“COMPARISON OF PAIN EXPERIENCED BY PATIENTS WHEN PLACED IN SUPINE AND SEMI-FOWLER’S POSITION DURING EXTUBATION AND IMMEDIATE POST OPERATIVE PERIOD FOLLOWING ABDOMINAL SURGERIES: A ONE YEAR HOSPITAL BASED RANDOMISED CLINCIAL TRIAL”

By

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Dissertation

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In

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LIST OF ABBREVATIONS

SP	Supine
SF	Semi-Fowler
PACU	Post Anaesthesia Care Unit
VAS	Visual Analogue Scale
IV	Intravenous
NSAIDs	Non-Steroidal Anti Inflammatory Drugs
CNS	Central Nervous System
GERD	Gastro Esophageal Reflux Disease
NMDA	N-Methyl-D-Aspartate
CO2	Carbon Dioxide
MAP	Mean Arterial Pressure
SVR	Systemic Vascular Resistance
PVR	Peripheral Vascular Resistance
FRC	Functional Residual Capacity
IAP	Intra-Abdominal Pressure
IOP	Intra-Ocular Pressure
PPC	Postoperative Pulmonary Complications
OSA	Obstructive Sleep Apnoea
SD	Standard Deviation
ASA	American Society of Anaesthesiologists
BMI	Body Mass Index
COPD	Chronic Obstructive Pulmonary Disease
ICU	Intensive Care Unit

NIBP	Non-Invasive Blood Pressure
HR	Heart Rate
SpO2	Peripheral Oxygen Saturation
RR	Respiratory Rate
N20	Nitrous Oxide
O2	Oxygen
OT	Operation Theatre

ABSTRACT

TITLE: "COMPARISON OF PAIN EXPERIENCED BY PATIENTS WHEN PLACED IN SUPINE AND SEMI-FOWLER'S POSITION DURING EXTUBATION AND IMMEDIATE POST OPERATIVE PERIOD FOLLOWING ABDOMINAL SURGERIES: A ONE YEAR HOSPITAL BASED RANDOMISED CLINCIAL TRIAL"

BACKGROUND:

The Anaesthetic Management of Laparoscopic surgeries usually consist of General Anaesthesia with intubation done using an endotracheal tube. The patients may experience severe pain in the immediate post-operative period and this may delay recovery and lead to increased morbidity and hospital stay. Pain in these patients is managed with IV analgesics including opioids, NSAIDs and Paracetamol and various fascial plane blocks. The Semi-Fowler's Position, involves raising the head end of the patient to 30 degrees. The Semi-Fowler's position, results in the caudal displacement of the diaphragm and in the better approximation of the surgical incisions of the abdomen. Hence, this may lead to reduced pain. This study hence aims to compare the pain experienced by the patients when placed in Semi-Fowler's position during extubation and immediate post-operative period.

METHODOLOGY:

A total of 66 adult patients of ASA Grade 1 and 2 of both the gender were randomized and allotted into 2 groups as GROUP-SP and GROUP-SF. In Group SP, the patients were placed in Supine position during extubation and in the PACU. The patients in Group SF, were placed in the Semi-Fowler's position during extubation

and in PACU. The Vitals were recorded at specified intervals. Pain was assessed in the Immediate post-operative period using VAS. Incidence of Post-operative Nausea and Vomiting was also noted.

RESULTS:

The patients in Group SF, i.e., those placed in Semi-Fowler's position experienced lesser pain in the immediate post-operative period compared to patients in the Group SP.

CONCLUSION:

The use of Semi-Fowler's position in extubation and in the PACU is effective in reducing the acute postoperative pain following elective laparoscopic surgeries. It is not associated with any complications and can be safely performed in all cases.

KEYWORDS:

Semi-Fowler's, extubation, post-operative pain, laparoscopy, PACU

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INTRODUCTION

Laparoscopy has become the mainstay for the surgical management of Acute Appendicitis, Cholecystitis, Hernias, and various other conditions.[1] Laparoscopy with the use of ports instead of large incisions, has helped to reduce postoperative pain in patients, reduce hospital stay and thereby improve patient care and satisfaction.[2,3,4]

The Anaesthetic Management of Laparoscopic surgeries usually consists of General Anaesthesia with intubation done using an endotracheal tube.[5]

Laparoscopic surgeries generally result in lung atelectasis, due to the cephalad displacement of the diaphragm, and the steep Trendelenburg position.[6,7] This results in poor and delayed recovery of pulmonary functions in patients in the Post Anaesthesia Care Unit and will lead to poor patient comfort and morbidities.[7]

In the early hours after surgery, patients may experience excruciating pain, which could hinder healing, increase morbidity, and lengthen hospital stays.[2,4] The recovery post general anaesthesia may also be delayed because of the pain during the stay in the post anaesthesia care unit.

It is believed that multiple factors contribute to the pain experienced in the initial post-operative period, most commonly it is due to the irritation of the diaphragm secondary to the creation of pneumoperitoneum, by insufflation with carbon dioxide and mostly due to presence of residual gas in the peritoneum.[2,8]

Generally, pain in these patients is managed with IV analgesics including opioids, NSAIDs and Paracetamol.[3,4] Various fascial plane blocks like the Transverse Abdominus Plane block, Rectus Sheath Block and Quadratus Lumborum Block are

also used to manage pain in these patients.[9,10] Neuraxial Blocks for post-operative analgesia are generally not performed in the patients.[11]

The use of patient positioning to manage pain and expediate recovery of pulmonary functions in the immediate post-operative period has not been studied previously.

The Semi-Fowler's Position, involves raising the head end of the patient to 30 degrees.[12] The Semi-Fowler's position, results in the caudal displacement of the diaphragm, thereby improving the functional residual capacity of these patients, and reversing the atelectatic changes in the lungs, thereby improving patient outcomes.[12]

The Semi-Fowler's Position also results in the better approximation of the surgical incisions of the abdomen. Hence, this may lead to reduced pain. But the use of Semi-Fowler's position during extubation and in the immediate post-operative period has not been studied extensively.[12]

The purpose of this study is to assess the discomfort experienced by patients in the Semi-Fowler's during extubation and the early post-operative period to the standard Supine position, as well as to determine its clinical value in improving lung functions following extubation.

Pain management in the post-operative period is of utmost priority to the anaesthesiologists globally and continues to be a challenge.

It has now turned into a multimodal concept, where various methods of analgesia, each of which act in a different way has been combined to reduce the pain experienced by the patient.[13] A combination of various drugs like NSAIDs and Opioids given intravenously, use of Epidural Analgesia with opioids or local

anesthetics, intraperitoneal infiltration with local anesthetics, fascial plane blocks like Transverse Abdominus Plane block or Quadratus Lumborum Blocks have been tried with varied success rates.[13]

However, all these methods, include the use of drugs like opioids and NSAIDs, all of which, have potential adverse effects, including respiratory depression, sedative effects, and delay patient recovery in the immediate post-operative period. The world bodies are aiming to reduce opioid consumption in surgical patients, moving towards opioid free anaesthesia.[13]

OBJECTIVES OF THE STUDY

Primary Objective:

To compare the pain experienced by the patients when placed in Supine and Semi-Fowler's position in immediate post-operative period, after undergoing laparoscopic abdominal surgeries.

Secondary Objective:

To compare the vital parameters and incidence of nausea and vomiting in patients when placed in Supine and Semi-Fowler's positions during extubation and immediate post-operative period in the patients undergoing laparoscopic abdominal surgeries.

REVIEW OF LITERATURE

Laparoscopy is used in the management of various abdominal conditions like[8,9,29]:

- Appendicitis, GI Perforation, Volvulus, etc.
- Surgeries of the Gall bladder & Liver
- Gynecological surgeries
- Hernia Repairs

There is lesser trauma caused to the tissues with minimal surgical incisions, resulting in minimal pain, faster wound healing and recovery and shorter hospital stay. Even though the intensity of pain has decreased, the patient does experience a degree of pain in the immediate post-operative period that can make him or her uncomfortable. The pain is mostly due to the trocar insertion sites, diaphragmatic irritation due to the pneumoperitoneum, any residual gas that was not evacuated at end of surgery, etc.[8,9]

In the modern day, multimodal analgesic approach, a combination of intravenous analgesics including opioids, fascial plane blocks, neuraxial blocks and local infiltration with local anesthetics is used to manage the pain in the immediate post-operative period following a laparoscopic surgery.[9]

Correctly positioning a patient in the PACU, helps prevent various complications in the recovery time, and can aid in improving patient outcomes.[12]

The Semi-Fowler's position during extubation and immediate post-operative period has been found to have various advantages.[12]

Laparoscopic surgeries, because of the pneumoperitoneum, the diaphragm is pushed up, this reduces the lung capacities. By enhancing the diaphragm's range of motion, the Semi-Fowler position during extubation helps to increase the FRC by 10-15%.[12,33]

Furthermore, it's thought that by minimising the abdominal muscles' stretch in the semi-fowler's position, the stress on the surgical wound is reduced and the pain associated with it is diminished.[12]

Ekstein et al conducted a randomized controlled trial involving 145 patients, comparing the pain levels in the immediate post-operative after laparoscopy and laparotomy under General Anaesthesia in 2005. The study concluded that patients who underwent laparoscopy experienced more pain in the immediate post-operative period, that is within the first four hours, compared to patients who underwent laparotomy. The average VAS scores experienced by patients who underwent laparoscopy was 6.06 ± 1.75 and 2.81 ± 1.14 at 10 minutes and 120 minutes ($p<0.0005$), and those who underwent laparotomy were 4.14 ± 2.14 and 1.39 ± 0.55 respectively. Thus, patients who underwent laparoscopy had more intense pain in the immediate postoperative period and demanded more analgesia. The study also found that 9 hours after surgery, the patients who underwent laparoscopy experienced lesser pain compared to those who underwent laparotomy. The patients who underwent laparotomy demanded 33% more doses of pain medications. By 24 hours, patients who underwent laparoscopy, were comfortable with minimal pain medications. The study concludes by explaining that pain in laparoscopic surgeries is multifactorial, and there is significant pain in the immediate post-operative period, and also tells more

research work is needed to understand the precise mechanics of intense pain in the immediate post-operative period post a laparoscopy.[34]

Allan W. Belcher et al, in a study published in 2017, done in a teaching hospital in USA, on adult patients undergoing non cardiac surgery between 2005 and 2013, and also receiving neuromuscular Blockers, found that the incidence of major complications in the PACU was 2.1% and that of any minor complication was 35.2% and the most frequent major complications were found to be re-intubation and ICU admissions.[35]

The lower FRC and impaired oxygenation typically seen during anaesthesia usually return to normal within a few hours following simple surgeries, but this is not always the case after major surgery, according to a 2017 review study by A. Miskovic and A. B. Lumb of the United Kingdom. Patients in the PACU continue to have atelectasis. Reduced FRC, persistent atelectasis, an ineffective cough, and aberrant respiratory control all combine to provide the perfect environment for post-operative pulmonary problems.[36]

Semi-fowler's position during emergence and extubation is safe and comfortable, according to a 2019 study by Zhu et al. in China. They found a significant reduction in VAS scores for wound pain at 30 minutes (p=0.005) after extubation when patient was placed in semi-fowler’s position. They attribute the same to the decreased abdominal wall tension in the semi-fowler’s position.[12]

They also believed that the patients were more comfortable in the head elevated position as they found that the comfort VAS scores were higher 5 minutes after extubation (p=0.007) and when leaving the recovery(p=0.034) compared to the

regular flat position.[12] They believed this is because of the reduced work of breathing because of the downward displacement of the diaphragm, thereby allowing the lungs to expand more freely. This helps improve oxygenation and can improve oxygen saturation. This is crucial as the incidence of Residual Neuromuscular Blockade in these patients can be as high as 64.7% as found in the 2019 RECITE-US study by Saager L et al.[37]

The Zhu et al study also found less coughing ($p=0.008$) and passive bucking ($p<0.001$) during extubation in the semi-fowler's position. This reduced incidence of coughing and passive bucking helped prevent sudden stressor responses to the coughing and bucking, and hence reduced tachycardia and hypertension.[12]

Huseyin Kiyak et al investigated the impact of semi-fowler's position on post-laparoscopy shoulder pain. Of the 106 patients they studied, they found the lowest post laparoscopy shoulder pain scores in patients in the 30 degree head up position ($P<0.001$). They concluded that the remaining post-operative CO_2 is better evacuated when patient is placed in head up. This is because of the raised intra-abdominal pressure, leading to increased outward efflux of remaining CO_2, causing lesser diaphragmatic irritation and stretching, and hence resulted in lesser post laparoscopy shoulder pain. They noted that this easy, cost-free implementation led to less postoperative analgesic and opioid administration, resulting in faster recovery and discharge in patients undergoing laparoscopy.[38]

Barash et al in Clinical Anaesthesia mentions that reduced pulmonary compliance increases the elastic work of breathing. Low compliance causes progressive respiratory muscle fatigue, hypoventilation, and respiratory acidosis. Increased abdominal pressure in supine or lateral position also decreases pulmonary

compliance, most notably after intra-abdominal laparoscopic procedures due to retained CO_2, that impairs diaphragm movement. Work of breathing is improved by resolving problems that reduce compliance. Allowing patients to recover in a semi-sitting (Semi-Fowler) position reduces work of breathing.[29]

The position of patients during extubation is generally supine, but studies have shown that changing the position of patients during extubation may improve patient outcomes depending upon the condition. This was demonstrated by H. Jung et al. in 2019, who compared the lateral and supine positions for tracheal extubation in children and discovered that, when compared to extubation in the supine position, deep extubation in the lateral position improved SpO_2 and decreased the incidence of stridor and laryngospasm in the early emergence period.[39]

According to a review article by Kalpana Vinod Kelkar, post-operative pulmonary complications (PPCs) affect 5–10% of non-thoracic surgery patients and 22% of high-risk patients, and attributed it to atelectasis because of general Anesthesia in the supine & head low position and the increased intra-abdominal pressure during laparoscopy.[40]

Atelectasis can linger for a few weeks after surgery in patients who had abdominal operations. The basal regions of the lungs are the most severely affected, and lung expansion techniques are particularly helpful in lowering postoperative pulmonary complications. Additionally, the article points out that effective postoperative analgesia reduces the neuroendocrine stress response, which can cause postoperative pulmonary complications and organ dysfunction.[40]

Pinto V. et al. conducted research on the tidal volume effects of various post-operative patient postures. They measured the tidal volume using a Wright's respirometer. They discovered that when patients were moved to a semi-recumbent position after being initially retained in the supine position, the mean tidal volume increased to 283 ml (P 0.0001). They discovered that the semi-recumbent position had better ventilatory characteristics than the supine position, in the end.[41]

In a 2022 study by Sakaguchi et al, they discovered that when upper body elevation of 30 degrees was combined with a high-flow nasal cannula, it significantly decreased the flow-based apnoea hypopnoea index in postoperative patients with untreated moderate to severe OSA (p 0.001). They ascribed it to the improvement in lung capacity.[42]

BASIC SCIENCES

Pain:

The International Association for the Study of Pain (IASP) in 2020 defined Pain as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage."[14,16]

Pain is experienced subjectively and differently by individuals. Pain occurs whenever the tissues are damaged and causes the individual to react to reverse the pain stimuli. Pain perception, being a complex phenomenon is influenced by various biological, psychological and social factors.

<u>Theories of Pain</u>[15]

Multiple theories of pain have been postulated over the years that describe the mechanics behind the pain perception.

Four of the most accepted theories include:

- Specificity Theory

Specificity Theory postulates that there are specific dedicated pathways for each somatosensory modality, that is, each modality has a specific receptor, that is sensitive to a specific stimulus and transmits the signal through a specific sensory fibre. The model also proposes that low threshold mechanoreceptors are responsible for capturing non noxious stimuli, that transmits the signal to the second order neurons in the brainstem or spinal cord. Noxious stimuli would activate a nociceptor that transmits signals to the higher pain centres through a pain fibre.

- Intensity Theory

Intensity Theory is also known as the Summation Theory of Pain. Studies in the 1900s found that there is a form of summation, that results in subthreshold stimuli to become unbearably painful. The theory lost favour after the discovery of nociceptors, which are specialised sensory receptors to noxious stimuli.

- Pattern Theory

This theory postulated that pain sensation occurred due to a specific and particular pattern of neuronal firing and that the spatial and temporal profile of the firing encoded the stimulus type and intensity.

- Gate Control Theory

The Gate Control Theory was proposed in the year 1965 by Ronald Melzack and Charles Patrick Wall. The theory accepted the presence of nociceptors and touch fibers and proposed that these fibres synapse in two different regions in the dorsal horn of the spinal cord. There are three different regions to which the primary afferents from stimulation are transmitted – substantia gelatinosa, dorsal column and transmission cells. They proposed that the substantia gelatinosa in the dorsal horn is the 'Gate' and it modulates the transmission of pain signals from the primary afferent receptors to the transmission cells. There are large and small fibers in the 'Gate' which inhibit (close) and facilitates (opens) the gate respectively. When nociceptive stimuli reach a threshold level, above the level of inhibition, the gate opens up and the stimuli is transmitted, lead to the perception of pain in the individual.

Nociception and Pain[15,16]

Pain refers to the subjective experience, whereas nociception refers to the neural encoding of impending or actual tissue damage, i.e., it is the peripheral and central nervous system processing of information about the internal or external environment, as generated by activation of nociceptors.

Noxious stimuli activate nociceptors, present on the surfaces, and they transmit signals to the spinal cord dorsal horn, and further travels through the pain pathway and reaches the cerebral cortex, where the perception of pain is generated. Nociception can occur in the absence of pain, as pain is a result of higher CNS function.

There are four distinct components of nociception, which includes – Transduction, Transmission, Modulation and Perception.

Transduction- it refers to the process by which a thermal, chemical or mechanical noxious stimulus in the tissues is converted into an electrical impulse in the sensory nerve endings.

Transmission – it is the process by which electrical impulses travel to the CNS from the sensory nerve endings.

Modulation – it is the process by which the transmission of pain is altered. This is often done by the inhibitory and excitatory mechanisms that modulate the pain impulse transmission.

Perception- The pain signals arriving into the CNS are mediated at the Thalamus, considered as a relay station and further the primary somatosensory cortex differentiates specific sensations.

Classification of Pain based on their Qualities[16]

Pain can be classified into two major types – Fast Pain and Slow Pain.

Fast Pain occurs instantly, often within 0.1 second after application of a painful stimuli, whereas Slow Pain begins only after 1 second or more and then it increases gradually over time.

Fast Pain is also called Acute Pain, Sharp Pain, Pricking Pain. This type of pain is felt in needle stick injuries or acute burns to skin. This is not felt in the deeper tissues of the body.

Slow Pain is also called as Chronic Pain, Throbbing Pain, Nauseous Pain, Slow Burning Pain. This is associated with tissue destruction and can lead to protracted intolerable misery. It can occur in the superficial skin, as well as in deep tissue and organs.

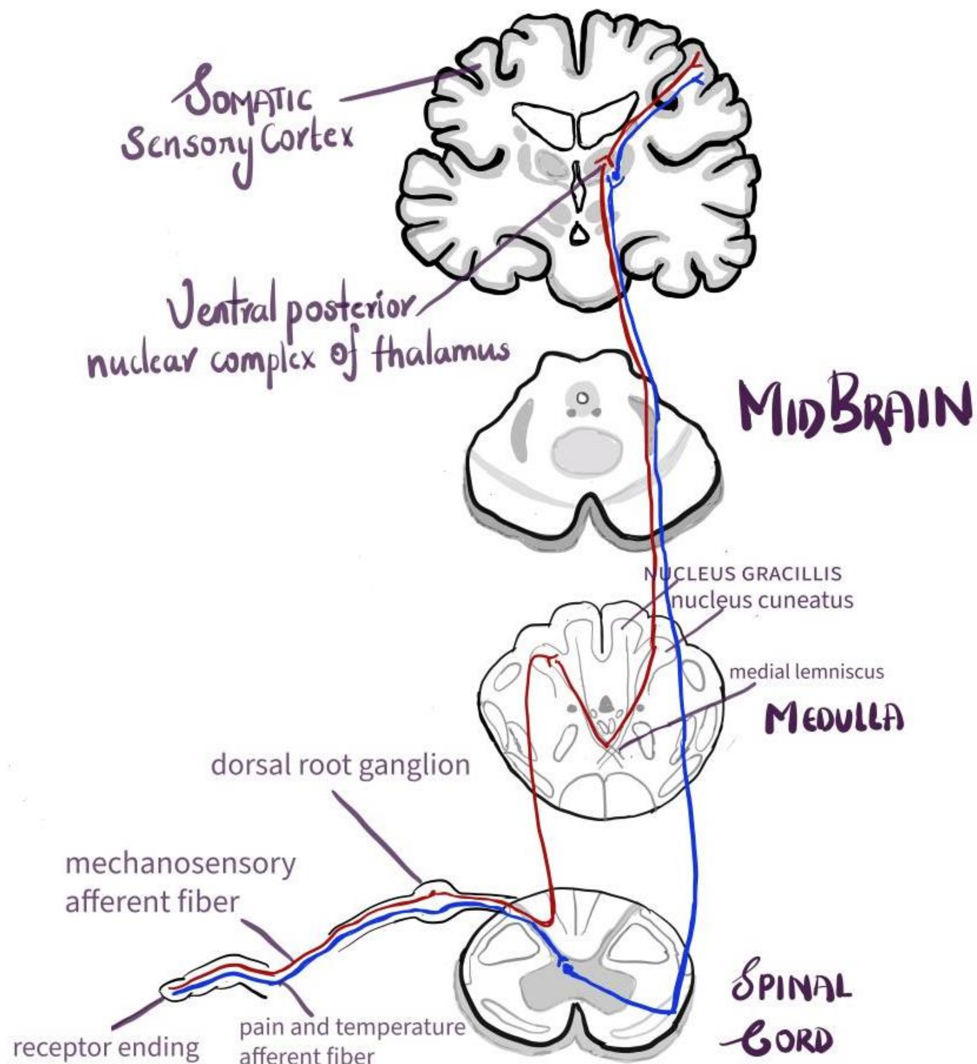


Figure 1: Pain Pathway[16]

Effects of Postoperative Pain[17]

Sufficient Postoperative pain relief is believed to improve surgical outcome, with reduced morbidity, need for hospitalisation and convalescence and aids in early postoperative recovery. It is believed that increased pain intensity, results in a proportional increase in neuroendocrine stress response, leading to postoperative organ dysfunction and poor outcomes.

Effects of Postoperative Pain on various systems[18]:

Cardiovascular Effects:

Perioperative cardiac morbidity is a major cause of mortality in the PACU. Postoperative myocardial ischemia may develop because of various factors like pre-existing ischemia, anaemia, tracheal intubation and suctioning, hypothermia, poorly controlled pain, etc. These conditions cause activation of the sympathetic system, leading to catecholamine induced tachycardia, increased contractility, increased afterload and preload (due to vasopressin and aldosterone), which will all increase myocardial oxygen demand. In patients with poor cardiac history, this will lead to development of ischemia.[19]

Pulmonary Effects[17,18,20]:

Postoperative Pain results in short and fast breaths. There is tachypnoea, with decrease in the tidal volume, forced expiratory volume, and most importantly the functional residual capacity, resulting in clinically significant hypoxia and hypercarbia

There is an increase in total body oxygen consumption and carbon dioxide production, resulting in increase in work of breathing. Severe pain, also supresses the patient's ability to cough, and the patient takes short breaths which are not deep, resulting in reduction in the functional residual capacity, leading to atelectasis, shunting and hypoxemia.

Gastrointestinal Effects[21]:

The increased sympathetic response to pain, results in increase in tone of sphincters and decreased gastric motility, leading to ileus. Also, there is increased gastric acid secretion, leading to GERD.

Endocrinal Effects[22]:

Pain results in activation of hypothalamic pituitary axis, leading to increased cathecholamine and catabolic hormone release, leading to sodium and water retention, hyperglycemia and lactic acidosis.

Measurement of pain[23,24]:

Pain measurement is done by two methods;

1. Type I methods:

Those are objective methods, done by the physician as he assigns numbers about the patient condition. It includes the following:

Physiological indices

- Endocrinal (increase in serum cortisol and catecholamine).
- Cardiovascular (increase in blood pressure and heart rate)
- Respiratory (increase in respiratory rate and decrease in tidal volume) Neuro-pharmacological
- Correlation with beta endorphin (decreased in acute painful conditions)
- Thermography (hypo-emission in chronic pain)

Neurological

- Nerve conduction velocity
- Evoked potentials
- Single positron emission tomography (SPET).

Behavioral

- Sighing, crying, shouting, trembling

2. Type II methods:

It includes either:

Single dimension methods

- Category scale (verbal rating scale)
- Numerical rating scale
- Graphic rating scale

Multi-dimensional methods

- Mc Gill pain Questionnaire, MPQ
- Dartmouth pain Questionnaire, DPQ
- West Haven-Yale pain Questionnaire, WHYPQ[25]

Measurement of pain in clinical practice depends largely on verbal dialogue between the patient and the doctor or nurse. A rating scale is mandatory in research projects and ideally when clinical data are being collected.

A number of individual differences between patients make comparisons of pain measurements more difficult. For example, the past experiences of the patients influence their present perception of pain. Also, demographic factors such as gender, age, and ethnic background influence the individual's perception of pain. Again, patients who are clinically depressed and anxious tend to report increased pain intensity.

Although pain is a subjective experience, great attention has been paid to the quantification of this experience. As pain is subjective experience, everyone has different perceptions of that experience. Differences are found in how individuals quantify pain. For example, some individuals would never say that their pain was a (10) on a scale from (0) to (10). On the other hand, other individuals report their pain as a constant (10) despite looking calm and relaxed. Also, all numeric scales used to measure pain have floor and ceiling effects. If the patients describe their pain to be a (10), there is no way to report an increase in pain intensity.

Of the many methods of pain scoring VAS and VRS are the most commonly used in the single dimension method.

Visual analogue scale (VAS): [26,27]

The visual analogue scale uses a straight line with extremities of pain intensity on either end. The line is typically 10 cm long with one end defined as "no pain" and the other end being excruciating unbearable pain". The line can be either vertical or horizontal. The patients are asked to place a mark on the line to describe the amount of pain that they are currently experiencing. The distance between the end labelled "no pain" and the mark placed by the patient is measured and rounded to the nearest

centimetre. To assist in describing the intensity of pain, words can be placed along the scale (for example, mild, moderate, or severe). Such descriptors can help to orient the patient for the degree of pain; this particular variation of the VAS has been known as a graphic rating scale. Explanation to the patient is needed by the clinician when using the VAS. Occasionally, the patient may be confused about the line, perceiving it to represent time of degree of relief rather than degree of pain intensity.

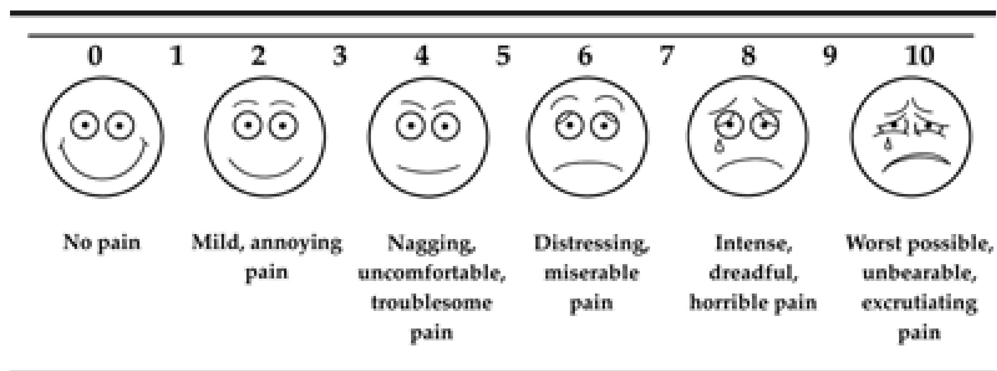


Figure 2: Visual Analogue Scale[26,27]

MANAGEMENT OF POSTOPERATIVE PAIN[28]

Prophylactic measures:

The incidence, severity, and duration of pain and suffering during the postoperative period can be decreased by proper preoperative and postoperative surgical and psychological care. Although the accepted definition of pain emphasizes the cognitive, emotional response to tissue damage, the role of psychological techniques in the relief of acute pain has been minimized. Psychoeducational care has beneficial effects on recovery, postoperative pain and psychological distress after surgery.

Psycho-educational care was classed as health-care information (information in preparation for surgery, timing of procedures, function and roles of health-care providers, self-care actions, and pain and discomfort information); skills teaching (coughing, breathing and bed exercises, relaxation, hypnosis); and psychosocial support (identifying and alleviating concerns, reassurance, problems solving, and encouraging questions).

Optimal surgical care also helps to decrease the severity of postoperative pain. Skilful and gentle handling of tissues while carrying out the operation and observance of other surgical principles assist to minimize trauma. Proper postoperative care help to decrease the magnitude of postoperative pain which involves continuing psychological support, proper care of wounds, early ambulation, and of course good nursing care.

Active measures

Postoperative pain can be partially or completely relieved by one of the following methods:

1. Systemic analgesics and adjuvant

a) Opioids

b) Non-steroidal anti-inflammatory drugs

c) NMDA antagonists

d) Alpha-2 adrenergic agonists

e) Miscellaneous non-opioid compounds

2. Local infiltration and field block - Regional analgesia with local anaesthetics

a) Continuous segmental epidural block

b) Intrapleural instillation

c) Intraperitoneal instillation

d) Infiltration of the incision site

3. Regional analgesia with neuro-axial opioids and local anaesthetics

4. Regional analgesia with combined local anaesthetics and opioids

5. Electrical analgesia achieved with transcutaneous electrical stimulation or electro acupuncture.

Laparoscopic Surgery [8,9,10,29]

Laparoscopy has become the standard of care for surgeries involving the abdomen. Compared to conventional approach of laparotomy, laparoscopy allows smaller incisions, reduces perioperative stress response, reduces postoperative pain and results in shorter recovery time. It requires the insufflation of intraperitoneal or extraperitoneal gas, usually carbon dioxide (CO_2), to create space for visualisation and performing the surgery.

Anaesthetic concerns for patients undergoing laparoscopic surgeries differ from those patients undergoing open abdominal surgery as it includes the effects of the pneumoperitoneum, absorption of carbon dioxide and extreme positioning of patient during surgery.

Physiological Effects of Laparoscopy

Cardiovascular System

1. Effects of Pneumoperitoneum-
    a. Neuroendocrine effects – Increase in Intraabdominal pressure results in release of catecholamines, and activation of the RAAS, resulting in increase in MAP.
    b. Mechanical Effects – Pneumoperitoneum causes increase in SVR and PVR.
2. Effect of Positioning –
    a. Head up position – (Reverse Trendelenburg) leads to venous pooling in the lower limbs, leading to reduced venous return to heart, resulting in hypotension in patients who are hypovolemic
    b. Head down position – (Trendelenburg Position) – Increases the Venous Return and pressures in the heart.

Pulmonary System –

1. Pneumoperitoneum – It causes cephalad displacement of the diaphragm, resulting in reduction in the FRC and pulmonary compliance, resulting in basal atelectasis and increased plateau pressures.
2. CO2 absorption – CO2 is absorbed rapidly into the circulatory system as it is highly soluble, and reaches a plateau in 60 mins of insufflation.
3. Ventilation-Perfusion Matching- Laparoscopy results in reduction in the FRC and atelectasis of lung fields. This combination leads to shunting and ventilation-perfusion mismatch.

4. Endotracheal tube position- Pneumoperitoneum and Trendelenburg Position causes upward displacement of the carina, resulting in the endobronchial migration of endotracheal tube, resulting in hypoxia and high inspiratory pressures.

Other Changes –

1. Splanchnic Blood Flow- Reduced due to the pressure effects of pneumoperitoneum. Hypercapnia may cause splanchnic vasodilation
2. Renal Blood Flow- Reduced Renal perfusion and urine output due to the pressure effect of pneumoperitoneum.
3. Cerebral Blood Flow – Increased IAP, hypercarbia and Trendelenburg position, all increases the cerebral blood flow, and hence the intracranial pressures.
4. Intraocular Pressures- IOP is raised due to Trendelenburg position and pneumoperitoneum.

Postoperative Pain after Laparoscopy

Studies have found that Laparoscopy surgeries, even though is minimally invasive, is associated with pain, although of lesser intensity. The pain is usually because of the port site incision and visceral pain, and generally lasts for the first 24 hours.

Mechanism of Pain in Laparoscopic Surgeries:

Pain in Laparoscopic Surgeries is believed to be multifactorial in origin. The causes may include – trauma at trocar entrance sites, diaphragmatic irritation by

pneumoperitoneum and CO2 insufflation, presence of residual intraperitoneal gas, chemical irritation of peritoneum, micro-ruptures of parietal peritoneum, etc.

Laparoscopic surgeries are also associated with Shoulder Tip Pain due to the irritation of the Phrenic Nerve due to the pneumoperitoneum. Any residual gas present in the abdomen post-surgical closure, can still cause pain, and hence complete aspiration of gas should be done.

Carbon Dioxide, generally used for creation of pneumoperitoneum, can also decrease the intraperitoneal pH in the immediate post-operative period, often close to pH of 6, this can cause irritation of the phrenic nerve.

Temperature and Humidity of Gases are also important factors. Studies have found significant pain reduction in patients in whom warmed gas was used. The use of Humidified gas in a study done in Adelaide, also found significant pain reduction.

Management of Post-Operative Pain after Laparoscopic Surgeries:[29]

The modern-day anaesthetic practice advocates the use of Multimodal analgesia. Hence a combination of IV analgesics including Opioids, Paracetamol, NSAIDs, Fascial Plane Blocks like Transversus Abdominus Plane Block and Quadratus Lumborum block, use of patient-controlled analgesia and neuraxial blockade, intraperitoneal infiltration of local anaesthetics and port site infiltration are all performed to manage pain.

Patient Positioning plays an important factor in post-operative recovery and comfort of patient.

Semi-Fowler's Position[12,30]

The Fowler's Position was first described by George Ryerson Fowler, after whom the position is named after. It was found that the position helped to reduce mortality in peritonitis.

The patient is made to sit in a semi-upright position with an angle of 45 to 60 degrees with knees straight or bent.

The Semi-Fowler's Position is a modification of the original Fowler's Position. Here, the patient is made to sit upright at an angle of 30 degrees.

In the semi-Fowler's position, the extension of abdominal muscles decreases, thereby potentially relieving the intension of surgical wound and abdominal pain. In addition, peritoneal effusion is restricted to the lower position, leading to a more adequate drainage.

Moreover, studies have shown that the semi-Fowler's position can increase the lung capacity by 10 to 15% and improve the range of motion of diaphragm muscle; this facilitates lung expansion and increases gas exchange. In addition, early postural interventions after general anaesthesia can facilitate pulmonary ventilation and increase blood oxygen content.

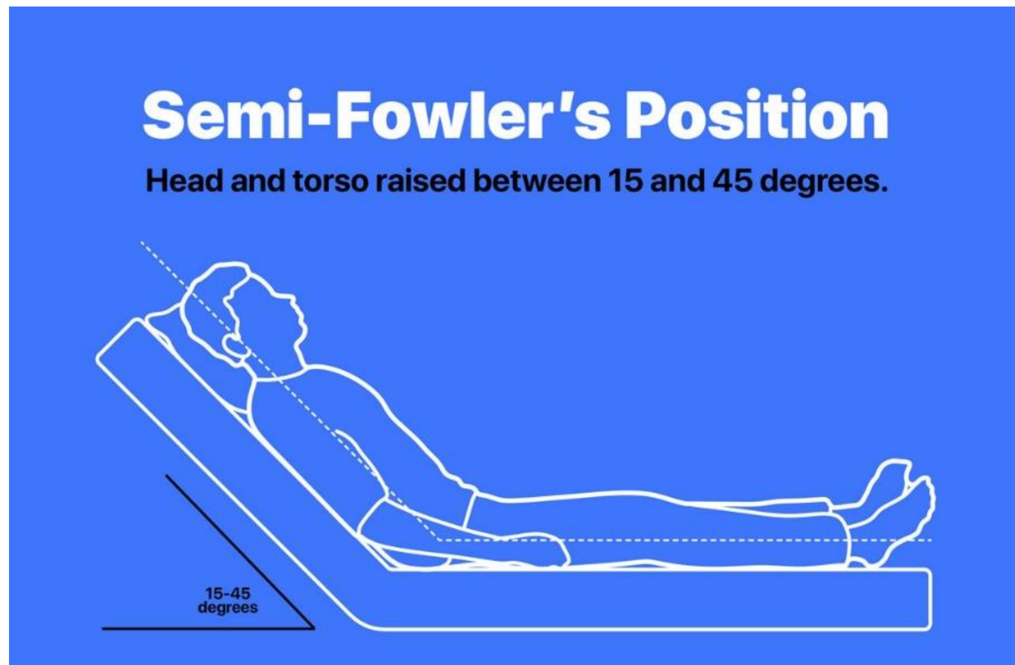


Figure 3: Semi-Fowler's Position

Clinometer[31]

It is an android application. It uses the gyroscope present in the smartphones to measure the plane of the phone in both horizontal and vertical axes. That is, it simply measures the degree of tilt or the degree of inclination from a neutral point on a plane surface if used perpendicular to that surface. If kept horizontally it acts similar to a spirit level and determines whether the surface is flat. It can be downloaded on android smart phones from the google play store. By using this application, the table tilts for Supine and Semi-Fowler's position can be measured in degrees effectively

Figure 4: Clinometer Application: Screenshot

MATERIALS AND METHODS

The present study was conducted at KLE'S Dr. Prabhakar Kore Hospital and Medical Research Centre, Nehru Nagar, Belagavi 590010, on patients undergoing laparoscopic abdominal surgery under General Anaesthesia between January 2021 to December 2021.

Study design: Randomized controlled trial

Study Period: January to December 2021

Sample size: A total sample size of 66 cases

Determining the Sample Size :

Based on the mean and standard deviation, the formula for the minimal sample size is

$$n = \frac{(z_\alpha + z_\beta)^2 (s_1^2 + s_2^2)}{(\bar{X}_1 - \bar{X}_2)^2}$$

where z_α is linked with the level of significance and z_β is linked with the power of the test. For 5% level of the significance $z_\alpha = 1.96$ and $z_\beta = 0.84$ for 80% power of the test[12]

$\bar{X}_1$ is the 1st group's mean. (6.11) and $\bar{X}_2$ is the 2nd group's mean (4.70)

s_1 is the SD of the 1st group (2.30) and s_2 is the SD of the 2nd group (1.78).

Substituting, a sample size of 33 is required.

There were two groups, each containing a minimum of 33 patients.

Sampling procedure:

A one-year Randomised clinical trial. Randomisation was achieved by computer generated randomisation chart.

Selection Criteria:

Inclusion Criteria:

- ASA physical status I and II.
- Age between 18 to 50 years.
- Patients undergoing elective laparoscopic abdominal surgeries under general anaesthesia.
- Provides Consent

Exclusion Criteria:

- Patients with difficult airway, obesity (BMI>35kg/sq.m), symptomatic reflux
- Patients with past history of pulmonary co-morbidities like COPD, Bronchial Asthma
- Patients who are chronic smokers.
- Pregnant women
- Patients requiring ICU admission following surgery

Methodology:

After receiving the ethical committee's permission and written informed consent from the patient, a total of 66 patients who had met the inclusion criteria, undergoing laparoscopic abdominal surgery under general anaesthesia were included in the study, and were randomised based on computer generated randomisation table into one of the two groups.

Group SF: Patients in whom endotracheal extubation was done in Semi-Fowler's position

Group SP: Patients in whom endotracheal extubation was done in Supine position.

After enrolment, demographic data, including age, gender, ASA Class and Malampatti Grade were recorded.

Before undergoing anaesthesia, baseline haemodynamic measurements (NIBP, HR, SpO2 and RR) were recorded.

The anaesthetic management for each patient was done as per standard institutional protocol.

On the day of surgery, intravenous access was secured using 18G or 20G IV cannula and intravenous fluids started. In the operation theatre patients were monitored by pulse oximetry, non-invasive blood pressure measurement, capnography and electrocardiography. After three minutes of preoxygenation, the patient was premedicated with injections of anticholinergic Glycopyrrolate (0.005 mg/kg IV), Benzodiazipine Midazolam (0.05 mg/kg IV), and an opioid Fentanyl (2 mcg/kg IV). Thiopentone sodium 5mg/kg IV injection was used to induce the anaesthesia, which was followed by 2mg/kg IV injection of succinylcholine to aid in orotracheal intubation. After confirming bilateral equal air entry, endotracheal tube was secured

with tapes at appropriate length and mechanically ventilated. General anaesthesia was maintained with O2:N2O in the ratio of 50:50 with Isoflurane with Inj. Vecuronium loading dose of 0.1mg/kg and intermittent top ups of 1/4th of loading dose.

After instituting general anaesthesia, patients in both the groups received one dose of intravenous Paracetamol at the dose of 15mg/Kg.

Following the procedure, they were positioned to either the Semi-Fowler's or the supine position.

Patients were extubated after achieving:

1. Spontaneous ventilation
2. Complete Reversal of Neuromuscular Blockade
3. Regaining of consciousness & Eye opening

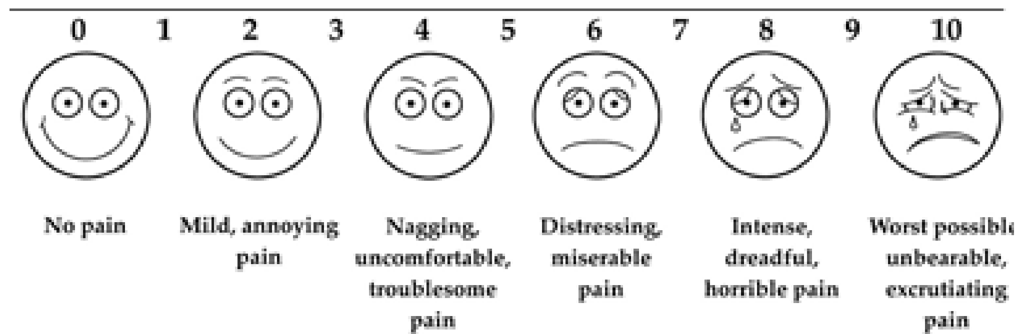
Patients were extubated in the operating room in either supine or semi-fowler's position after thorough suctioning and adequate reversal with injections of glycopyrrolate(0.01mg/kg) and neostigmine (0.05mg/kg), and then they were moved to the recovery where they underwent standard haemodynamic monitoring.

The patients were administered oxygen by face mask in the PACU. The patients who were in the Semi-Fowler’s position and develop vomiting were placed back in supine position.

The comfort VAS score

The comfort VAS score (0 to 10) were recorded as per the intensity of the pain:

Intensity	Score
None	0-2
Uncomfortable	2-4
Annoying	4-6
Dreadful	6-8
Excruciating	8-10



Rescue Analgesia was given with Inj. Tramadol (1mg/kg) for all patients with VAS scores above 5.

Vital signs were recorded at 6 points

1. At end of surgery (T1)
2. After Positioning (T2)
3. 1 min after extubation (T3)
4. 10 mins after extubation (T4)
5. 30 mins after extubation (T5)
6. 60 mins after extubation (T6)

In addition, the following were recorded,

Frequency of Vomiting & Nausea in the postoperative period

Statistical Analysis:

The study's main objective was to compare the two groups. The mean and standard deviation for the continuous quantitative variables were computed. Suitable statistical tools, such as the unpaired student's t test, were used to compare the continuous variables between groups. Using a paired t test, two quantitative variables within a group were compared.

Rates, ratios, and percentages were used to express the categorical data. Using the Chi-square test or Fisher's exact test, the relationship between the result, clinical, and demographic factors was examined. Median was used to represent discrete variables. Discrete variables were compared using nonparametric testing. The comparison will be shown using appropriate graphs.

The value of p less than 5% (0.05) was regarded as significant for all tests.

RESULTS

The present study was done to compare the pain and vital parameters in between the two positions, namely Semi-Fowler's position and Supine position during extubation and in the immediate post-operative period in patients who underwent laparoscopic abdominal surgeries.

66 patients were enrolled in this study, keeping in mind the inclusion and exclusion criteria.

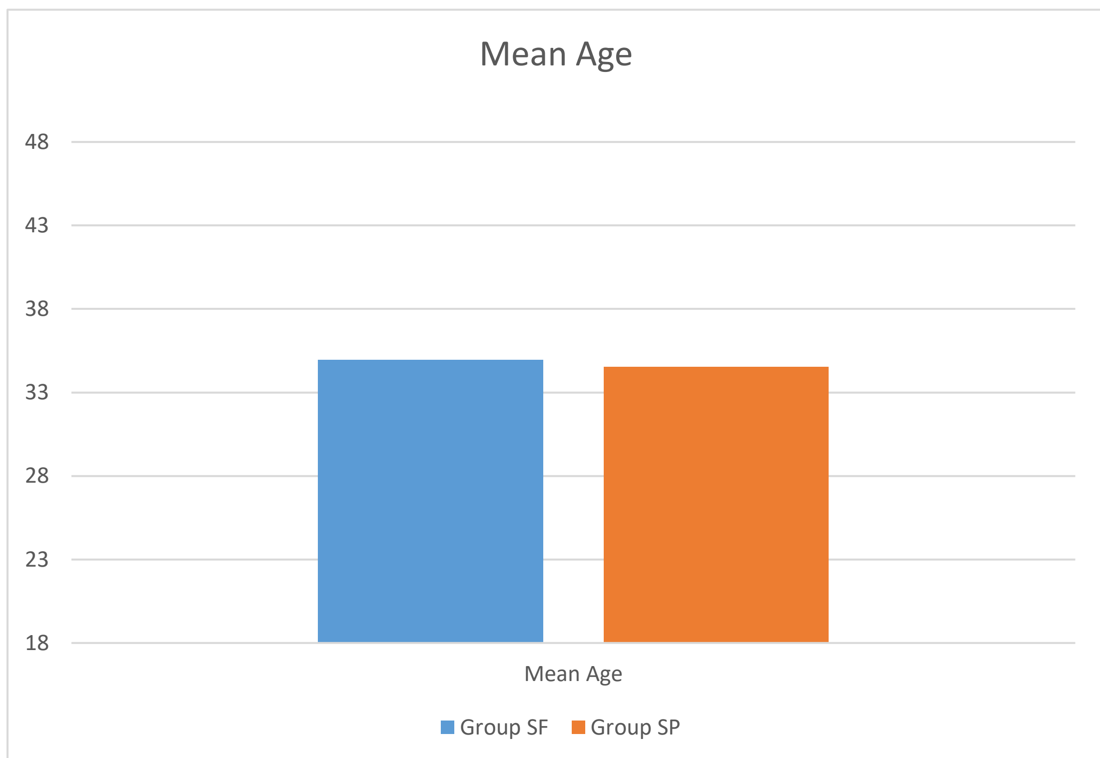
33 patients in Group SF were placed in the Semi-Fowler's Position and 33 patients in Group SP were placed in Supine Position.

Demographic Data

Table 1: Mean Age

	Group SF		Group SP		p value
	Mean	Standard Deviation	Mean	Standard Deviation	
Age (years)	34.97	9.80	34.55	9.95	0.8620

Graph 1: Mean Age

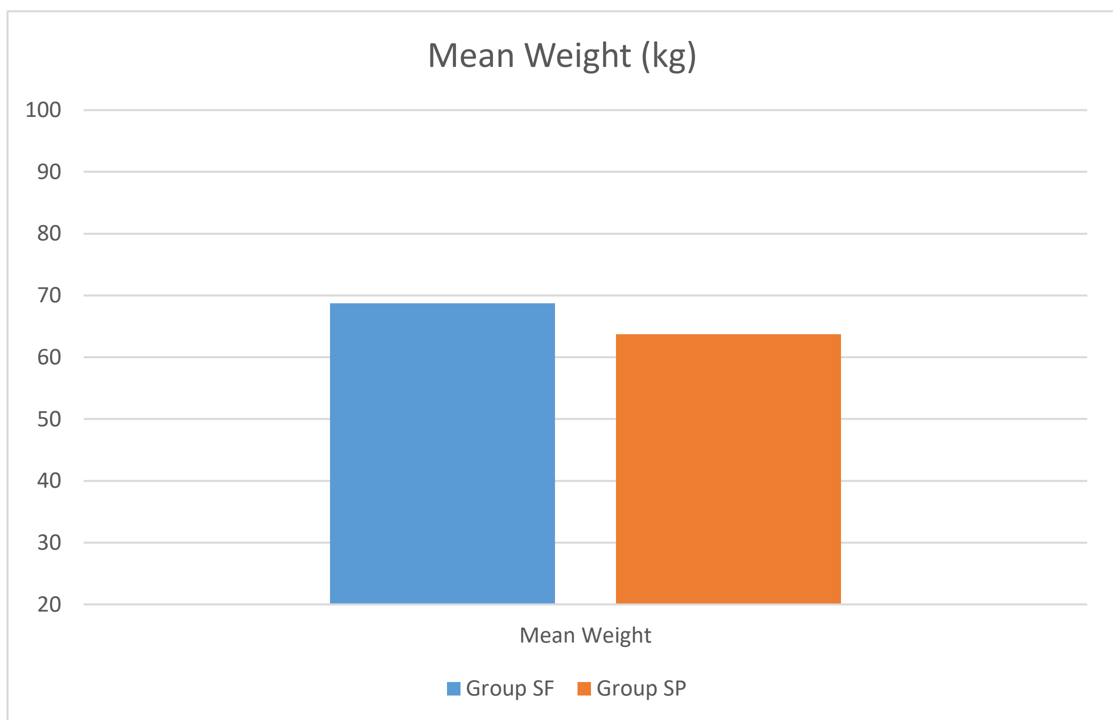


Our study found no statistical difference in mean age between groups . (34.97±9.80 years, 34.55±9.95 years respectively; p =0.8620). The p value was calculated using student's unpaired 't' test.

Table 2: Mean Weight

	Group SF		Group SP		p value
	Mean	Standard Deviation	Mean	Standard Deviation	
Weight(kg)	68.70	12.16	63.67	14.42	0.1305

Graph 2: Mean Weight

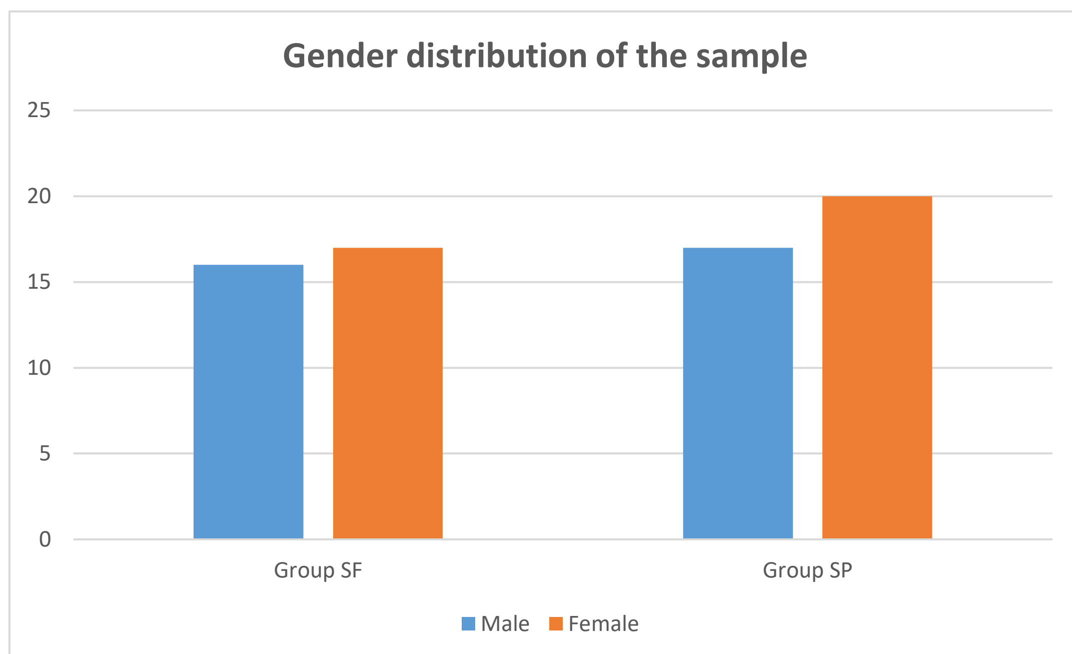


The mean weights in both the groups were comparable. (SF 68.70±12.16 years, SP 63.67±14.42 years; p =0.1305). The p value was calculated using student's unpaired 't' test.

Table 3: Gender distribution of the sample

	Group SF		Group SP	
	Number	**Percent (%)**	**Number**	**Percent**
Male	16	48.48	13	39.39
Female	17	51.52	20	60.61
Total	33	100	33	100

Graph 3: Gender distribution of the sample

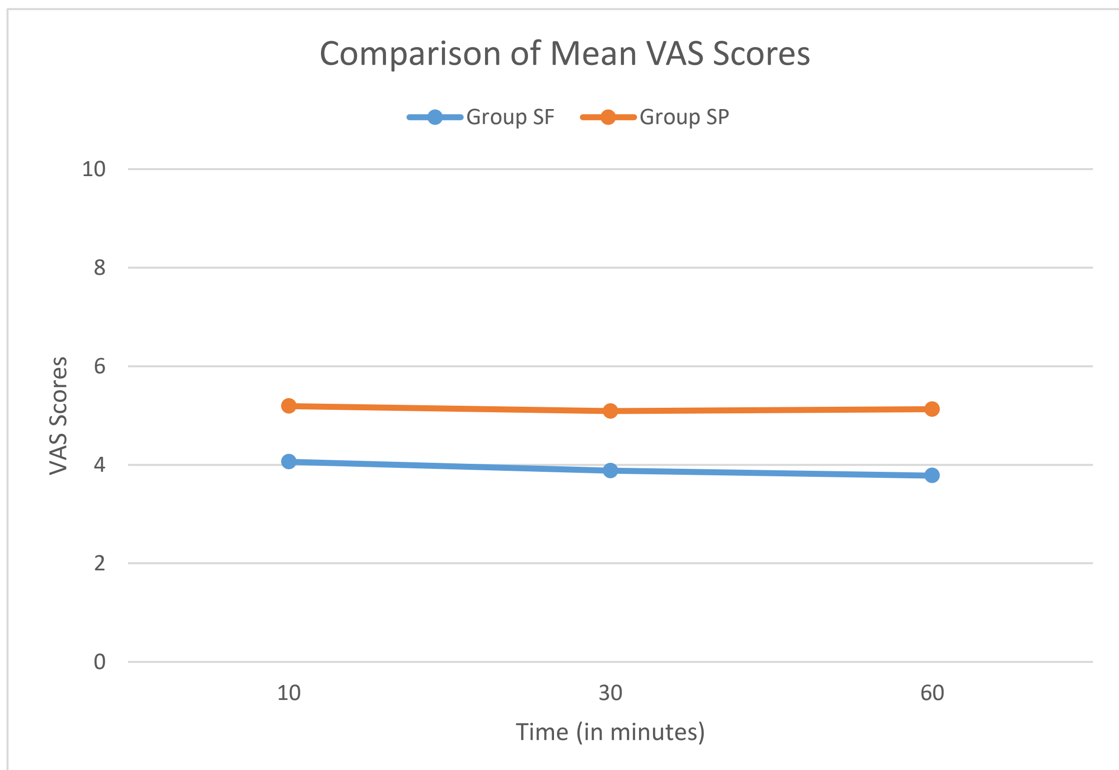


Of the total 33 patients in group SF, 16 (48.48%) were male & 17 (51.52%) were female. Of the total 33 patients in group SP, 13 (39.39%) were male & 20 (60.61%) were females. When compared the difference between the two groups was not found to be statistically significant (p =0.4569). Both the groups had similar demographic characteristics. The value of p was calculated using chi-square test.

Table 4: Comparison of Mean VAS scores

Time (minutes)	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
10	4.06	0.84	5.19	0.93	<0.0001
30	3.88	0.71	5.09	0.64	<0.0001
60	3.78	0.71	5.13	0.75	<0.0001

Graph 4: Comparison of Mean VAS scores



The p values for VAS score were calculated using student's unpaired t- test. In our study, we found that the Mean VAS scores at 10 minutes post operatively was 4.06±0.84 in the Group SF and 5.19±0.93, and the difference between the two groups was statistically significant ($p<0.0001$).

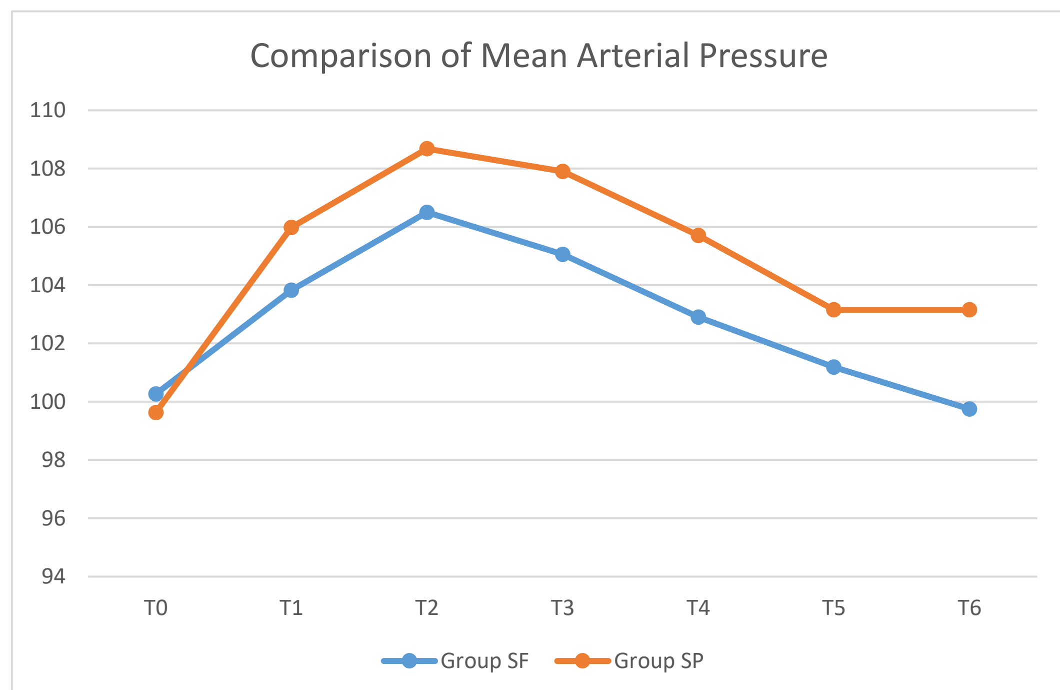
After 30 minutes post operatively, the mean VAS scores had come down in both groups. The VAS Scores in Group SP (5.09±0.64) was significantly higher than in Group SF (3.88±0.71); ($p<0.0001$).

At 60th minute postoperatively, it was found that the mean VAS scores in Group SF were 3.78±0.71 and those in Group SP was 5.13±0.75. The difference was found to be statistically significant ($p<0.0001$).

Table 5: Comparison of Mean Arterial Pressure

Time	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
T0	100.27	9.97	99.63	9.42	0.7908
T1	103.83	5.81	105.98	8.09	0.2275
T2	106.50	5.50	108.68	8.31	0.2210
T3	105.06	7.40	107.90	6.54	0.1098
T4	102.90	6.66	105.70	5.90	0.0797
T5	101.19	7.74	103.15	6.56	0.2791
T6	99.75	8.27	103.15	5.30	0.0550

Graph 5: Comparison of Mean Arterial Pressure



The p values were calculated using student's unpaired t- test.

In our study, the Mean Arterial Pressure in Group SF at T1, was 103.83±5.81, and in Group SP was found to be 105.98±8.09. The difference was not statistically significant. (p=0.2275).

At T2 and T3, the MAP recorded in Group SF was 106.50±5.50 and 105.06±7.40 respectively and in Group SP was 108.68 ± 8.31 and 107.90±6.54 respectively. The p values were 0.2210 and 0.1098. Hence the values were comparable.

In Group SF, the MAP at T4 decreased to 102.90±6.66, and to 105.70±5.90 in Group SP (p=0.0797)

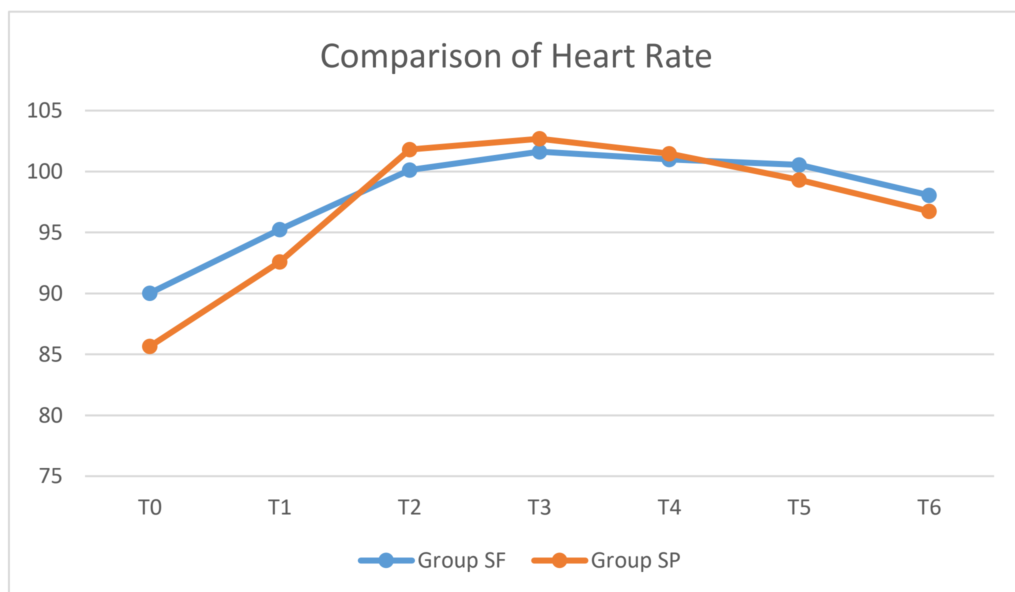
The MAP further decreased in both groups, at T5 and T6, in Group SF, it was 101.19±7.74 and 99.75±8.27 respectively. In Group SP, it was 103.15±6.56 and 103.15±5.30. The p-values calculated were 0.2791 at T5 and 0.0550 at T6.

The MAP recorded were lower in Group SF, compared to Group SP, but the difference was not statistically different.

Table 6: Comparison of Heart Rate

Time	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
T0	90.03	8.51	85.66	11.47	0.0881
T1	95.25	9.04	92.59	9.94	0.2679
T2	100.13	9.17	101.81	12.61	0.5426
T3	101.63	8.91	102.69	12.13	0.6911
T4	101.00	8.35	101.47	9.26	0.8322
T5	100.56	8.34	99.31	8.11	0.5453
T6	98.06	7.93	96.75	8.69	0.5303

Graph 6: Comparison of Heart Rate

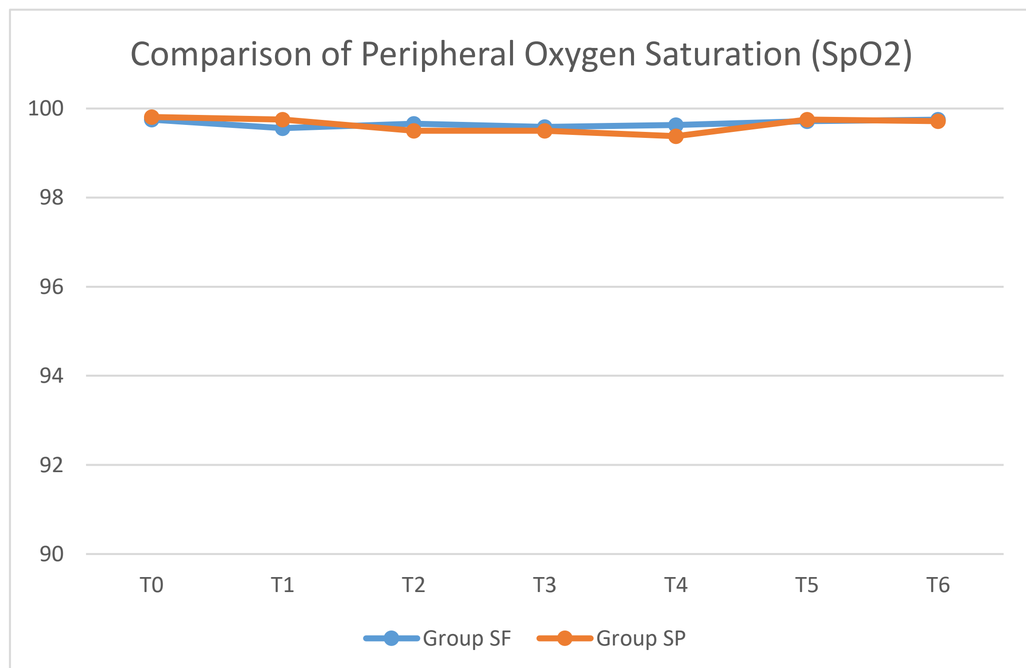


We found that there was no significant difference in the Mean Heart Rates. The Mean Heart Rate in Group SF and Group SP at T2 was 100.13 and 101.81 respectively and it decreased to 98.06 and 96.75 at T6.

Table 7: Comparison of Peripheral Oxygen Saturation (SpO2)

Time	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
T0	99.75	0.62	99.81	0.78	0.7243
T1	99.56	0.95	99.75	0.67	0.3650
T2	99.66	0.90	99.50	1.34	0.5870
T3	99.59	0.95	99.50	1.14	0.7210
T4	99.63	0.91	99.38	1.56	0.4363
T5	99.72	0.68	99.75	0.67	0.8542
T6	99.75	0.62	99.72	0.85	0.8674

Graph 7: Comparison of Peripheral Oxygen Saturation (SpO2)

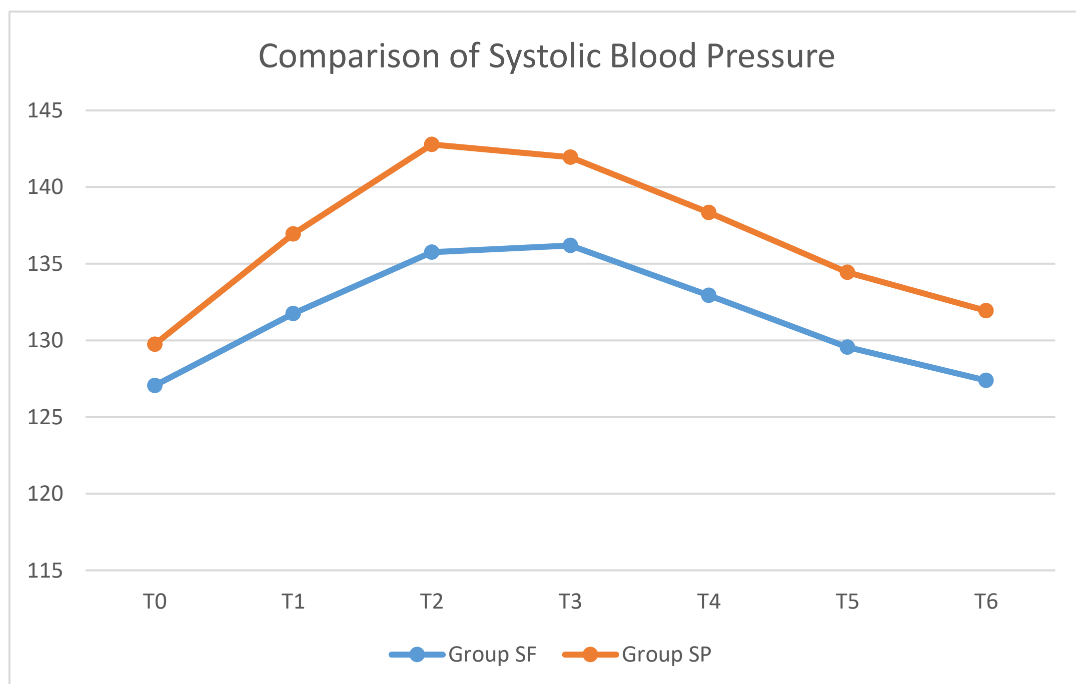


Mean Peripheral Oxygen Saturation was comparable in between Group SF and Group SP as the difference was not statistically significant.

Table 8: Comparison of Systolic Blood Pressure

Time	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
T0	127.06	10.58	129.75	11.10	0.3255
T1	131.75	10.28	136.94	9.95	0.0446
T2	135.75	9.20	142.78	12.47	0.0127
T3	136.19	11.12	141.94	11.63	0.0476
T4	132.94	9.84	138.34	10.08	0.0337
T5	129.56	10.47	134.44	10.25	0.0644
T6	127.38	9.25	131.94	8.09	0.0397

Graph 8: Comparison of Systolic Blood Pressure

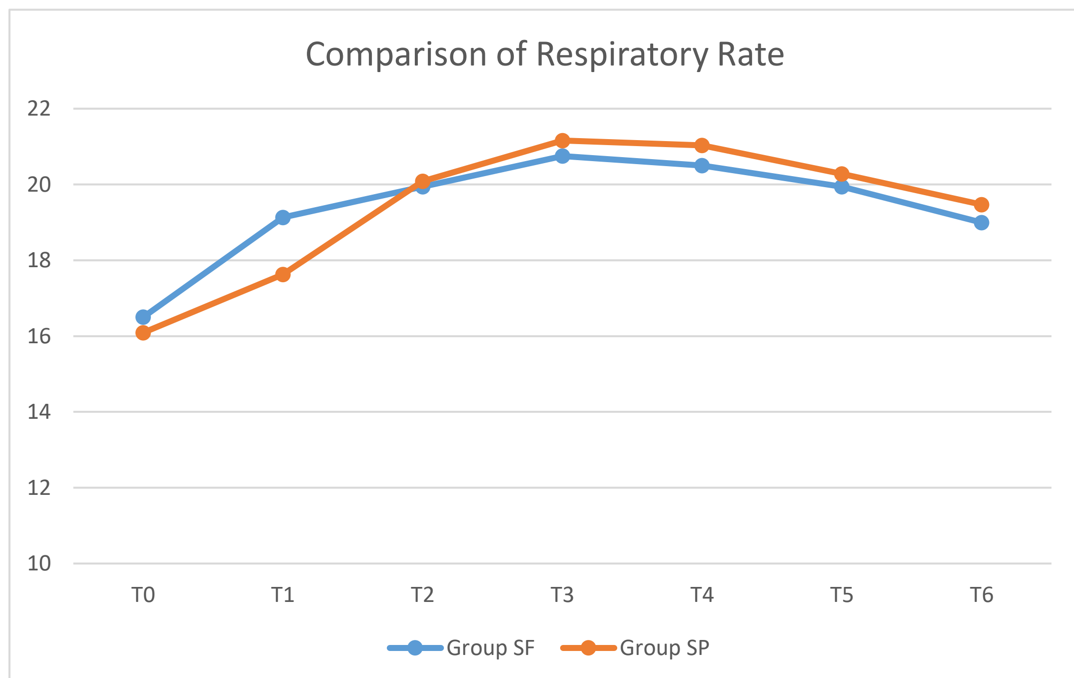


The Mean Systolic Blood Pressures at T0 were comparable in between the groups (p=0.3225). From T1 onwards, the difference was statistically significant. At T1, mean systolic blood pressure in Group SF and Group SP were 131.75±10.28 and 136.94±9,95 (p=0.0446). The difference in mean systolic blood pressure from points T2 to T4 was significant (p=0.0127, p=0.0476, p=0.0337). At T5, the mean values were comparable in Group SF and Group SP(p=0.0644). At T6, the mean SBP was 127.38±9.25 in Group SF and 131.94±8.09, the difference was significant (p=0.0397)

Table 9: Comparison of Respiratory Rate

Time	Group SF		Group SP		p Value
	Mean	SD	Mean	SD	
T0	16.50	2.03	16.09	1.97	0.4203
T1	19.13	2.87	17.63	2.89	0.0415
T2	19.94	2.85	20.09	2.67	0.8217
T3	20.75	2.99	21.16	2.63	0.5662
T4	20.50	3.21	21.03	2.87	0.4879
T5	19.94	3.03	20.28	2.87	0.6424
T6	19.00	3.21	19.47	2.66	0.5275

Graph 9: Comparison of Respiratory Rate



The Mean Respiratory Rates in Group SF were lesser than those of Group SP, but the difference was not significant.

DISCUSSION

Laparoscopic surgeries, over the years, have become more popular than conventional open approaches to surgeries of the abdomen. This is because of the various advantages that laparoscopy offers, including lesser morbidity, lesser postoperative pain, early ambulation, faster recovery and discharge from the hospital.[1,3,12] Although, laparoscopic surgeries are less painful, pain still continues to haunt patients in the postoperative period, causing discomfort, morbidity and delayed. The postoperative period immediately following surgery is when problems and postoperative pain are at their peak intensity.[34]

Anaesthesiologists, for analgesia in the postoperative period, use a combination of IV analgesics like opioids, paracetamol, NSAIDs, port site and intraperitoneal infiltration with local anaesthetics, fascial plane blocks like Transverse Abdominus Plane Block, and neuraxial analgesia. Most of these agents, like opioids have adverse effects like dependence, nausea and vomiting, respiratory depression, etc. NSAIDs, are also associated with complications like gastric ulcers, renal dysfunction, bleeding disorders, etc.[10,11,13]

Positioning a patient for therapeutic purposes, that is to reduce pain in this case, is an easy to perform maneuverer, without any additional cost. The patient's head end will be elevated at an angle of 30 degrees in the Semi-Fowler's position. In the study group, we placed patients in the Semi-Fowler's position during the extubation and we continued to keep the patient in the same position in PACU.

We hypothesised that the Semi-Fowler's position can reduce post-operative pain in patients following laparoscopic surgeries. We conducted a prospective, randomised clinical experiment to evaluate the pain and vital parameters in patients extubated in the Semi-Fowler's position vs those extubated in the supine position in order to test the hypotheses.

Mean ages in both Group SF and SP was 34.97±9.80 and 34.55±9.95, and the values were comparable. (p=0.8620). Male patients constituted 29 and female patients constituted 37 in number. The mean weight in Group SF was 68.70±12.16 and Group SP was 63.67±14.42. The difference in mean weight was not statistically significant (p=0.1305).

The patients we included underwent Laparoscopic Abdominal Surgeries under General Anaesthesia. At end of surgery, these patients, based on their randomisation were placed into their respective positions, namely Semi-Fowler's and Supine for extubation. Once they were extubated, they were shifted to the Post Anaesthesia Care Unit. Using the Visual Analog Scale (VAS), the patients' intensity of pain was evaluated at 10 minutes, 30 minutes and 60 minutes. In terms of pain scores, we saw a substantial difference between the groups. The patients in Group SF had a mean pain score of 4.06±0.84 at 10 minutes compared to a mean pain score of 5.19±0.93 in SP. Statistics showed that the difference was substantial; (p<0.0001). Similarly, the pain scores at 30 minutes, 3.88±0.71 v/s 5.09 ±0.64 and at 60 minutes 3.78±0.71 v/s 5.13±0.75, were statistically significant (p<0.0001). This is similar to what was observed in a similar study conducted by Zhu et al, where he compared both the positions post laparoscopic surgery[12]. He found that the mean pain scores at 5 minutes in Semi-Fowler's group was 3.51±2.50 and that of Supine group was 4.58±2.26. The

difference was significant with p value of 0.009. Further, at 30 minutes post extubation, he found the pain scores to be 2.23±1.68 in Semi-Fowler's group and 3.11±2.00 in Supine Group. The difference was again significant. Again, pain scores were assessed before shifting the patients out of the PACU, it was found to be 1.81±1.32 in Semi-Fowler's Group and 2.59±1.88 in Supine Group. The difference in pain scores continued to be significant (p=0.005). They attributed the reduction to the diminished abdominal wall tension in the Semi-Fowler's group. Similar findings were noted by Choi et al in their study –" The effects of Semi-Fowler's position on Post-Operative Recovery and Pain for patients with laparoscopic abdominal surgery".[43] They compared pain in patients between two groups- Semi-Fowler's and Supine position. They found the mean pain score to be 3.21 ±1.82 in the Semi-Fowler's group and 3.85±1.61 in the Supine Group, and the difference was substantial (p=0.032).

There was a gradual decrease of mean pain scores in both the groups, from 4.06 to 3.78 in Group SF and from 5.19 to 5.13 in Group SP. The reduction in pain scores was found to be highly significant in Group SF (p=0.0761). Although a mild decrease in pain in Supine Group was observed, it was not statistically noteworthy. We found that patients experience maximum pain in the immediate minutes post extubation following a laparoscopic surgery. Such an observation was made by Zhu et al also, where the pain scores decreased over time from 3.51 to 1.81 in the Semi-Fowler's group and from 4.58 to 2.59 in the Supine Group. Such reductions in pain scores post laparoscopic surgery have also been found out by Ekstein et al, where he found a slow reduction in pain VAS scores in the initial four hours, after which the pain scores plateaued.[34]

Most head elevated positions are associated with the complication of Postural Hypotension. The semi-fowler's position involves elevation of the head end of the patient by 30 degrees. There was no discernible difference in the mean arterial pressure between the two groups, according to our analysis. When the patient was placed in the Semi- Fowler's at T2, the Mean Arterial Pressure in Group SF was 106.50mmHg with a Standard Deviation of 5.50mmHg, as opposed to 108.688.31mmHg in Group SP, with a p value of 0.2210. Similarly, in the time periods following T2, that is, T3 to T6, the values were comparable. We discovered no change between the two groups' MAP. This was also seen in the study conducted by Zhu et al[12] and a similar study by Leiping et al.[44]

It was anticipated that a decrease in pain would also result in a decrease in heart rate, but we were unable to detect a discernible difference in between the groups. The P values remained more than >0.05. Infact, the heart rates were more or less similar. This was also seen in the study conducted by Leiping et al[44]. In contrast to our finding, the study done by Zhu et al[12], recorded an increase in the heart rate in the Semi-Fowler's group. They speculated that it can be due to the effect of the posture on the systemic circulatory blood volume.

We had also compared the Peripheral Oxygen Saturation (SpO2) in between the two groups, both groups had mean SpO2 values within safe limits (above 96%) at all times. We could not demonstrate any advantage to one group statistically. Although, research had found that the semi-fowler's position increased FRC in the lungs, improving ventilation and reducing the risk of hypoxia, we could not demonstrate the difference in our study. This can be because, we included only ASA I and II patients, with BMI in the normal range, and excluded patients with respiratory complications

in our study. Also, all patients were oxygenated throughout the time. Zhu et al, also failed to demonstrate any obvious advantage[12]. However, in the study conducted by Sakaguchi et al on postoperative patients who had Obstructive Sleep Apnoea, they found a reduction in apnoea-hypopnoea index in the post-operative period, from 60±12 in the control group to 45±10 in the Semi-Fowler's group, Interestingly, when the Semi-Fowler's position was combined with High-Flow Nasal Cannula, it resulted in even further reduction in Apnoea-Hypopnoea Indexto 37±21, with even further reduction in Oxygen Desaturation episodes to 4±5.[42]

Head elevated positions are believed to reduce the work of breathing in patients. We compared the mean respiratory rates in between the two groups, we found that, although the mean Respiratory Rates were lesser in the Semi-Fowler's group, there was statistically similar. The study conducted by Deye N et al[45], where they used the Semi-Fowler's position in ICU patients for weaning, he found there was significant reduction in patient effort in breathing ($p<0.01$) and concluded that the semi-seated position reduced the work of breathing by helping to unload the respiratory muscles, improves patient comfort, and eventually aids in the weaning process in ventilator-dependent patients.

We did not find any incidence of Post-Operative Vomiting in the patients.

There were also some practical difficulties observed in our study, we found that, for the anaesthesiologists who found it difficult to suction and extubate the patient while standing at the elevated head end in the Semi-Fowler's group, the operating room table had to be lowered.

CONCLUSION

It is concluded from our study, that practice of Semi-Fowler's position at the end of surgery during extubation and in the recovery is effective in reducing the acute postoperative pain following laparoscopic surgeries. It is not associated with any complications and can be safely performed in all cases

LIMITATIONS

Our study was done in a single institute, and included different types of laparoscopic surgeries. The Semi-Fowler's position, in the previous studies, is shown to be most effective in patients who had a respiratory pathology, or in obese patients, both of which were outside our inclusion criteria. We believe that the Semi-Fowler's position is best performed in patients who have a pre-existing respiratory complication or in obese patients.

SUMMARY

Our current study was done to compare the pain experienced and the vital parameters in between the two positions, namely supine and semi-fowler's position, during extubation and in the immediate post operative period in patients who underwent elective laparoscopic abdominal surgeries under General Anaesthesia.

In our study we included 66 patients of either sex, keeping in mind the inclusion and exclusion criteria. 33 patients in Group SF were placed in the Semi-Fowler's position and 33 patients in Group SP were placed in Supine Position.

We found that the patients placed in semi-fowler's position experienced statistically significant lesser pain compared with those in the supine position ($p<0.0001$). We concluded that the Semi-Fowler's position does help in reducing the pain experienced by the patients.

We also found no significant difference in between the vitals parameters of patients belonging to the two groups.

To summarise, our study compared the Supine and Semi-Fowler's position during extubation and in the PACU. We found that placing the patients in the Semi-fowler's position is useful in reducing the pain experienced. It can be performed safely in all cases.

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ANNEXURE I

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH STUDY

Mr. /Mrs. /Miss. ______________________________ we are requesting you to enrol you in the study titled **"COMPARISON OF PAIN EXPERIENCED BY PATIENTS WHEN PLACED IN SUPINE AND SEMI-FOWLER'S POSITION DURING EXTUBATION AND IMMEDIATE POST OPERATIVE PERIOD FOLLOWING ABDOMINAL SURGERIES: A ONE YEAR HOSPITAL BASED RANDOMISED CLINICAL TRIAL"** conducted by ________ Post Graduate in M.D. Anaesthesiology under the guidance of _____________., Professor, Department of Anaesthesiology, J.N. Medical College, Belagavi under KAHER, Belagavi.

Respected Sir/Madam, we request you to participate in our study as you are eligible for it. During the study you will be asked some questions regarding your medical history and you are supposed to answer to the best of your knowledge.

Your participation in this research is voluntary. Your decision whether or not to participate in the study will not affect your relationship with J.N. Medical College. If you decide to participate you are free to withdraw at any time.

Purpose of the study: The purpose of research is to know whether the study will be helpful in evaluating the patient comfort and safety of the Semi-Fowler's position during tracheal extubation after abdominal surgery, compared to the Supine position. Hence it will be helpful in assessing whether the Semi-Fowler's position results in lesser PACU complications compared to the Supine position.

Procedure Involved: If you agree to enrol in my study, I will ask your present, past and family history. Then you will be clinically examined in detail. You will be allotted into one of the two groups randomly using computer generated software. Group SF will undergo extubation in Semi Fowler's position. Group SP will undergo extubation in Supine position.

Voluntary Participation/Withdrawal: Taking part in the study is voluntary. You may choose not to enrol yourself in this study. Your decision will not change any health care services offered to you or your ward at K.L.E. S Hospital & MRC.

Risks: There is almost no risk involved with extubating in Semi-Fowler's position compared to the Supine position.

Benefits: Tracheal Extubation in Semi-Fowler's position offers the patient, more comfort and lesser pain following abdominal surgery, compared to the Supine position. The Anaesthesiologist also benefits with increased patient safety associated with the extubation in Semi-Fowler's position.

Privacy and Confidentiality: The only people to know that you are as research subject are you and members of the research team. No information provided by you during the research will be disclosed to other without your written permission except:

1. In emergency to protect your rights and welfare.

2. If required by law.

Authorisation to Publish Results: When the results of the research are published or discussed, in a conference, no information will be displayed that would disclose your

identity. Any information that is obtained in connection with this study and that can be identified with your identity remaining confidential.

Financial Incentives for participation: No financial incentives are being offered to enrolled patients. It is purely being done with the idea of research and all the cost of the study will be borne by the investigator.

Compensation: In the event of injury related to the study, treatment will be made available through KLES Hospital and MRC, Belagavi. There is no compensation or payment for such medical treatment by law. If you get injured you may contact

Questions:

If you have any queries about your rights as a study subject, you may call **DR. HARSHA HEGDE,** Chairperson, JNMC IEC & Scientist D, ICMR, National Institute Of Traditional Medicine, Belagavi. Phone number: 9480422500

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH TRIAL

"COMPARISON OF PAIN EXPERIENCED BY PATIENTS WHEN PLACED IN SUPINE AND SEMI-FOWLER'S POSITION DURING EXTUBATION AND IMMEDIATE POST OPERATIVE PERIOD FOLLOWING ABDOMINAL SURGERIES: A ONE YEAR HOSPITAL BASED RANDOMISED CLINICAL TRIAL"

Mr./Ms./Mrs. ________________________________ voluntarily agree for the participation of as a subject of study. By signing this consent form I am not giving up any of my legal rights, I may withdraw from the study anytime. I am signing the consent form after having read or been read for me in vernacular language, including the risks and the benefits and having all my questions answered.

Subject Name : ______________________

Signature or the Left Thumb Print of Subject/Guardian: ____________________

Date:

Witness Name: ______________________ Signature: ________________

Investigators Name: ___________________ Signature: ________________

Date:

Place : ________________.

ANNEXURE II – PROFORMA

"COMPARISON OF PAIN EXPERIENCED BY PATIENTS WHEN PLACED IN SUPINE AND SEMI-FOWLER'S POSITION DURING EXTUBATION AND IMMEDIATE POST OPERATIVE PERIOD FOLLOWING ABDOMINAL SURGERIES: A ONE YEAR HOSPITAL BASED RANDOMISED CLINICAL TRIAL"

Group allotted SF □ SP □

Name : Age :

Gender : Date of Examination :

Address : IP Number :

Past History

- HTN □ DM □ IHD □ Arrhythmia □ Valvular heart diseases □
- H/o previous surgery/(s) where airway difficulty was encountered. Yes □ No □

<u>General physical examination</u>

Weight (Kg) : Temperature (^{0}F) : Pallor :

Cyanosis : Pedal oedema : Clubbing :

PR : BP : RR :

Systemic examination:

RS : CNS :

CVS : GIT :

Preoperative physical status ASA Grade I □ II □ III □ IV □ V □

DIAGNOSIS: ____

PROCEDURE PERFORMED:______________________________________

METHODOLOGY:

After obtaining the approval of ethical committee and written informed consent, a total of 66 patients undergoing surgery under general anaesthesia will be included in the study.

After having met inclusion and exclusion criteria and having obtained informed consent, patients will be randomised based on computer generated randomisation table into one of the two groups.

Group SF: Patients in whom tracheal extubation is done in Semi-Fowler's position

Group SP: Patients in whom tracheal extubation is done in Supine position

A through pre-anaesthetic evaluation will be done on the day before surgery.

After enrolment, demographic data, including age, gender, ASA Class and Malampatti Grade are recorded.

Baseline data, consisting of Non-Invasive blood pressure (BP), heart rate (HR), peripheral capillary oxygen saturation (SpO_2), respiratory rate (RR), are recorded before anaesthesia (T0). Besides, type of surgery, estimated blood loss, crystalloid replacement, anaesthesia time and surgical time, are recorded intraoperatively.

After the operation is complete, the drapes are removed, Isoflurane is discontinued, and patients are given 100% oxygen. The patients were randomised to either the supine or semi-Fowler's position and placed into corresponding position.

The patients have to achieve the following conditions before extubation:

1. Spontaneous ventilation
2. Complete reversal of neuromuscular blockade
3. Eye opening and regaining of consciousness

After through suctioning, patients are extubated in the OT and then shifted to the PACU, where they undergo standard electrocardiography and non-invasive blood pressure and peripheral capillary oxygen saturation monitoring. The patients are administered Oxygen using face mask.

Vitals are recorded at 6 points after end of surgery

1. At end of surgery (T1)
2. Immediately after positioning (T2)
3. 1 min after extubation (T3)
4. 10 mins after extubation (T4)
5. 30 mins after extubation (T5)
6. 60 mins after extubation (T6)

It will be recorded as follows:

Parameters	**Time**	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
SpO_2 (%)								
Heart Rate (per minute)								
Blood Pressure (mmHg)								
Respiratory Rate (per minute)								

In addition, on arrival into the PACU, the following are recorded,

1.The comfort VAS score

2. Frequency of Passive bucking due to stimulation of secretion.

3. Frequency of Vomiting

The comfort VAS score (0 to 10) will be recorded as per the intensity of the pain at three points: 5 minutes, 30 minutes and 60 minutes after extubation.

Intensity	**Score**	**Grade**
None	0-2	I
Uncomfortable	2-4	II
Annoying	4-6	III
Dreadful	6-8	IV
Excruciating	8-10	V

The Comfort VAS Scores will be noted as below:

Visual Analogue Scale

Choose a Number from 0 to 10 That Best Describes Your Pain

No Pain — Distressing Pain — Unbearable Pain

0 1 2 3 4 5 6 7 8 9 10

ASK PATIENTS ABOUT THEIR PAIN

INTENSITY—LOCATION—ONSET—DURATION—VARIATION—QUALITY

Comfort VAS Score	**Score (out of 10)**	**Grade (I-V)**
10 mins after extubation		
30 minutes after extubation		
60 minutes after extubation		

The complications will be noted as follows:

Complication	**Observation**
Vomiting	
Passive Bucking	

Name of Witness: ____

Signature of Witness: ____

Name of Consultant:____

Signature of Consultant:____

Signature of Primary Investigator: ___________________________________

ANNEXURE III PHOTOGRAPH

PHOTOGRAPH 1:EXTUBATION IN SEMI-FOWLER's POSITION

PHOTOGRAPH 2:EXTUBATION IN SUPINE POSITION

PHOTOGRAPH 3: PATIENT PLACED IN SEMI-FOWLER's POSITION IN PACU

ANNEXURE IV KEY TO MASTER CHART:

Sl No.	Serial Number
IP No.	In Patient Number
ASA	American Society of Anesthesiologists
HR	Heart Rate
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
MAP	Mean Arterial Pressure
RR	Respiratory Rate
T0	Time before anaesthesia
T1	At end of surgery
T2	Immediately after positioning
T3	1 min after extubation
T4	10 min after extubation
T5	30 min after extubation
T6	60 min after extubation

ANNEXURE V –MASTER CHART

MASTERCHART- SUPINE GROUP

Sl No.	IP No.	Sex	Age	Weight	ASA	Diagnosis	Proposed Surgery	HR	SBP	DBP	MAP	RR	SpO2 T0	HR T0	SBP T0	DBP T0	MAP T0	RR T0	SpO2 T1	HR T1	SBP T1	DBP T1	MAP T1	RR T1	SpO2 T2	HR T2	SBP T2	DBP T2	MAP T2	RR T2	SpO2 T3	HR T3	SBP T3	DBP T3	MAP T3	RR T3	SpO2 T4	HR T4	SBP T4	DBP T4	MAP T4	RR T4	SpO2T5	HR T5	SBP T5	DBP T5	MAP T5	RR T5	SpO2 T6	HR T6	SBP T6	DBP T6	MAP T6	RR T6	Pain 10	Pain 30	Pain 60	Vomiting	Bucking
1	1042310	F	39	60	II	Acute Cholecystitis	Laparoscopic Cholecystectomy	90	130	90	103	16	100	92	100	60	73	16	100	96	120	90	100	18	100	106	134	98	110	22	100	114	140	96	111	18	100	100	124	82	96	20	100	98	130	80	97	22	100	102	130	96	107	20	6	5	5	N	N
2	1044100	F	28	48	I	Acute Appendicitis	Laparoscopic Appendicectomy	80	100	60	73	16	100	82	110	60	77	16	100	96	130	96	107	22	100	105	130	96	107	20	100	104	136	82	100	22	100	104	138	88	105	20	100	96	128	90	103	22	100	96	132	84	100	18	5	5	5	N	N
3	1044900	M	47	75	II	Acute Cholecystitis	Laparoscopic Cholecystectomy	86	130	80	97	16	100	80	130	80	97	16	100	108	144	90	108	22	100	120	150	100	117	24	100	108	130	90	103	22	100	108	130	100	110	20	100	108	130	84	99	22	100	90	130	90	103	22	5	5	6	N	N
4	1049320	F	28	56	I	Misplaced Copper T	Laparoscopy and Proceed	72	110	70	83	12	100	84	136	80	99	16	100	93	138	90	106	18	100	112	140	90	107	22	100	110	140	90	107	22	100	108	130	90	103	22	100	110	130	90	103	22	100	102	124	76	92	20	4	4	5	N	N
5	1046222	F	26	65	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	100	100	60	73	16	100	96	140	90	107	16	100	98	130	90	103	18	100	114	144	96	112	20	100	110	140	96	111	22	100	110	150	96	114	22	100	108	150	90	110	22	100	106	140	96	111	22	7	6	6	N	N
6	1046121	M	50	60	II	Acute Appendicitis	Laparoscopic Appendicectomy	50	140	80	100	15	100	50	140	80	100	15	100	60	130	90	103	16	100	80	136	96	109	16	100	86	132	90	104	20	100	90	132	90	104	20	100	90	140	90	107	20	100	90	142	90	107	20	4	4	3	N	N
7	1046802	F	48	56	I	Acute Cholecytitis	Laparoscopic Cholecystectomy	60	120	70	87	18	100	76	116	70	85	18	100	90	140	70	93	20	100	96	142	68	93	22	100	98	142	80	101	24	100	90	140	80	100	24	100	100	136	90	105	22	100	96	138	90	106	22	2	4	4	N	N
8	1045016	M	40	42	I	Inguinal Hernia	Laparoscopic Mesh Repair	80	140	80	100	14	100	86	140	80	100	16	100	92	148	90	109	20	100	108	148	90	109	22	100	108	140	90	107	22	100	104	146	90	109	24	100	104	140	90	107	16	100	100	142	90	107	16	5	5	6	N	N
9	1045196	F	34	54	I	Acute Cholecytitis	Laparoscopic Cholecystectomy	68	120	90	100	16	100	98	140	90	107	12	100	98	140	96	111	12	100	114	142	90	107	14	100	114	136	90	105	18	100	120	138	90	106	18	100	96	140	90	107	16	100	96	136	90	105	16	6	5	5	N	N
10	1054915	M	32	64	I	Acute Appenidicits	Laparosocpic Appendicectomy	76	110	60	77	16	100	80	130	90	103	14	100	88	140	70	93	16	100	142	150	90	110	24	100	144	160	70	100	24	100	110	130	90	103	24	100	120	132	60	84	20	100	110	128	70	89	16	5	6	6	N	N
11	1046002	M	21	60	I	Acute Appenidicits	Laparosocpic Appendicectomy	66	110	80	90	16	100	76	110	90	97	14	100	84	130	90	103	18	100	96	140	90	107	20	100	96	142	96	111	20	100	96	140	90	107	20	100	90	140	90	107	16	100	96	136	90	105	16	4	5	5	N	N
12	1054764	F	50	60	I	Acute Appenidicits	Laparosocpic Appendicectomy	66	130	90	103	16	96	80	130	90	103	16	98	96	140	110	120	22	98	86	150	90	110	22	98	86	130	90	103	22	100	86	130	90	103	22	100	86	120	90	100	22	99	80	120	96	104	22	6	5	5	N	N
13	1055436	M	38	60	I	Acute Cholecytitis	Laparoscopic Cholecystectomy	88	130	80	97	16	100	80	140	90	107	22	100	80	140	92	108	22	100	92	156	100	119	25	100	96	158	110	126	25	100	98	140	90	107	25	100	98	142	90	107	25	100	96	140	96	111	25	6	6	6	N	N
14	1055614	F	42	40	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	84	130	80	97	16	100	80	130	90	103	14	100	86	130	94	106	14	100	88	160	94	116	14	100	86	150	90	110	14	100	88	150	90	110	14	100	84	130	90	103	16	100	86	132	92	105	18	5	5	5	N	N
15	1067421	F	37	40	I	Interval Sterilization	Laparoscopic Sterilization	81	150	90	110	16	100	72	120	76	91	14	100	74	120	76	91	14	100	86	110	76	87	20	100	90	140	90	107	20	100	90	150	90	110	22	100	96	140	90	107	14	100	84	140	90	107	16	5	5	5	N	N
16	1062061	F	35	60	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	86	120	70	87	16	100	96	130	90	103	14	100	98	140	90	107	14	100	108	142	90	107	20	100	110	138	90	106	20	100	102	130	80	97	24	100	104	138	74	95	20	100	76	130	96	107	20	7	7	7	N	N
17	1059190	M	48	66	I	Acute Appenidicits	Laparosocpic Appendicectomy	96	150	90	110	16	100	90	140	70	93	14	100	92	142	72	95	14	100	96	180	70	107	16	100	120	186	72	110	22	100	110	150	70	97	20	100	110	156	78	104	20	100	110	148	72	97	20	6	6	6	N	N
18	1063521	F	40	76	I	Acute Cholecytitis	Laparoscopic Cholecystectomy	68	140	90	107	12	100	63	136	92	107	14	100	96	170	110	130	14	100	97	168	120	136	24	100	100	160	108	125	24	100	101	172	98	123	22	100	90	160	90	113	20	100	94	150	76	101	16	6	6	6	N	N
19	1062335	M	20	60	II	Acute Appenidicits	Laparosocpic Appendicectomy	90	100	60	73	16	100	96	120	90	100	18	100	98	130	96	107	16	96	100	140	96	111	18	98	102	142	96	111	20	96	114	144	96	112	22	98	106	144	98	113	20	98	108	134	90	105	20	5	5	5	N	N
20	1062697	F	35	80	I	Acute Appenidicits	Laparosocpic Appendicectomy	80	130	80	97	16	100	68	114	70	85	16	100	68	118	90	99	18	100	74	130	90	103	18	100	86	136	92	107	16	100	88	140	90	107	16	100	86	128	90	103	18	100	86	128	90	103	18	5	5	4	N	N
21	1062338	M	50	75	II	Acute Cholecystitis	Laparoscopic Cholecystectomy	90	150	90	110	16	100	90	150	96	114	20	98	96	140	96	111	24	94	106	150	90	110	20	96	106	140	90	107	24	94	106	144	96	112	20	98	104	134	90	105	24	96	100	130	90	103	20	6	5	5	N	N
22	1064367	M	32	66	I	Acute Appenidicits	Laparosocpic Appendicectomy	86	110	70	83	16	100	90	130	90	103	16	100	98	136	96	109	18	100	110	138	96	110	20	100	120	140	96	111	20	100	122	140	90	107	26	100	100	130	90	103	20	100	100	128	90	103	18	5	5	5	N	N
23	1064838	F	19	50	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	90	120	80	93	16	100	90	130	90	103	18	100	96	140	98	112	20	100	98	140	98	112	22	100	86	142	90	107	22	100	88	136	90	105	22	100	96	128	90	103	22	100	94	120	90	100	20	5	5	5	N	N
24	1065552	F	38	75	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	76	120	90	100	16	100	98	130	96	107	18	100	98	134	90	105	18	100	104	138	98	111	20	100	104	138	98	111	20	100	100	130	90	103	20	100	106	128	90	103	20	100	100	126	90	102	20	5	5	5	N	N
25	1065882	F	47	90	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	80	120	80	93	18	100	90	130	96	107	16	100	102	142	90	107	16	100	104	144	90	108	18	100	102	150	90	110	24	100	104	140	90	107	22	100	100	136	90	105	22	100	108	128	90	103	22	6	5	4	N	N
26	1072741	M	38	80	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	86	126	78	94	16	100	104	140	90	107	16	100	100	154	90	111	16	100	100	144	90	108	20	98	98	140	90	107	26	98	96	136	90	105	26	98	98	136	90	105	26	98	90	136	90	105	26	5	4	5	N	N
27	1074059	F	34	98	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	82	126	78	94	18	100	96	140	90	107	16	100	96	144	90	108	16	100	104	150	90	110	20	100	104	150	96	114	24	100	104	148	96	113	20	100	100	144	96	112	24	100	100	134	90	105	20	5	5	5	N	N
28	1073482	F	21	60	I	Acute Appenidicits	Laparosocpic Appendicectomy	76	118	76	90	18	98	90	140	90	107	16	98	98	136	90	105	16	98	104	136	90	105	20	98	104	126	98	107	20	96	106	120	98	105	22	100	100	120	90	100	20	100	100	124	90	101	20	5	5	5	N	N
29	1075214	M	26	45	I	Right Illiac Fossa Mass	Diagnostic Laparoscopy & Proceed	80	130	70	90	16	100	98	120	70	87	16	100	96	130	70	90	16	100	98	130	72	91	22	100	98	130	72	91	22	100	98	137	70	92	16	100	96	110	70	83	18	100	96	114	76	89	16	5	5	5	N	N
30	1080161	M	23	80	I	Acute Appenidicits	Laparosocpic Appendicectomy	60	130	90	103	18	100	90	130	90	103	18	100	96	136	98	111	18	100	98	130	90	103	20	100	98	140	90	107	20	100	98	136	90	105	22	100	90	130	90	103	22	100	90	130	96	107	22	5	5	5	N	N
31	1082818	M	22	75	I	Acute Appenidicits	Laparosocpic Appendicectomy	90	110	70	83	18	100	90	130	90	103	18	98	98	130	96	107	20	98	98	135	98	110	20	96	98	128	90	103	20	96	98	126	90	102	20	98	100	122	90	101	20	100	104	122	90	101	20	5	5	5	N	N
32	1082694	M	33	80	I	Paraumbilical Hernia	Laparoscopic Hernia Repair	80	120	70	87	18	100	90	130	90	103	16	100	98	140	100	113	18	100	114	142	100	114	18	100	100	140	100	113	18	100	110	130	90	103	16	100	108	130	90	103	16	100	110	130	98	109	16	5	5	5	N	N
33	1084916	M	19	45	I	Acute Appenidicits	Laparosocpic Appendicectomy	80	130	70	90	18	100	90	130	90	103	18	100	96	110	90	97	16	100	92	112	90	97	16	100	92	130	90	103	16	100	92	130	90	103	20	100	94	124	90	101	20	100	92	120	90	100	22	4	4	4	N	N

MASTERCHART- SEMI-FOWLER'S GROUP

Sl No.	IP No.	Sex	Age	Weight (kg)	ASA	Diagnosis	Proposed Surgery	HR (bpm)	SBP	DBP	MAP	RR (/min)	SpO2(%) T0	HR(bpm) T0	SBP T0 (mmhg)	DBP T0 (mmhg)	MAP T0 (mmhg)	RR T0	SpO2(%) T1	HR(bpm) T1	SBP T1 (mmhg)	DBP T1 (mmhg)	MAP T1 (mmhg)	RR T1	SpO2(%) T2	HR(bpm) T2	SBP T2 (mmhg)	DBP T2 (mmhg)	MAP T2 (mmhg)	RR T2	SpO2(%) T3	HR(bpm) T3	SBP T3 (mmhg)	DBP T3 (mmhg)	MAP T3 (mmhg)	RR T3	SpO2(%) T4	HR(bpm) T4	SBP T4 (mmhg)	DBP T4(mmhg)	MAP T4 (mmhg)	RR T4	SpO2(%) T5	HR(bpm) T5	SBP T5 (mmhg)	DBP T5 (mmhg)	MAP T5 (mmhg)	RR T5	SpO2(%) T6	HR(bpm) T6	SBP T6 (mmhg)	DBP T6 (mmhg)	MAP T6(mmhg)	RR T6	Pain 10	Pain 30	Pain 60	Vomiting	Bucking
1	1043218	M	46	80	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	86	138	90	106	18	100	76	140	96	111	18	100	88	140	98	112	18	100	108	150	90	110	16	100	100	150	90	110	18	100	100	150	96	114	16	100	100	140	90	107	16	100	90	132	90	104	16	4	4	4	N	N
2	1050121	F	50	41	I	Acute Appendicitis	Laparoscopic Appendicectomy	86	160	100	120	14	100	93	114	74	87	14	100	98	120	90	100	16	100	120	130	90	103	16	100	110	132	90	104	16	100	110	130	90	103	16	100	108	130	96	107	16	100	104	132	96	108	16	4	3	4	N	N
3	1049981	F	29	56	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	76	100	60	73	16	100	100	130	70	90	12	100	108	120	90	100	14	100	96	126	90	102	16	100	98	132	90	104	16	100	98	122	90	101	16	100	90	130	90	103	16	100	90	136	90	105	16	3	4	4	N	N
4	1052122	F	30		I	Acute Cholecystitis	Laparoscopic Cholecystectomy	76	100	60	73	14	100	96	140	106	117	12	100	98	130	90	103	16	100	120	132	90	104	18	100	110	170	90	117	20	100	108	150	90	110	20	100	108	146	96	113	20	100	106	140	98	112	16	7	6	5	N	N
5	1053196	F	48	80	II	Fibroid Uterus	Laparoscopic Hysterectomy	96	148	90	109	16	100	86	144	80	101	16	96	88	134	90	105	18	96	96	150	96	114	18	96	100	150	96	114	20	96	112	150	90	110	20	100	108	150	90	110	20	100	100	140	90	107	20	5	5	5	N	N
6	1057603	F	35	60	I	Umbilical Hernia	Mesh Repair Laparoscopic	80	130	90	103	14	100	70	120	80	93	12	100	72	124	76	92	14	100	100	150	90	110	20	100	106	150	96	114	20	100	108	146	78	101	24	100	100	140	80	100	20	100	106	142	82	102	16	4	4	4	N	N
7	1063448	M	40	80	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	104	130	80	97	14	99	96	128	90	103	16	99	98	120	90	100	18	98	90	130	90	103	16	99	98	130	90	103	18	99	98	132	90	104	16	98	104	118	76	90	16	99	102	124	90	101	16	4	4	4	N	N
8	1063856	M	50	80	II	Pyogenic Liver Abscess	Laparoscopy and Proceed	82	130	90	103	18	100	90	130	90	103	16	100	98	140	90	107	18	100	100	140	96	111	22	100	114	142	94	110	20	100	106	140	90	107	16	100	108	136	90	105	16	100	90	130	90	103	16	5	3	3	N	N
9	1066006	F	50	75	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	86	130	80	97	18	100	96	130	96	107	16	100	98	140	90	107	18	100	96	130	96	107	18	100	98	132	98	109	16	100	100	130	90	103	18	100	104	128	90	103	18	100	100	126	90	102	16	5	4	4	N	N
10	1065940	M	41	72	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	82	120	70	87	16	100	96	136	90	105	16	100	96	130	90	103	20	100	98	130	96	107	18	100	96	138	90	106	20	100	94	140	90	107	22	100	94	138	90	106	20	100	94	130	90	103	20	5	4	4	N	N
11	1074493	M	20	54	I	Acute Appendicitis	Laparoscopic Appendicectomy	68	118	70	86	16	100	80	120	70	87	16	100	84	130	90	103	16	100	86	130	96	107	16	100	88	120	70	87	14	100	84	122	70	87	16	100	86	122	70	87	14	100	84	124	70	88	14	4	4	4	N	N
12	1075344	F	35	60	I	Acute Appendicitis	Laparoscopic Appendicectomy	86	126	70	89	16	100	90	130	90	103	16	100	96	136	90	105	24	100	98	138	90	106	20	100	96	130	90	103	22	100	96	130	90	103	22	100	96	126	90	102	22	100	94	128	76	93	24	4	4	4	N	N
13	1075765	F	24	60	I	Acute Appendicitis	Laparoscopic Appendicectomy	112	90	60	70	16	100	90	130	90	103	16	100	96	120	90	100	18	100	96	120	90	100	20	100	98	122	90	101	22	100	96	120	90	100	22	100	96	120	90	100	20	100	90	120	78	92	16	4	4	4	N	N
14	1076643	F	50	80	II	Supraumbilical Hernia	Lap Repair	86	136	76	96	16	100	90	150	90	110	16	98	96	140	90	107	16	100	98	150	90	110	16	100	96	140	90	107	20	100	96	140	90	107	16	100	96	140	90	107	16	100	96	144	96	112	16	4	4	4	N	N
15	1082203	M	38	85	II	Acute Appendicitis	Laparoscopic Appendicectomy	90	160	100	120	20	100	96	140	100	113	22	98	114	160	90	113	20	98	118	140	90	107	20	98	118	140	90	107	20	98	114	130	90	103	20	98	112	130	90	103	20	98	114	132	90	104	20	5	5	4	N	N
16	1081805	F	21	60	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	80	130	90	103	18	98	80	110	70	83	18	100	88	130	90	103	24	100	100	130	98	109	20	100	88	128	90	103	24	100	80	120	90	100	24	100	80	110	70	83	24	100	80	110	76	87	20	4	4	4	N	N
17	1082313	M	23	68	I	Acute Appendicitis	Laparoscopic Appendicectomy	90	110	70	83	16	98	96	110	70	83	16	98	98	130	90	103	22	100	104	130	90	103	20	100	100	140	90	107	22	98	100	130	90	103	16	98	100	120	90	100	16	98	100	110	70	83	16	4	4	4	N	N
18	1083574	M	24	60	I	Acute Appendicitis	Laparoscopic Appendicectomy	80	130	90	103	18	100	96	130	100	110	18	100	102	132	100	111	24	98	100	132	100	111	22	100	110	136	100	112	24	100	108	130	100	110	24	100	100	130	96	107	24	100	96	128	96	107	26	3	3	3	N	N
19	1083864	F	33	65	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	102	110	70	83	18	100	72	110	76	87	18	100	84	114	76	89	18	100	84	118	76	90	18	100	84	112	76	88	24	100	88	110	76	87	24	100	86	110	76	87	22	100	96	110	76	87	20	4	4	4	N	N
20	1083601	F	30	49	I	Acute Appendicitis	Laparoscopic Appendicectomy	80	110	70	83	18	100	80	120	76	91	18	100	80	120	76	91	18	100	88	130	76	94	18	100	88	132	76	95	20	100	96	132	70	91	24	100	98	114	76	89	22	100	90	116	78	91	20	3	3	3	N	N
21	1083274	F	40	90	I	Acute Cholecystitis	Laparoscopic Cholecystectomy	106	130	100	110	18	100	90	130	100	110	18	100	96	140	90	107	18	100	92	150	102	118	20	100	92	140	100	113	22	100	92	130	92	105	22	100	98	132	96	108	26	100	98	130	98	109	26	4	4	4	N	N
22	1084212	F	23	54	I	Acute Appendicitis	Laparoscopic Appendicectomy	102	110	76	87	18	100	90	110	70	83	18	100	92	112	88	96	18	100	98	130	90	103	22	100	112	128	90	103	24	100	110	132	90	104	24	100	110	110	76	87	24	100	108	128	70	89	24	3	3	3	N	N
23	1083994	M	46	70	II	Acute Cholecystitis	Laparoscopic Cholecystectomy	78	140	90	107	18	100	98	130	100	110	18	100	98	136	98	111	20	100	104	138	90	106	22	100	108	140	90	107	24	100	104	142	90	107	24	100	100	142	90	107	20	100	98	130	96	107	20	5	5	5	N	N
24	1087136	M	21	59	I	Right Inguinal Hernia	Lap Repair	100	116	90	99	18	100	90	114	90	98	18	100	96	130	90	103	18	100	98	132	90	104	26	100	114	130	90	103	26	100	108	128	90	103	22	100	120	122	90	101	24	100	106	120	70	87	24	4	3	3	N	N
25	1087132	M	45	75	I	Supraumbilical Hernia	Lap Repair	82	128	90	103	24	100	98	140	90	107	18	100	96	142	90	107	20	100	98	144	90	108	22	100	96	140	90	107	22	100	96	136	90	105	22	100	96	132	90	104	20	100	96	130	90	103	20	4	4	4	N	N
26	1083216	M	29	60	I	Acute Appendicitis	Laparoscopic Appendicectomy	90	130	90	103	22	100	98	130	96	107	18	100	98	140	90	107	22	100	104	138	96	110	24	100	106	138	90	106	24	100	106	130	90	103	20	100	104	128	90	103	22	100	108	120	90	100	20	3	3	3	N	N
27	1096221	F	40	80	II	Acute Appendicitis	Laparoscopic Appendicectomy	90	150	90	110	16	100	102	130	90	103	16	100	110	150	90	110	22	100	118	154	96	115	24	98	116	150	90	110	24	98	110	140	90	107	24	98	110	140	90	107	20	98	114	134	80	98	20	4	4	3	N	N
28	1090793	M	32	76	I	Acute Appendicitis	Laparoscopic Appendicectomy	90	124	80	95	16	100	92	130	90	103	16	100	98	126	98	107	22	100	96	128	90	103	22	100	98	130	90	103	24	100	98	132	90	104	22	100	100	130	90	103	22	100	96	126	90	102	20	3	3	2	N	N
29	1088453	M	39	75	II	Acute Cholecystitis	Laparoscopic Cholecystectomy	80	142	80	101	18	99	90	130	100	110	16	99	92	132	96	108	22	99	92	140	96	111	24	98	98	142	96	111	20	99	110	140	90	107	22	99	96	140	90	107	22	99	94	140	92	108	20	4	4	5	N	N
30	1090793	M	32	80	I	Acute Appendicitis	Laparoscopic Appendicectomy	90	120	90	100	16	100	82	120	90	100	16	100	94	130	90	103	24	100	96	136	92	107	24	100	102	130	90	103	22	100	100	130	90	103	24	100	100	128	80	96	20	100	96	120	76	91	16	3	3	3	N	N
31	1090221	F	40	80	I	Acute Appendicitis	Laparoscopic Appendicectomy	102	130	96	107	18	100	80	120	90	100	16	100	84	140	90	107	20	100	102	140	92	108	22	100	102	144	92	109	20	100	96	144	90	108	22	100	100	136	96	109	22	100	96	130	96	107	20	4	4	4	N	N
32	1095720	F	23	50	I	Acute Appendicitis	Laparoscopic Appendicectomy	80	110	60	77	18	98	102	120	70	87	18	98	114	128	90	103	16	100	110	128	96	107	18	98	112	120	70	87	16	100	110	116	70	85	16	100	110	128	80	96	18	100	106	114	90	98	18	4	4	3	N	N
33	1091779	M	27	80	I	Acute Appendicitis	Laparoscopic Appendicectomy	80	116	70	85	16	98	92	130	90	103	18	100	96	120	96	104	20	100	92	136	90	105	20	100	92	140	90	107	20	100	90	130	90	103	18	100	90	136	98	111	18	100	90	130	96	107	18	4	4	4	N	N