ಪಿಗೆಯನ್ನು ನೀಡಿ. ಒಳಗೊಂಡಿರುವ ಸ್ವಭಾವ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನಗೆ ತೃಪ್ತಿಪಡಿಸಲು ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಸಮ್ಮತಿಸುತ್ತೇನೆ. ನನ್ನ ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆ, ಕಾರ್ಯವಿಧಾನ, ತನಿಖೆಗಳಿಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ವೈದ್ಯರಿಗೆ / ಸಂಸ್ಥೆಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ, ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನವನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ ಮಾಡಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ/ ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆಯನ್ನು ಜವಾಬ್ದಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.

ಈ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಒಪ್ಪಿಗೆ ನಮೂನೆಯ ಪ್ರತಿಯನ್ನು ಮತ್ತು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಭಾಗವಹಿಸುವವರಿಗೆ ಒದಗಿಸಲಾಗಿದೆ.

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(ಪಿಟಿ. ಅಟೆಂಡೆಂಟ್‌ನ ಸಹಿ ಮತ್ತು ಹೆಸರು) (ಸಹಿ/ಹೆಬ್ಬೆರಳಿನ ಗುರುತು ಮತ್ತು ರೋಗಿಯ ಹೆಸರು)

(ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)

ಸಾಕ್ಷಿ 1: (ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿ/ವೈದ್ಯರ ಸಹಿ ಮತ್ತು ಹೆಸರು)

ಸಾಕ್ಷಿ 2:

PROFORMA

STUDY GROUP:

Personal Details:

Name: Age(yrs.): Gender: Uhid no:

Address:

Occupation:

Height (cms): Weight(kg): - IBW (kg):

BMI (kg/m^2): - telephone no:

ASA Grading:

History of smoking: -

CO-MORBIDITIES:

PRE-OP - VITALS: -

HR (BPM): - SPO2 (%): -

NIBP (mm of Hg): - Respiratory rate (cpm): -

MAP (mm of Hg): -

INVESTIGATIONS:

Hb (%)		PT (sec)		Serum Urea (mg/dl)	
WBC (Th. cells/mm^3)		aPTT (sec)		Serum Creatinine(mg/dl)	
Platelets (Th. cells/mm^3)		INR			

CLINICAL DIAGNOSIS:

PROPOSED OPERATION:

a. Surgical procedure:

b. Incision site:

ARISCAT SCORE: -

TIME	ANAESTHESIA	SURGERY
START TIME		
END TIME		

ESTIMATED BLOOD LOSS: -

BLOOD AND BLOOD PRODUCTS TRANSFUSION: -

VASOACTIVE AGENTS USED: -

VASOACTIVE DRUG	DOSAGE	TIME

NAME OF THE PATIENT: -

LUNG ULTRASOUND SCORE: - **GROUP: -**

SL.NO	LUNG SEGMENT	MODIFIED LUNG ULTRASOUND SCORE		
		PREOPERATIVE	IN PACU (AFTER 30 MINUTES)	TOTAL
1	RL 1			
2	RL2			
3	RL3			
4	RL4			
5	RL5			
6	RL6			
7	LL1			
8	LL2			
9	LL3			
10	LL4			
11	LL5			
12	LL6			
	TOTAL			

NAME: - **INTRAOPERATIVE MONITORING**

TIME (mins)	HR (bpm)	BP & MAP (mmHg)	SPO_2 (%)	RR (Cpm)	Et CO_2 (mmHg)	PEAK Pr. (Cm of H_2O)	PLATEAU Pr. (Cm of H_2O)	COMPLIA-NCE (mL/cm H2O)	FLUID INTAKE (ml)	URINE OUTPUT (ml)	BLOOD LOSS (ml)	
After intubation												
5												
15												
30												
60												
90												
120												
150												
180												
210												
240												

NAME	AGE	GENDER	UHID	DIAGNOSIS	PROCEDURE	HEIGHT(M)	WEIGHT(KG)	BMI(KG/M2)	HEIGHT(CM)	IBW(KG)	ASA PHYICAL STATUS	SMOKING HISTORY	COMORBIDITIES	PREOP HB(g/dl)	HEART RATE(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	RR(CPM)	ARISCAT SCORE	DURATION OF ANAESTHESIA(HOURS)	DURATION OF SURGERY(HRS)	TOTAL FLUID INPUT(ML)	ESTIMATED BLOOD LOSS(ML	BLOOD AND BLOOD PRODUCTS TRANSFUSION	URINE OUTPUT(ML/hr)	VASOACTIVE DRUGS REQUIREMENT	INCIDENCE OF HYPOTENSION	TIDAL VOLUMES(ML/KG)	RR(CPM)	MV(ml/MIN)	EtCO2(MM OF HG)	PEAK PRESSURES(CM OF H20)	PLATEAU PRESSURES(CM OF H20)	DYNAMIC COMPLIANCE(ML/CM Hy20)	HR(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	LUNG ULTRASOUND SCORE	
																																										PREOP	PACU (AFTER 30 MINUTES)
NAGARATH NAMMA	45	F	291704	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.7	60	20.76124567	170	65	1	No	No	13.1	90	120	80	70	98	16	31	180	200	1500	600	-	30	-	no	520	16	8320	35	20	18	25	80	110	70	65	100	0	0
PAVITHRA	18	F	292276	LEFT OVARIAN TORSION	EXPLORATORY LAPAROTOMY	2	70	17.5	143	38	2	No	No	10.7	90	110	80	65	96	18	32	190	220	1600	500	-	25	-	no	304	14	4256	35	22	20	20	70	100	60	60	100	0	0
VANITHA	26	F	295353	G2P1L1 WITH 22WEEKS GA WITH IUD AND UTERINE RUPTURE	EXPLORATORY LAPAROTOMY	1.69	64	22.40817899	169	64	1	Yes	Yes	13.3	95	128	80	94	100	14	27	150	180	1400	200	-	45	-	no	512	16	8192	36	23	19	21	78	126	80	90	100	0	0
SONU	29	M	295386	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.23	56	37.0150043	123	23	2	No	No	11.2	85	124	78	83	100	14	44	160	210	1700	400	-	50	-	no	184	18	3312	37	17	28	22	71	112	70	84	100	0	0
CHINNATAY APPA	63	M	291371	RIGHT RENAL CELL CARCINOMA	RIGHT RADICAL NNEPHRECTOMY	1.49	68	30.62925093	149	49	2	No	No	9.9	90	130	90	103	100	15	33	175	225	1200	300	-	30	-	no	392	14	5488	40	18	26	17	63	112	84	93	100	0	0
ASHWINI	26	F	298550	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.54	74	31.20256367	154	49	1	No	No	10.5	69	134	70	91	100	16	37	180	230	1900	100	-	25	-	no	392	14	5488	39	20	24	19	75	120	70	87	100	0	0
ARUNA	30	F	301008	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.63	54	20.32443826	163	58	2	No	Yes	13.5	80	142	70	94	100	14	26	140	190	2000	600	-	30	-	no	464	15	6960	38	21	25	28	92	114	76	89	100	0	0
NIKITHA	31	F	2990082	P2L2 POD-16 WITH HEMOPERITONEUM	EXPLORATORY LAPAROTOMY	1.66	64	23.22543185	166	61	1	No	No	11.9	102	130	84	99	100	15	30	160	200	1400	600	-	25	-	no	488	16	7808	35	22	23	26	70	130	80	97	100	0	0
RAVANAM MA	41	F	280885	NULLIGRAVIDA WITH RIGHT ADNEXAL CYST TORSION	EXPLORATORY LAPAROTOMY	1.8	68	20.98765432	180	75	2	No	No	12.1	85	118	80	93	100	18	28	130	180	1500	500	-	40	-	no	600	14	8400	35	17	17	24	90	118	80	93	100	0	0
SALMA	29	F	282426	PRIMIGRAVIDA WITH 13WEEKS+4 DAYS GA WIITH ECTOPIC PREGNANCY WITH MODERATE HEMOPERITONEUM	EXPLORATORY LAPAROTOMY	1.74	74	24.44180209	174	69	1	No	No	13.9	100	110	78	89	100	16	42	180	230	1600	200	-	45	-	no	552	15	8280	36	19	18	25	90	128	80	96	100	0	0
MANJUNAT H	46	M	283504	POLYTRAUMA WITH BLUNT TRAUMA ABDOMEN AND HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.48	66	30.13148283	148	48	2	Yes	No	11.5	79	132	92	92	100	14	41	190	240	1500	400	-	30	-	no	384	18	6912	37	28	23	23	70	124	78	93	100	0	0
JAGADESH	25	M	284190	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.36	55	29.73615917	136	36	1	No	Yes	11.3	90	126	80	103	100	15	36	150	190	1600	300	-	20	-	no	288	16	4608	40	26	17	17	90	130	90	103	100	0	0
GOVINDAPP A	64	M	287876	INTESTINAL OBSTRUCTION WITH APPENDICULAR MASS	EXPLORATORY LAPAROTOMY	1.52	64	27.70083102	152	52	2	No	Yes	9.1	99	130	90	97	100	16	28	160	200	1400	100	-	25	-	no	416	14	5824	39	24	18	18	90	134	70	91	100	0	0
SAROJAMM A	48	F	286821	RIGHT OBSTRUCTIVE INCISIONAL HERNIA	EXPLORATORY LAPAROTOMY	1.53	68	29.0486565	153	48	1	No	No	8.8	83	128	78	106	100	14	27	175	220	1700	600	-	45	-	no	384	15	5760	38	25	20	23	98	142	70	94	100	0	0
SHIVA	31	M	286702	LEFT OBSTRUCTED INGUINAL HERNIA	EXPLORATORY HERNIOTOMY WITH MESH REPAIR	1.61	60	23.14725512	161	61	2	Yes	No	13.6	88	116	72	83	100	15	44	180	230	1200	600	-	50	-	no	488	16	7808	35	23	19	17	92	130	84	99	100	0	0
RAJAMMA	60	F	287818	RIGHT OBSTRUCTIVE INCISIONAL HERNIA	EXPLORATORY LAPAROTOMY	1.71	48	16.41530727	171	66	1	No	No	12.3	80	120	70	85	100	16	33	140	180	1900	500	-	30	-	no	528	14	7392	35	17	28	21	120	118	80	93	100	0	0
SUBRAMANI	35	M	266299	ACUTE INTESTINAL OBSTRUCTION	EXPLORATORY LAPAROTOMY	1.7	68	23.52941176	170	70	2	No	Yes	10.8	110	118	74	94	100	18	37	160	210	2000	200	-	25	-	no	560	15	8400	36	18	26	22	82	110	78	89	100	0	0
KAVYA	27	F	879350	P3L3 MISSING IUCD	EXPLORATORY LAPAROTOMY	1.49	84	37.83613351	149	44	1	No	No	11.4	85	120	88	103	100	17	26	130	190	1400	400	-	20	yes	Yes	352	16	5632	37	23	24	17	80	132	92	105	100	0	0
NAGARAJ	62	M	268489	ACUTE INTESTINAL OBSTRUCTION	EXPLORATORY LAPAROTOMY	1.58	66	26.43807082	158	58	1	No	No	11.4	86	124	90	94	100	20	42	180	225	1500	300	-	45	-	no	464	18	8352	40	17	25	19	83	126	80	95	100	0	0

NAME	AGE	GENDER	UHID	DIAGNOSIS	PROCEDURE	HEIGHT(M)	WEIGHT(KG)	BMI(KG/M2)	HEIGHT(CM)	IBW(KG)	ASA PHYICAL STATUS	SMOKING HISTORY	COMORBIDITIES	PREOP HB(g/dl)	HEART RATE(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	RR(CPM)	ARISCAT SCORE	DURATION OF ANAESTHESIA(HOURS)	DURATION OF SURGERY(HRS)	TOTAL FLUID INPUT(ML)	ESTIMATED BLOOD LOSS(ML	BLOOD AND BLOOD PRODUCTS TRANSFUSION	URINE OUTPUT(ML/hr)	VASOACTIVE DRUGS REQUIREMENT	INCIDENCE OF HYPOTENSION	TIDAL VOLUMES(ML/KG)	RR(CPM)	MV(ml/MIN)	EtCO2(MM OF HG)	PEAK PRESSURES(CM OF H20)	PLATEAU PRESSURES(CM OF H20)	DYNAMIC COMPLIANCE(ML/CM Hy20)	HR(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	LUNG ULTRASOUND SCORE	
LATHA BHUVANES HWARI	45	F	269668	APPENDICULAR PERFORATION	EXPLORATORY LAPAROTOMY	1.62	74	28.1969212	162	57	2	No	Yes	10.3	80	130	90	86	100	16	31	190	240	1600	100	-	40	-	no	456	16	7296	39	18	23	28	88	110	70	83	100	0	0
SHABEENA	31	F	265369	CHOLELITHIASIS	OPEN CHOLECYSTECTOMY	1.54	72	30.35925114	154	49	1	No	No	9.9	98	124	72	86	99	14	27	150	190	1500	600	-	45	-	no	392	18	7056	38	20	17	26	85	126	80	95	99	0	0
MUNISWA MY	60	M	256146	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATRY LAPAROTOMY	1.56	76	31.22945431	156	56	1	No	No	12.3	90	118	78	88	100	15	44	160	200	1600	600	-	50	-	no	448	14	6272	35	21	18	24	84	112	70	84	100	0	0
ANUSHA	20	F	258861	PERITONITIS SE. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.63	68	25.59373706	163	58	2	No	No	8.8	98	124	80	98	100	16	33	175	225	1400	500	-	30	-	no	464	14	6496	35	22	23	25	74	112	84	93	100	0	0
HARISH	31	M	261626	HEMATOMA OVER RIGHT LUMBAR REGION FOLLOWING BLUNT TRAUMA	EXPLORATION	1.66	64	23.22543185	166	66	1	Yes	No	11.8	98	120	80	83	100	14	37	180	240	1700	200	-	25	-	no	528	15	7920	36	17	17	23	90	120	70	87	100	0	0
GANGIREDD Y	70	M	262666	EPIGASTRIC HERNIA	ANATOMICAL REPAIR	1.8	48	14.81481481	180	80	2	No	No	14.3	78	120	90	74	100	15	26	140	190	1200	400	-	30	-	no	640	16	10240	37	19	18	17	88	114	76	89	100	0	0

NAME	AGE	GENDER	UHID	DIAGNOSIS	PROPOSED SURGERY	HEIGHT(M)	WEIGHT(KG)	BMI(KG/M2)	HEIGHT (CM)	IBW(KG)	ASA PHYICAL STATUS	SMOKING HISTORY	COMORBIDITIES	PREOP HB(g/dl)	HEART RATE(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	RR(CPM)	ARISCAT SCORE	DURATION OF ANAESTHESIA(HOURS)	DURATION OF SURGERY(HRS)	TOTAL FLUID INPUT(ML)	ESTIMATED BLOOD LOSS(ML	BLOOD AND BLOOD PRODUCTS TRANSFUSION	URINE OUTPUT(ML0	VASOACTIVE DRUGS REQUIREMENT	INCIDENCE OF HYPOTENSION	TIDAL VOLUMES(ML/KG)	RR(CPM)	MV(mL/MIN)	EtCO2(MM OF HG)	PEAK PRESSURES(CM OF H20)	PLATEAU PRESSURES(CM OF H20)	DYNAMIC COMPLIANCE(ML/CM Hy20)	HR(BPM)	SBP(MM HG)	DBP(MM HG)	MAP(MM HG)	SPO2(%)	LUNG ULTRASOUND SCORE	
																																										PREOP	PACU (AFTER 30 MINUTES)
THYAMMA	65	F	337781	STANGULATED INFRAUMBILICAL HERNIA	EXPLORATORY LAPAROTOMY	1.51	64	28.06894434	151	46	1	No	Yes	12.7	78	126	80	90	100	14	30	160	210	2000	600	-	30	-	no	368	14	5152	35	17	25	24	90	120	80	70	100	0	0
MUNEER KHAN	59	M	343438	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTMY	1.62	56	21.33821064	162	62	2	No	No	10.7	71	112	70	84	100	14	28	175	225	1400	600	-	25	-	no	496	15	7440	35	19	23	25	90	110	80	65	100	0	1
VENKATASWAMY	60	M	346128	OBSTRUCTED LEFT INGUINAL HERNIA	EXPLORATION OF LEFT INGUINAL REGION	1.7	68	23.52941176	170	70	2	Yes	No	9.1	63	112	84	93	100	15	42	180	230	1500	500	-	40	-	no	560	18	10080	36	28	17	23	95	128	80	94	100	0	0
SUMITHRAMMA	40	F	343948	INTESTINAL OBSTRUCTION	EXPLORATORY LAPAROTMY	1.43	74	36.18758864	143	40	1	No	No	14.1	75	120	70	87	100	16	41	140	190	1600	200	-	45	yes	yes	320	16	5120	37	26	18	17	85	74	58	83	100	0	0
SRINIVAS	50	M	351120	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.69	54	18.90690102	169	69	2	No	Yes	13.6	92	114	76	89	100	14	36	160	200	1500	400	-	30	-	no	552	14	7728	40	24	23	18	90	130	90	103	100	0	0
VINOD	33	M	336517	INTESTINAL OBSTRUCTION WITH CKD V ON MHD	EXPLORATORY LAPAROTOMY	1.23	64	42.30286205	123	40	1	No	No	10.9	70	130	80	97	100	15	28	130	180	1600	300	-	20	-	no	320	15	4800	39	25	17	23	69	134	70	91	100	0	0
DASAPPA	68	M	353256		EXPLORATORY LAPAROTOMY	1.49	60	27.02580965	149	49	1	Yes	No	14.4	90	118	80	93	100	18	27	180	230	1400	100	Yes	25	-	no	392	16	6272	38	23	18	17	80	142	70	94	100	0	0
SHARFARAJ SHAIK	21	M	87794	THALASEMMIA WITH MASSIVE SPLEENOMEGALY	OPEN SPLEENECTOMY	1.54	70	29.51593861	154	54	2	No	No	9.2	90	128	80	96	100	16	44	190	240	1700	600	-	45	-	no	432	14	6048	35	17	20	21	102	130	84	99	100	0	0
PRANITHA	41	F	322169	INCISIONAL HERNIA	EXPLORATORY LAPAROTOMY AND PROCEED	1.63	64	24.08822312	163	58	1	No	No	13.4	70	124	78	93	100	14	33	150	190	1200	600	-	50	yes	yes	464	15	6960	35	18	19	28	85	88	60	69	100	0	0
ARATHI	32	F	283184	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	LAPAROTOMY AND PROCEED	1.66	56	20.32225287	166	61	2	No	Yes	9.5	90	130	90	103	100	15	37	160	200	1900	500	-	30	-	no	488	16	7808	36	20	28	26	100	110	78	89	100	0	0
VENKATAMUNIYAPPA	65	M	327335	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.8	68	20.98765432	180	80	2	No	No	10.1	90	134	70	91	100	16	26	175	220	2000	200	-	25	-	no	640	18	11520	37	21	26	24	79	132	92	92	100	0	0
RAMESH	52	M	119024	INTESTINAL OBSTRUCTION	EXPLORATORY LAPAROTOMY	1.74	74	24.44180209	174	74	1	No	Yes	10.7	98	142	70	94	100	14	30	180	230	1400	400	-	30	-	no	592	14	8288	40	22	24	25	90	126	80	103	100	0	0
VENKATAPPA	65	M	317789	ACUTE INTESTINAL OBSTRUCTION	EXPLORATORY LAPAROTOMY	1.48	54	24.65303141	148	48	2	No	No	12	92	130	84	99	100	15	28	140	180	1500	300	-	25	-	no	384	15	5760	39	17	25	23	99	130	90	97	100	0	0
PRAMILA	41	F	322168	INCISIONAL HERNIA	EXPLORATORY LAPAAROTOMY	1.36	64	34.60207612	136	36	1	No	Yes	11.3	90	118	80	93	100	16	42	160	210	1600	100	-	40	yes	yes	288	18	5184	38	19	23	17	83	108	78	106	100	0	1
SENAPPA	50	M	324600	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.52	68	29.43213296	152	52	2	No	No	10.2	82	110	78	89	100	18	41	130	190	1500	600	-	45	-	no	416	16	6656	35	28	25	18	88	116	72	83	100	0	0
ARUNA	30	F	301008	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.53	74	31.61177325	153	53	1	No	No	13.5	80	132	92	105	100	17	36	180	225	2000	600	-	30	-	no	424	14	5936	35	26	23	23	80	120	70	85	100	0	0
NASEEB	23	M	301608	APPENDICULAR PERFORATION	OPEN EXPLORATORY LAPAROTOMY	1.61	66	25.46198063	161	61	2	Yes	No	15.8	83	126	80	95	100	20	28	160	210	1400	600	-	20	yes	yes	488	15	7320	35	24	17	17	90	78	54	94	100	0	0
SUHAS	28	M	301757	INTESTINAL OBSTRUCTION ? SIGMOID VOLVULUS	EXPLORATORY LAPAROTOMY	1.71	55	18.80920625	171	71	1	No	No	13.4	88	110	70	83	100	16	27	175	225	1500	500	-	25	-	no	568	16	9088	36	25	18	21	85	120	88	103	100	0	0
NARAYANASWAMY	30	M	305877	LEFT HEMITHORAX WITH MULTIPLE RIB FRACTURE WITH GRADE 4 SPLENIC INJURY	EXPLORATORY LAPAROTOMY	1.7	64	22.14532872	170	70	2	No	Yes	12.8	85	126	80	95	99	14	44	180	230	1600	200	-	45	yes	yes	560	14	7840	37	23	23	20	86	104	70	94	99	0	0
MUNIRAJU	40	M	306923	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.49	68	30.62925093	149	49	1	No	No	12.8	84	112	70	84	100	15	33	140	190	1500	400	-	50	-	no	392	15	5880	40	17	17	21	80	130	90	86	100	0	0
RATHNAMMA	43	F	294080	DUODENAL CYST	EXPLORATORY LAPAROTOMY	1.58	60	24.03460984	158	58	2	No	No	13.1	74	112	84	93	100	16	37	160	200	1600	300	-	30	-	no	464	16	7424	39	18	18	22	98	124	72	86	100	0	0
RAVICHANDRA	32	M	30725	PENETRATING INJURY TO ABDOMEN	EXPLORATORY LAPAROTOMY	1.62	48	18.28989483	162	62	1	No	No	10.4	90	120	70	87	100	14	26	130	180	1400	100	-	25	-	no	496	18	8928	38	20	20	17	90	118	78	88	100	0	0
NARAYANASWAMY	30	M	305877	SECONDARY PERITONITIS WITH WOUND DEHISCENECE	REEXPLORATION	1.54	68	28.67262608	154	54	2	No	Yes	13	88	114	76	89	100	15	42	180	230	1700	600	-	20	-	no	432	14	6048	35	21	19	19	98	124	80	98	100	0	0
SHILPA	32	F	311521	P2L2 MASS PER ABDOMEN	STAGING LAPAROTOMY	1.56	84	34.51676529	156	56	1	No	No	15	80	130	80	97	100	16	31	190	240	1200	600	-	45	-	no	448	15	6720	35	22	28	28	98	120	80	83	100	0	0
VENKATARAMANAPPA 60	60	M	316076	PERITONITIS SEC. TO HOLLOW VISCOUS PERFORATION	EXPLORATORY LAPAROTOMY	1.63	66	24.84098009	163	63	1	No	No	13	94	118	80	93	100	17	37	150	190	1900	500	-	40	yes	yes	504	17	8568	36	18	26	26	78	90	60	74	100	0	0

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