# “PREOPERATIVE SERUM ALBUMIN, SERUM PREALBUMIN, SERUM TRANSFFERIN AND BODY MASS INDEX AS PREDICTORS OF POSTOPERATIVE MORBIDITY AND MORTALITY IN LAPAROTOMY CASES”

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**P.G. in Department of General Surgery**

**Dissertation Submitted to**

**BLDE (DEEMED TO BE UNIVERSITY)’S SHRI.B. M. PATIL MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE, VIJAYAPURA KARNATAKA**

**In partial fulfilment of the degree of**

**MASTER OF SURGERY**

**IN**

**GENERAL SURGERY**

**Under the guidance of**

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I hereby declare that this dissertation, **"PREOPERATIVE SERUM ALBUMIN, SERUM PREALBUMIN, SERUM TRANSFFERIN AND BODY MASS INDEX AS PREDICTORS OF POSTOPERATIVE MORBIDITY AND MORTALITY IN LAPAROTOMY CASES "** is a bonafide and genuine research work carried out by me under the guidance of **DR.DAYANAND BIRADAR,** Associate Professor, Department of General Surgery at BLDE (Deemed to be University), Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.

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## ABSTRACT

**Introduction:** Malnutrition significantly impacts postoperative outcomes in patients undergoing emergency laparotomy. Despite advances in surgical care, the role of preoperative nutritional parameters in predicting surgical outcomes remains crucial.

**Methods:** A prospective observational study was conducted at B.M.Patil College ,Hospital and Research Center, Vijayapura, from April 2023 to March 2025. 83 patients undergoing emergency laparotomy were included. Preoperative serum albumin, prealbumin, transferrin levels, and BMI were measured. Primary outcomes included postoperative complications, mortality, and length of hospital stay.

**Results:** Low albumin levels (<2.5 mg/dl) were significantly associated with wound infection rates (77.8%, p<0.001). Transferrin levels <160 mcg/dl correlated with increased mortality (18.9%, p=0.04). Higher BMI was associated with increased mortality (p=0.007). ROC curve analysis showed BMI as the strongest predictor of mortality (AUC=0.735). Wound infection occurred in 48.2% of cases, with overall mortality rate of 9.6%.

**Conclusion:** The findings emphasized the importance of comprehensive nutritional assessment in emergency surgical patients for risk stratification and outcome prediction.

**Keywords:** Emergency laparotomy, Serum albumin, Prealbumin,Transferrin, Body Mass Index; Surgical outcomes, Nutritional assessment.

# INTRODUCTION

Perioperative care has traditionally placed a high priority on the connection between surgical outcomes and nutritional health. Preoperative nutritional evaluation has become an essential part in predicting postoperative problems, morbidity, and mortality in the context of major abdominal surgery, especially laparotomy.[1] One A major factor influencing surgical outcomes is nutritional condition because of the intricate physiological stress response to surgery and the metabolic requirements of wound healing.

Malnutrition has a major impact on postoperative recovery and complications and is frequently underdiagnosed in surgical patients. According to studies, between 30 and 50 percent of hospitalized patients suffer from malnutrition, and the percentage is significantly greater for surgical patients. [2.] Preoperative nutritional screening and assessment, especially using biochemical markers and anthropometric measurements that may objectively quantify nutritional status, has received more attention as a result of this alarming occurrence.

A well-known indicator of nutritional status, serum albumin has been thoroughly investigated in surgical settings. Albumin levels, which have a half-life of roughly 20 days, are a good indicator of long-term nutritional condition and have been strongly associated with surgical results. [3.] Prolonged hospital stays, delayed wound healing, and higher incidence of surgical site infections have all been linked to low preoperative albumin levels. Hypoalbuminemia and poor surgical outcomes are especially related in emergency laparotomy situations, where time restrictions may limit preoperative optimization. [4]

Because of its shorter half-life of roughly two to three days, prealbumin, commonly referred to as transthyretin, has various benefits as a nutritional marker. As a result, it may be more useful in short-term nutritional assessment and more sensitive to sudden changes in nutritional status. [5.] Prealbumin is especially helpful in tracking the efficacy of preoperative nutritional support because of its high turnover rate, which enables it to more closely reflect recent dietary interventions than albumin.

Transferrin offers more information on nutritional status because of its half-life, which is roughly 8–10 days, which is in between that of albumin and prealbumin. Because of its function in iron transport and metabolism, it is especially important for surgical patients, whose wound healing and recuperation depend on having sufficient iron stores. [6.] A more thorough evaluation of nutritional status can be obtained by combining these three protein indicators than by using only one.

Despite being a rather imprecise indicator of nutritional condition, body mass index (BMI) is nonetheless a crucial tool for assessing surgical risk. Increased surgical complications have been linked to both BMI extremes. Underweight status (BMI <18.5 kg/m2) is frequently associated with inadequate nutritional reserves and heightened postoperative problems, whereas obesity (BMI ≥30 kg/m2) has been associated with greater incidence of wound complications and technical difficulties during surgery. [7.]

Preoperative risk evaluation is even more thorough by combining these dietary indicators with BMI. According to recent research, anthropometric and biochemical measurements together provide better prognostic value than either one alone. [8.] More focused preoperative interventions and improved identification of high-risk patients are made possible by this multimodal approach to nutritional assessment.

The importance of these nutritional factors is especially noticeable in the setting of laparotomy. Significant metabolic reserves are needed for recuperation following major abdominal surgery, which causes a great deal of physiological stress. The metabolic demands on patients are increased by the significant tissue manipulation, blood loss danger, and postoperative ileus risk. [9.] In this situation, knowing the predictive value of preoperative nutritional markers becomes essential, possibly enabling better decision-making about the necessity of preoperative nutritional optimization and the timing of surgery.

Furthermore, finding trustworthy prognostic indicators is becoming more and more crucial due to the financial consequences of post-surgical problems. There is increasing pressure on healthcare systems around the world to improve outcomes while lowering complications and length of stay. Through targeted interventions, early identification of high-risk individuals through nutritional assessment may enable more effective resource allocation and possibly lower healthcare expenditures. [10.]

In order to predict postoperative outcomes for patients undergoing laparotomy, the current study is to assess the predictive value of preoperative serum albumin, prealbumin, transferrin, and BMI. Establishing more efficient preoperative screening procedures and directing dietary intervention tactics may be made easier with an understanding of these linkages.

# AIM & OBJECTIVES

## Aim:

To Study the efficacy of preoperative serum albumin, Serum prealbumin, serum transferrin and Body Mass Index as predictors of postoperative morbidity and mortality in laparotomy cases.

## Objectives:

- Primary :

Evaluate efficacy of nutritional markers in predicting post-laparotomy outcomes

- Secondary:

Determine correlation between markers and complications

Duration of hospital stay

# REVIEW OF LITERATURE

## LAPAROTOMY

In order to reach the peritoneal cavity, a laparotomy, also called a celiotomy, is carried out by making a wide incision in the belly. The Greek terms lapara, which means "flank," and tomy, which means "cut," are the roots of the English word laparotomy. To reach the peritoneal cavity during surgery, this means making a large incision in the abdomen. A typical laparotomy involves making a cut along the linea alba in the middle. Between 30,000 and 50,000 of these procedures are carried out each year in the United Kingdom. [11]

### Anatomy and Physiology

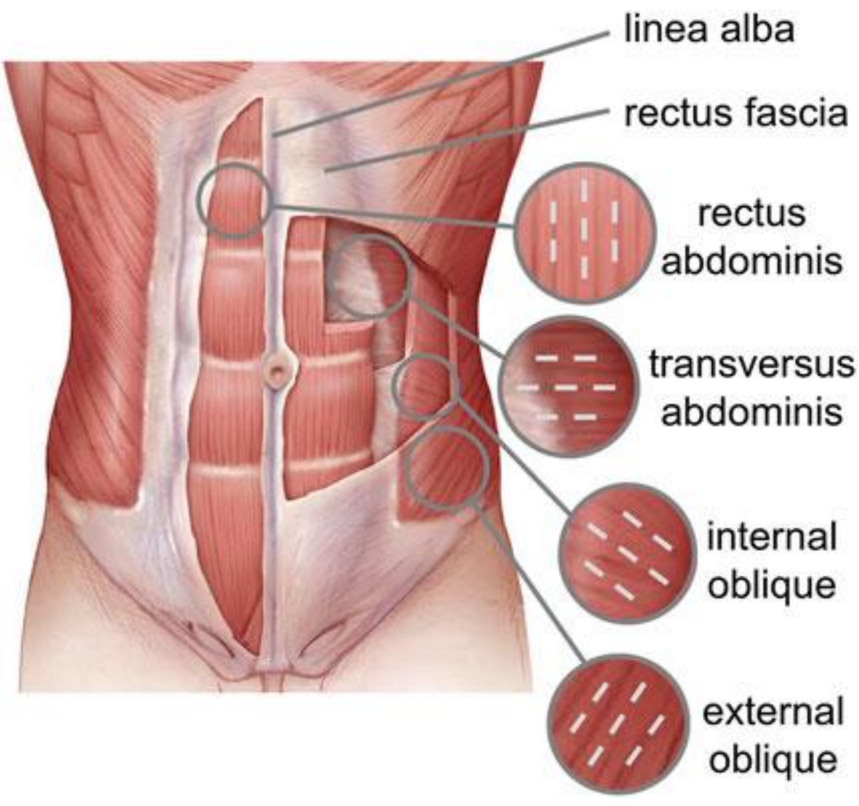
The abdominal cavity is enclosed and the abdominal viscera are shielded by the abdominal wall. Skin, subcutaneous fat, Camper and Scarpa fascia, external and internal oblique muscles, rectus abdominis muscle, transverse abdominis muscle, pyramidalis muscle, transversalis fascia, and peritoneum are the layers of the anterior abdominal wall that may be encountered during a laparotomy, ranging from superficial to deep.

Two long, vertical muscles on either side of the abdominal wall's midline are known as the rectus abdominis. The linea alba, a fibrous avascular plane that extends from the pubic symphysis inferiorly to the xiphoid process of the sternum superiorly, connects the two recti in the midline. The linea semilunaris is a surface feature formed by the lateral boundary of this muscle's two sides. The well-known six-pack is created by the division of this muscle by fibrous junctions that connect the linea alba. The xiphoid process and costal cartilages of ribs 5, 6, and 7 are where the rectus abdominis inserts after attaching to the pubic crest.It is regarded as a flat muscle that stabilizes the pelvis during motions like walking and compresses the abdominal viscera. The thoracoabdominal nerve, which is supplied by nerve roots T7–T11, innervates it.

As the name implies, the pyramidalis is a little, triangular muscle. Its base is on the pubis bone, and it is located superficially, inferior to the rectus abdominis, linked to the linea alba.

The rectus sheath, which is made up of the aponeuroses of the external, internal, and transversus abdominis muscles, encloses the rectus abdominis and pyramidalis muscles. There are two halves to the rectus sheath: anterior and posterior.

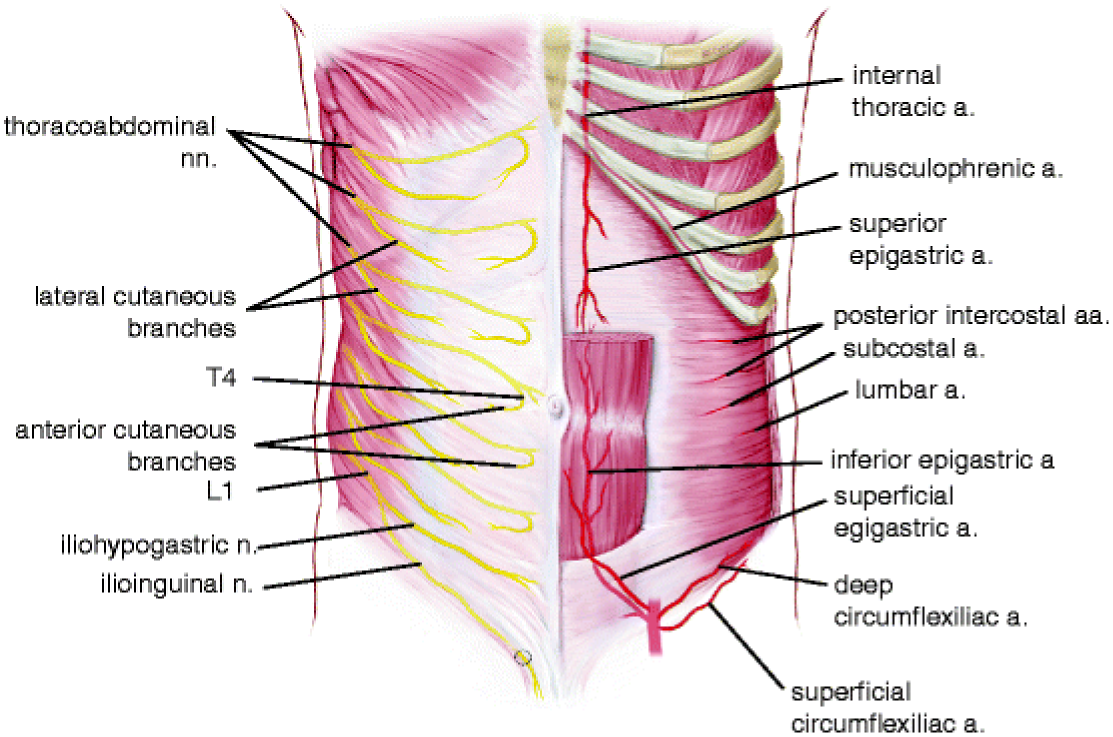
The aponeuroses of the external oblique and part of the internal oblique make up the anterior rectus sheath.
The aponeuroses of the external oblique and part of the internal oblique make up the posterior rectus sheath.



But beneath the arcuate line, there is no posterior rectus sheath. The transversalis fascia makes direct touch with the rectus abdominis at this position, which is roughly halfway between the pubic symphysis and umbilicus. One may think of the blood flow to the abdominal wall as a dual supply. The initial supply comes from the deep epigastric arcade, which is situated between the posterior rectus sheath (also called the retrorectus plane) and the rectus abdominis muscle. It is made up of the inferior and superior epigastric arteries. Perforating vessels supply the rectus muscle and branch off to supply the linea alba. The segmental arteries, which emerge from the aorta to supply the transverse and oblique muscles, are the other major source.

These connect the transverse and internal oblique muscles. [12]

The abdominal wall is innervated by the thoracoabdominal nerve, the iliohypogastric and ilioinguinal nerves, and the ventral branches from the 5 to 12 thoracic nerves.



**Indications :**

Since minimal access surgery became available, the number of reasons needing a laparotomy has drastically decreased. However, it's crucial to remember that access is essential for any surgical treatment. In many cases, the risk of harming important structures may outweigh the advantages of minimal access operations, making keyhole surgeries exceedingly challenging or even impossible. The more conventional laparotomy continues to be the standard procedure in these circumstances, whether they are elective or emergency. In general, these circumstances include huge ascites in patients with end-stage liver or heart illness, severely enlarged intestines in intestinal blockage, or numerous thick adhesions from prior surgeries or inflammatory diseases.

The most frequent reasons for laparotomy are still emergency situations, including acute intraperitoneal hemorrhage, unmanageable gastrointestinal hemorrhage, traumatic or piercing abdominal injuries, and generalized intraperitoneal infection brought on by a ruptured gastrointestinal tract. Laparotomy is also indicated for elective surgeries involving a large specimen, such as intestine or pancreatic transplants or pancreaticoduodenectomy. [13.]

**Contraindications :**

The patient who is unfit for general anesthesia is the most significant contraindication to be aware of. This is usually caused by a combination of variables, such as sepsis, hemodynamic instability, co-morbidities, and widespread metastatic malignant disease. The patient's wishes are also crucial since, if they are capable of doing so, they have the right to refuse a laparotomy, regardless of the indication.

A complete clinical evaluation and pertinent radiological investigations are essential because there should always be a high index of suspicion for conditions like acute pancreatitis, hyperglycaemic crisis, gout, gastritis, or urinary tract infections that could mimic acute abdomen and give a false indication for laparotomy. [14]

## POST-OPERATIVE MORBIDITY AND MORTALITY IN LAPAROTOMY PATIENTS[15]

- Common post-operative complications following laparotomy can be categorized into immediate, early, and late complications. Immediate complications, occurring within the first 24 hours, include hemorrhage, which presents as internal bleeding from surgical sites and may manifest as hypotension, tachycardia, and decreased urine output, often requiring immediate reoperation. Respiratory issues, such as atelectasis, pneumonia, and pulmonary embolism, are also common and are related to anesthesia and prolonged bed rest. Early complications, occurring within 1-7 days, include wound complications such as surgical site infections (SSIs), wound dehiscence, seroma formation, and hematoma. Gastrointestinal complications, such as ileus, nausea, vomiting, and early bowel obstruction, are also common during this period. Urinary complications, including urinary tract infections, urinary retention, and acute kidney injury, may also arise. Late complications, typically occurring after 7 days, include adhesions, which are a leading cause of late bowel obstruction and may necessitate subsequent surgery. Incisional hernias, occurring in approximately 15-20% of cases, also become apparent in this phase, with the risk increased by wound infection and obesity. Several risk factors contribute to post-operative complications, with patient-related factors such as advanced age, obesity, diabetes mellitus, malnutrition, smoking, and immunocompromised status increasing the likelihood of complications. Surgery-related factors, including emergency surgery, prolonged operative time, contaminated or dirty procedures, multiple procedures, and significant blood loss during surgery, also heighten the risk of complications. Mortality statistics indicate that elective laparotomy carries a 1-3% mortality rate, while emergency laparotomy has a significantly higher mortality rate of 15-20%. Mortality rates increase with advancing age (especially over 80 years), multiple comorbidities, sepsis, and organ failure.

- Laparotomy mortality statistics indicate significant variations based on the type of surgery, patient age, underlying conditions, and other risk factors. For elective surgery, the overall 30-day mortality rate is between 1-3%, with a 90-day mortality rate of 4-5%, and 1-year mortality ranging from 8-12%. In contrast, emergency surgeries have much higher mortality rates. The 30-day mortality for emergency surgeries is between 15-20%, which increases to 25-30% in elderly patients and can reach as high as 35-40% in cases involving sepsis. The 90-day mortality for emergency surgery ranges from 20-25%, and 1-year mortality is between 25-35%. Mortality rates also vary with age. For individuals under 50 years, elective surgery carries a mortality rate of less than 1%, whereas emergency surgery leads to 5-10% mortality. For those aged 50-70 years, elective surgery carries a mortality rate of 2-4%, while emergency surgery mortality is 12-18%. For individuals aged 70-80 years, the mortality for elective surgery increases to 4-6%, while emergency surgery leads to 20-25% mortality. In patients over 80 years of age, elective surgery carries a mortality rate of 8-12%, while emergency surgery mortality ranges from 35-45%. Mortality also depends on specific conditions. For instance, peritonitis results in an overall mortality rate of 20-30%, which escalates to 40-60% with septic shock and 70-80% with multiple organ failure. In bowel obstruction, simple obstruction has a mortality rate of 3-5%, but the rate increases to 20-25% with strangulation and 30-40% with perforation. Trauma also plays a significant role, with isolated abdominal trauma having a mortality rate of 5-10%, multiple trauma increasing the rate to 15-25%, and major vascular injury leading to 40-50% mortality. Several risk factors influence mortality, with high-impact factors such as septic shock, multiple organ failure, advanced age (over 80), emergency surgery, and an ASA score greater than 4 being associated with more than a threefold increased risk. Moderate-impact factors, including malnutrition, severe comorbidities (such as heart failure, chronic kidney disease, and liver cirrhosis), immunosuppression, and extensive cancer, contribute to a 2-3 times increased risk, while lower-impact factors such as diabetes, obesity, smoking, and previous abdominal surgery contribute to a 1.5-2 times increased risk. Mortality trends reveal that the immediate causes of death within the first 24 hours include hemorrhage, cardiovascular events, and anesthetic complications, with a 0.5-1% mortality rate in elective cases and a 2-5% rate in emergency cases. The early phase, occurring between 1-7 days, accounts for 40-50% of deaths, primarily due to sepsis, organ failure, and pulmonary complications. Late deaths, occurring between 8-30 days, account for 30-40% of all deaths, with causes including progressive organ failure, hospital-acquired infections, and cardiovascular events.[16,17]

## HISTORICAL PERSPECTIVE OF NUTRITIONAL ASSESSMENT IN SURGERY[18, 19]

1. Early Recognition (1800s-1930s)

- First observations linking poor nutrition to surgical complications
- Early work by surgeons like Theodor Billroth who noted the importance of nutritional status
- Initial crude methods of assessment based mainly on physical appearance and weight loss

2. World War Era Developments (1940s-1950s)

- Observations from war injuries and recovery patterns
- Recognition of protein malnutrition's impact on wound healing
- Development of first biochemical tests to assess nutritional status
- Introduction of anthropometric measurements in surgical assessment

3. Protein Era (1960s-1970s)

- Discovery of serum proteins as nutritional markers
- Introduction of albumin as a nutritional assessment tool
- Development of transferrin measurement techniques
- Recognition of visceral protein depletion's importance

4. Standardization Period (1980s-1990s)

- Development of structured nutritional screening tools
- Introduction of Subjective Global Assessment (SGA)
- Validation of biochemical markers
- Integration of Body Mass Index into assessment
- Creation of first nutritional risk scores

5. Modern Era (2000s-Present)

- Development of evidence-based guidelines
- Introduction of advanced screening tools like NRS-2002, MUST

- Understanding of inflammation's impact on nutritional markers
- Recognition of sarcopenia and body composition
- Integration of nutritional assessment into Enhanced Recovery After Surgery (ERAS) protocols

**Nutritional Status and Its Importance in Surgery**

Nutritional status plays a crucial role in the outcomes of surgical procedures, as it directly impacts the body's ability to heal, fight infection, and recover postoperatively. The significance of proper nutritional intake before surgery is well-established, influencing both short-term and long-term recovery, complication rates, and overall survival.

**1. Role of Nutrition in Preoperative Preparation**

Good nutritional status is considered one of the key factors in preoperative management. Nutrients like proteins, carbohydrates, fats, vitamins, and minerals are essential for cellular function, immune response, and tissue repair. Adequate nutrition ensures the following:[20, 21]

- **Immune function:** Proper nutrition helps maintain a strong immune system, which is critical for preventing infections after surgery.
- **Wound healing:** Protein and other nutrients, such as vitamins and minerals, are essential for collagen formation and tissue regeneration. Without adequate nutrition, wound healing is impaired, increasing the risk of complications like wound infections or dehiscence (wound reopening).
- **Energy balance:** The body needs sufficient energy reserves for recovery and to cope with the stress of surgery. This helps in preventing catabolism (breakdown of body tissue) and aids in maintaining muscle mass and strength.

**2. Impact of Malnutrition on Surgical Outcomes[22, 23]**

Malnutrition is commonly observed in surgical patients, particularly those undergoing major surgeries like laparotomies. It can be the result of factors like chronic illness, inadequate dietary intake, gastrointestinal disorders, or pre-existing medical conditions that interfere with nutrient absorption. Malnutrition can contribute to:

- **Increased risk of infections:** Malnourished patients have a compromised immune system, which reduces their ability to fight off infections. Postoperative infections, such as wound infections, pneumonia, or urinary tract infections, are more common in malnourished patients.
- **Delayed wound healing:** Low protein levels, including deficiencies in serum albumin, impair the body's ability to repair tissue, which can lead to poor wound healing and prolonged recovery.
- **Muscle weakness and functional impairment:** Malnutrition, particularly protein deficiency, can result in muscle wasting and weakness, reducing a patient's ability to regain strength after surgery and increasing the risk of complications like falls and prolonged bed rest.
- **Increased risk of morbidity and mortality:** Studies consistently show that malnourished patients experience higher rates of postoperative complications such as pneumonia, sepsis, and longer hospital stays, all of which contribute to increased morbidity and mortality.

**3. Role of Specific Nutrients[24]**

- **Proteins:** Proteins are critical for tissue repair and immune function. Serum albumin and prealbumin levels are often used as biomarkers to assess nutritional status because they reflect the body's protein stores. Low levels of these proteins are associated with poor surgical outcomes and higher complication rates.
- **Carbohydrates and Fats:** Carbohydrates provide energy for the body, while fats help in tissue repair and maintaining the integrity of cell membranes. A balanced intake of these macronutrients is necessary for optimal recovery.
- **Vitamins and Minerals:** Vitamins like vitamin C, A, and zinc play important roles in collagen synthesis, immune function, and wound healing. Deficiencies in these micronutrients can significantly impair postoperative recovery.

## 4. Nutritional Assessment Methods

Before surgery, it is important to assess the nutritional status of patients to identify those at risk of malnutrition. Common methods of assessing nutritional status include:[24]

- **Anthropometric measurements:** Body weight, body mass index (BMI), and skinfold thickness can provide insight into a patient's nutritional state.
- **Biochemical markers:** Serum albumin, prealbumin, transferrin, and other markers like C-reactive protein (CRP) and total lymphocyte count are useful in assessing nutritional status and predicting postoperative complications.
- **Clinical signs:** Physical signs of malnutrition, such as muscle wasting, edema, and delayed wound healing, can help in identifying at-risk patients.
- **Dietary assessment:** A thorough review of a patient's food intake and dietary habits can help identify potential deficiencies or risks for malnutrition.

## 5. Nutritional Support in the Perioperative Period

For patients identified as malnourished or at risk of malnutrition, perioperative nutritional support is crucial. This can include:[25]

- **Enteral nutrition:** Feeding through a tube (e.g., nasogastric or percutaneous endoscopic gastrostomy) for patients who are unable to consume enough food orally.
- **Parenteral nutrition:** Intravenous feeding for patients who cannot tolerate enteral feeding due to gastrointestinal issues.
- **Dietary supplementation:** Providing oral supplements, such as protein drinks or multivitamin tablets, to meet nutritional needs.

Preoperative nutritional optimization, through either dietary changes or supplementation, has been shown to reduce the risk of complications, shorten recovery time, and improve overall surgical outcomes.

## Serum Albumin as a Predictor of Postoperative Morbidity and Mortality[26, 27]

Serum albumin is a key plasma protein synthesized by the liver and plays a critical role in maintaining osmotic pressure, transporting hormones, fatty acids, and drugs, and supporting immune function. In the context of surgery, serum albumin levels are commonly used as a marker of nutritional status, as well as an indicator of the body's overall health. It is particularly important because it can reflect the presence of underlying conditions such as malnutrition, liver disease, and kidney dysfunction, all of which can affect surgical outcomes.

**1. Serum Albumin and Nutritional Status**

- **Nutritional assessment**: Serum albumin levels are often used to evaluate a patient's nutritional status. Low levels of serum albumin are typically associated with malnutrition, particularly protein-energy malnutrition, and can signal an increased risk of postoperative complications. Albumin has a long half-life (around 20 days), so it is considered a more chronic marker, reflecting the patient's nutritional state over time rather than immediate deficiencies.
- **Impact on surgical outcomes**: In patients undergoing surgery, low preoperative serum albumin levels are linked to a higher risk of postoperative complications, including wound infection, delayed wound healing, an increased length of hospital stay, and a higher incidence of overall morbidity and mortality. This is due to albumin's role in fluid balance, tissue repair, and immune function.

**2. Mechanisms through Which Low Serum Albumin Levels Affect Surgical Recovery**

- **Impaired immune function**: Albumin plays a vital role in modulating immune responses by binding and transporting various immune-related molecules. Low albumin levels can impair the body's ability to defend against infections post-surgery. This can result in an increased incidence of sepsis, wound infections, and pneumonia, which are common causes of postoperative morbidity and mortality.

- **Impaired wound healing**: Albumin is essential for tissue repair and wound healing. It carries important substances, such as zinc and other nutrients, that are necessary for collagen synthesis and tissue regeneration. Low serum albumin levels are associated with delayed wound healing, increasing the likelihood of wound dehiscence (wound reopening), infections, and other complications.
- **Edema and fluid balance**: Albumin helps maintain colloid osmotic pressure, which is crucial for keeping fluid in the blood vessels and preventing edema. Low albumin levels can lead to edema (fluid accumulation in tissues), which can cause complications like respiratory distress, impaired organ function, and a delay in recovery.
- **Impaired drug metabolism and transport**: Albumin binds to a wide variety of drugs, and low levels can affect drug efficacy and clearance. In a postoperative setting, this can result in altered drug metabolism, potentially affecting the effectiveness of medications or causing toxicity.

**3. Clinical Evidence Linking Low Serum Albumin with Postoperative Morbidity and Mortality**

Numerous studies have demonstrated that low preoperative serum albumin levels are associated with poor postoperative outcomes:

- **Wound infection and sepsis**: Research has shown that low albumin levels are associated with an increased risk of postoperative infections, including wound infections, pneumonia, and urinary tract infections.
- **Length of hospital stay**: Low albumin levels are correlated with longer hospital stays, as patients with low albumin are more likely to experience complications that delay recovery.
- **Increased mortality**: Hypoalbuminemia has been consistently linked with increased mortality in various surgical settings. For example,

**4. Serum Albumin as Part of Multivariate Risk Models**

- Serum albumin is often included in risk models to predict postoperative outcomes. Multivariate models, such as the **Revised Cardiac Risk Index (RCRI)** or **Nutrition Risk Index (NRI)**, use serum albumin levels along with other clinical variables to predict postoperative morbidity and mortality. These models help clinicians identify high-risk patients who may benefit from enhanced perioperative care, including nutritional support and close monitoring.
- **Nutritional Risk Index (NRI)**: The NRI combines albumin levels with weight loss and is a strong predictor of adverse outcomes. It is particularly useful in assessing the nutritional status of patients before surgery and guiding preoperative nutritional interventions.

**5. Cut-off Values for Serum Albumin in Surgical Risk Assessment**

- The predictive value of serum albumin depends on specific cut-off values. While normal serum albumin levels range from 3.5 to 5.0 g/dL, levels below 3.0 g/dL are commonly considered indicative of malnutrition and have been associated with poor surgical outcomes.
- **Hypoalbuminemia (serum albumin < 3.0 g/dL)** is a well-established predictor of increased postoperative complications, including wound infection, sepsis, prolonged ICU stays, and mortality.

**Serum Prealbumin as a Predictor of Postoperative Morbidity and Mortality**[28, 29]

Serum prealbumin (also known as transthyretin) is a low molecular weight protein primarily synthesized in the liver. It is an important biomarker used to assess nutritional status, especially protein malnutrition. Prealbumin has a shorter half-life than serum albumin (about 2–3 days), making it a more sensitive marker for acute changes in nutritional status. Due to its rapid turnover, prealbumin is particularly useful in assessing short-term nutritional deficiencies and predicting postoperative outcomes, including morbidity and mortality.

1. **Serum Prealbumin and Nutritional Status**
    - **Nutritional marker**: Serum prealbumin levels reflect a patient's protein status and can provide more immediate feedback on nutritional interventions compared to serum albumin. Prealbumin is less influenced by long-term factors like liver function or fluid status, which makes it an ideal marker for assessing acute changes in nutrition, especially in the perioperative setting. Low prealbumin levels are commonly associated with malnutrition and protein deficiency, both of which are linked to worse surgical outcomes.
    - **Impact on surgical outcomes**: Prealbumin levels, when low, are indicative of impaired nutritional status, which can lead to various complications during and after surgery. This is especially critical in major surgeries where wound healing, immune function, and tissue repair are essential for recovery.
2. **Mechanisms Linking Low Prealbumin with Postoperative Complications**
    - **Immune system dysfunction**: Prealbumin plays an essential role in maintaining immune function. Low prealbumin levels are associated with a reduced capacity to fight infections, which increases the risk of postoperative complications such as sepsis, pneumonia, and wound infections. Patients with low prealbumin levels often experience longer hospital stays and higher rates of infection.
    - **Wound healing**: Prealbumin is involved in the transport of key nutrients and molecules required for tissue regeneration, including retinol-binding protein, which is essential for vitamin A transport, a critical factor in wound healing. Deficient prealbumin levels may lead to impaired wound healing, increasing the risk of complications such as wound dehiscence or infection.
    - **Fluid balance**: Prealbumin helps regulate fluid balance by maintaining the osmotic pressure of plasma. Low levels can contribute to edema and fluid imbalances, which may complicate the postoperative period, leading to respiratory distress or the need for prolonged mechanical ventilation.

**5. Prealbumin as Part of Nutritional Risk Scores**

Prealbumin is often included in comprehensive nutritional risk scoring systems used to assess surgical patients' preoperative nutritional status. These systems, which may include markers like serum albumin, prealbumin, and BMI, help in predicting the likelihood of complications and mortality after surgery. For instance, the **Nutrition Risk Index (NRI)** combines prealbumin levels with weight loss data to stratify patients by risk, and it has been shown to predict postoperative outcomes in various surgical populations.

**Serum Transferrin as a Predictor of Postoperative Morbidity and Mortality**[30, 31]

Serum transferrin is a glycoprotein primarily responsible for the transport of iron in the bloodstream. Transferrin is produced by the liver and has a half-life of about 8–10 days, making it a useful marker for assessing chronic changes in nutritional status, particularly protein malnutrition. Low transferrin levels are often associated with poor nutritional intake, inflammation, and various chronic diseases. In the context of surgery, serum transferrin is a valuable marker in predicting postoperative complications, including morbidity and mortality.

**1. Serum Transferrin and Nutritional Status**

- **Nutritional marker**: Transferrin levels provide information about the body’s protein status and iron levels. It is sensitive to protein-energy malnutrition and reflects changes in nutritional intake and inflammation over a medium-term period (since it has a relatively long half-life). Low serum transferrin levels are typically seen in patients with protein deficiency or malnutrition, conditions that increase the risk of postoperative complications.
- **Influence of inflammation**: Transferrin is an acute-phase reactant, meaning that its levels can be reduced in response to inflammation, infection, or stress. This makes it a more specific marker of nutritional status than some other markers like serum albumin, which can be influenced by other factors (such as liver

disease or fluid balance). Transferrin, therefore, provides more reliable information on the nutritional state of patients undergoing surgery.

**2. Mechanisms Linking Low Serum Transferrin with Postoperative Complications**

- **Impaired immune response**: Transferrin plays a crucial role in iron transport to cells, including those of the immune system. Iron is essential for the proliferation and function of immune cells, including macrophages and lymphocytes, which are vital for combating infection. Low transferrin levels have been associated with weakened immune responses, making patients more susceptible to infections and sepsis after surgery.
- **Wound healing**: Adequate iron supply is also critical for wound healing. Iron deficiency, indicated by low transferrin levels, can impair collagen synthesis and cell proliferation, both of which are essential for tissue repair. As a result, patients with low transferrin levels may experience delayed wound healing, increasing the risk of wound infections, dehiscence, and other postoperative complications.
- **Increased risk of anemia**: Transferrin is closely related to iron metabolism. Low transferrin levels often indicate iron deficiency, which can result in anemia. Anemia, in turn, leads to decreased oxygen delivery to tissues, increasing the likelihood of postoperative complications such as poor wound healing, cardiovascular stress, and organ dysfunction. Additionally, anemia can prolong recovery times and increase the need for blood transfusions after surgery.

**4. Cut-off Values for Transferrin in Predicting Surgical Outcomes**

- **Predictive thresholds**: Similar to other nutritional markers, serum transferrin has been studied for specific cut-off values that can predict postoperative outcomes. While the normal range for transferrin is approximately 200-360 mg/dL, studies have suggested that levels below 200 mg/dL are often associated with higher risks of postoperative complications and mortality.

**Body Mass Index (BMI) as a Predictor of Postoperative Morbidity and Mortality**

Body Mass Index (BMI) is a widely used measurement to assess an individual's body weight in relation to their height. It is calculated as weight (kg) divided by height ($m^2$). BMI serves as a basic tool for categorizing individuals into different weight categories, such as underweight (BMI < 18.5 kg/$m^2$), normal weight (18.5–24.9 kg/$m^2$), overweight (25–29.9 kg/$m^2$), and obese (BMI ≥ 30 kg/$m^2$). In surgical settings, BMI has become a critical parameter in predicting postoperative outcomes, including morbidity (complications) and mortality (death).

BMI provides insight into an individual's nutritional status, fat distribution, and overall health. While BMI is not a perfect measure of body composition (since it does not differentiate between fat mass and lean mass), it remains an important and easily accessible tool in clinical practice.

**BMI and Postoperative Morbidity**

- **Increased risk of complications in underweight patients**: Underweight patients (BMI < 18.5 kg/$m^2$) are at higher risk for postoperative complications, including wound infections, delayed wound healing, and impaired immune function. This is often due to insufficient nutritional reserves and muscle mass, which are critical for tissue repair and recovery. Malnutrition, often associated with a low BMI, impairs immune function and increases the risk of infection and delayed healing.[32]
- **Obesity and its impact on morbidity**: Obesity (BMI ≥ 30 kg/$m^2$) is also a strong risk factor for increased postoperative morbidity. Obese patients have a higher incidence of complications such as wound infections, deep vein thrombosis (DVT), respiratory issues (e.g., sleep apnea), and surgical site infections. Obesity increases the difficulty of surgeries due to technical challenges (e.g., difficulty with intubation, prolonged anesthesia time, or technical challenges during surgery), which can lead to higher complication rates.[33]

**2. BMI and Postoperative Mortality**

- **Obesity and increased mortality risk**: Obesity has been consistently linked with an increased risk of postoperative mortality. Obese patients are more likely to have underlying comorbidities such as diabetes, hypertension, and cardiovascular disease, which can negatively affect surgical outcomes. Additionally, the increased complexity of surgical procedures, prolonged anesthesia, and difficulty in post-anesthesia recovery contribute to an elevated risk of death.
- **Underweight and mortality risk**: Although less frequently discussed than obesity, being underweight is also associated with higher mortality rates in the postoperative period. Underweight patients tend to have lower muscle mass, which increases the risk of postoperative weakness, organ dysfunction, and prolonged recovery. Additionally, the nutritional deficiencies common in underweight individuals contribute to increased vulnerability to infections and other complications.[34]
- **The ASA Physical Status Classification System**: BMI is also used alongside other factors in assessing patients' physical status before surgery. The classification system, which ranges from 1 (healthy) to 4 (severe systemic disease), can be combined with BMI to stratify risk for surgery. BMI > 30 or BMI < 18.5 can lead to a higher ASA score, indicating increased risk.[35]

**4. Cut-off Values for BMI in Predicting Surgical Outcomes**[36]

- **Normal BMI (18.5–24.9 kg/m²)**: This group typically has the best surgical outcomes, with the lowest risks of complications and mortality. However, even within the normal BMI range, there can be variations in muscle mass and fat distribution that may influence outcomes, which is why BMI is often used in conjunction with other assessments like body composition analysis.
- **Obesity (BMI ≥ 30 kg/m²)**: Obese patients are at a higher risk of postoperative complications. **BMI ≥ 35 kg/m²** is often used as a cutoff for severe obesity, and

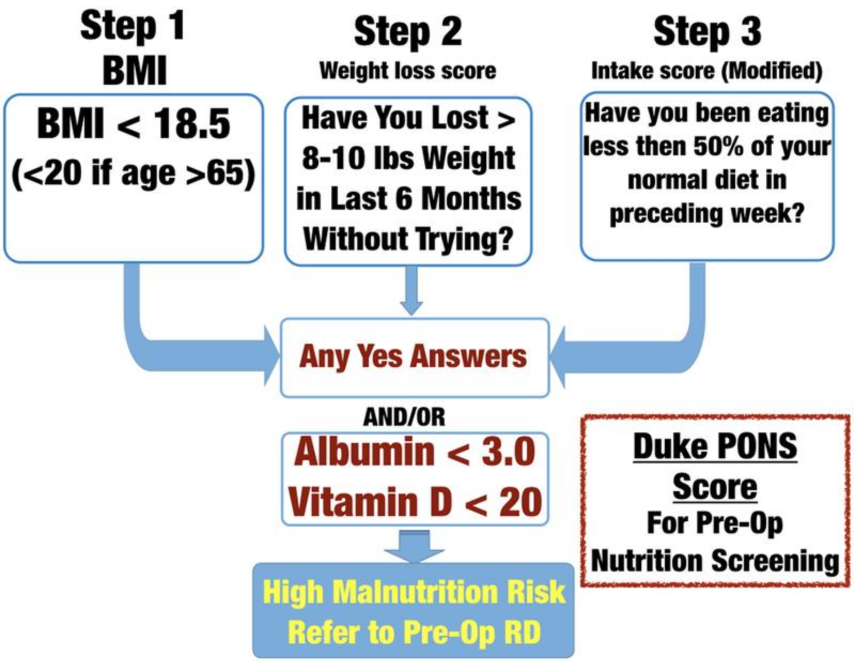
studies show that the risk of complications and mortality increases significantly in this group, particularly in major surgeries like bariatric surgery, abdominal surgery, or orthopedic procedures.

- **Underweight (BMI < 18.5 kg/m$^2$)**: While the exact cutoff for increased risk varies, underweight patients generally face a higher risk of postoperative complications, including infections, prolonged recovery, and mortality. This is especially true in elderly patients or those with malnutrition.

## How Can the Perioperative Nutrition Screen (PONS) Score Help Us Identify Malnourished Surgical Patients?

Improving nutrition status during the perioperative phase requires early detection of the malnourished surgical patient. [37] Patients at risk for malnutrition who might benefit from preoperative nutritional supplementation can be identified through screening for malnutrition before elective surgery. With two out of every three patients who appear for surgery being underweight before to surgery, the risk of perioperative malnutrition is frequently highest for gastrointestinal and oncologic procedures. [38] Additionally, improved rehabilitation programs frequently target these high-risk surgeries, enabling more significant optimization. [37]. There is currently no widely recognized screening tool for preoperative malnutrition risk, despite the fact that a number of screening instruments have been approved for use with hospitalized patients. The use of the Perioperative Nutrition Screen (PONS) for preoperative evaluation of malnutrition is advised by a significant recent article from the Perioperative Quality Initiative (POQI). [37] PONS, a modified version of the well-validated Malnutrition Universal Screening Tool (MUST), uses frequently used malnutrition questions to determine nutrition risk. A "positive" response (maximum PONS score of 3) earns one point for each inquiry, including one with an albumin level less than 3.0. The patient's preoperative albumin and vitamin D levels are used to further evaluate the risk of perioperative malnutrition. A patient is at high risk for perioperative malnutrition[37] if they have PONS > 1 (any positive response to the first three questions), an albumin < 3.0 (and/or a vitamin D < 20), and/or both. They should undergo pre-operative nutrition intervention before surgery, as explained below. Referral to a qualified dietician for additional preoperative nutritional assessment is also advised, if one is available. It has been demonstrated that postoperative problems are more common in underweight patients (BMI <18.5 kg/m2 for adults under 65) after major surgery. [39] Unintentional weight reduction, regardless of BMI, has been linked to adverse surgical consequences, such as functional decline and morbidity. Albumin has long been used as a malnutrition indicator, and preoperative albumin levels are a powerful predictor of postoperative problems, including mortality, despite its limitations as a nutritional measure in post-operative settings and states of systemic inflammation. [40] These elements work together to create a comprehensive preoperative malnutrition screening method.

Figure 1: Pre-Operative Nutrition Score (PONS) Assessment Tool (modified from the reference). [37] PONS evaluates perioperative patients for malnutrition risk using questions from the validated Malnutrition Universal Screening Tool. Malnutrition risk can be detected by a PONS score of ≥1, an albumin level of <3.0, or a vitamin D level of <20. Prior to surgery, the patient should receive preoperative nutrition therapy.

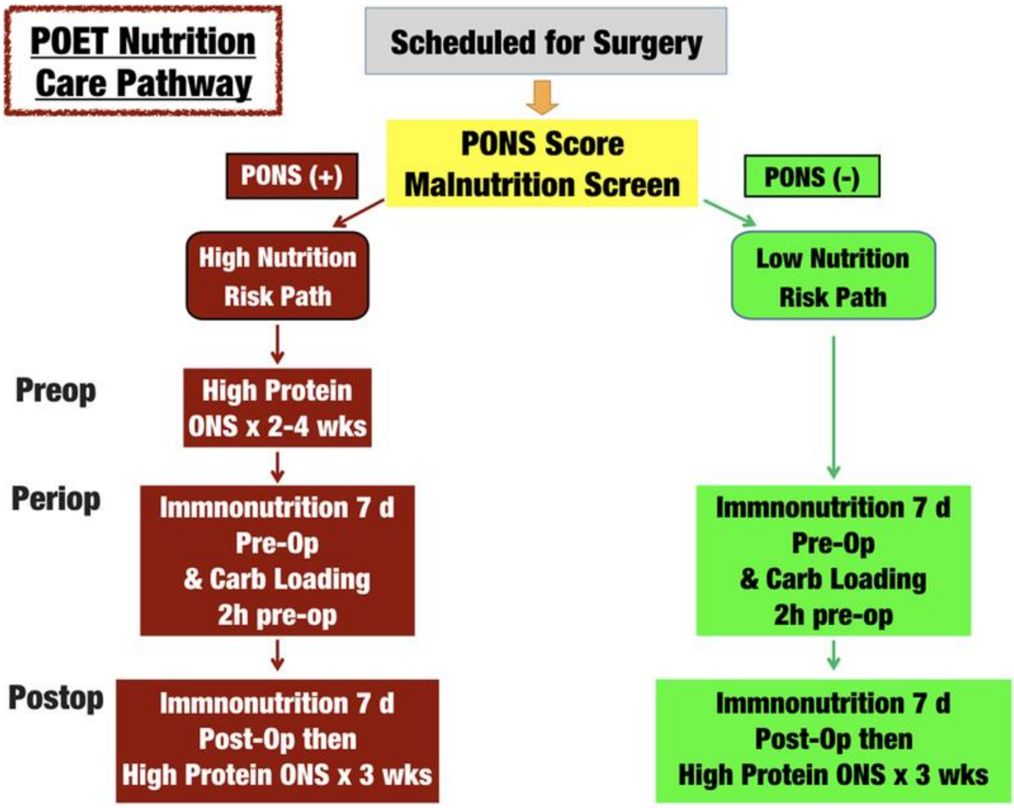



Every patient undergoing major surgery should have a preoperative assessment using the PONS, which enables rapid and effective identification of preoperative malnutritional risk. Patients who have a positive PONS score, which indicates that they are at risk for malnutrition, should have their major elective surgery postponed to allow for proper nutrition optimization. The best time to optimize preoperative nutrition is unknown, although it seems to be at least 7 to 10 days. The danger of illness progression from postponing surgery should be balanced against the high risk of operating on a patient who is malnourished. [37]

## Optimizing Preoperative Nutrition Enhances Surgical Results

The human body experiences metabolic and physiological stress after surgery, which leads to an increase in the synthesis of proteins involved in wound healing, immunological function, and hepatic acute phase protein synthesis. Preoperative fasting should be avoided since perioperative fasting can worsen the surgical stress response and increase protein loss. [37]

Figure 2: The Duke Perioperative Enhancement Team (POET) Nutrition Program's Perioperative Nutritional Care Pathways. consists of the Nutrition Pathway for Low Nutrition Risk Patients (those with a PONS score less than 1) and the Nutrition Pathway for High Nutrition Risk Patients (those with a PONS score of at least 1).




Therefore, the requirements for protein intake are raised, and LBM breakdown becomes the source of amino acids when protein intake is not enough to fulfill the increased demands of protein synthesis. Although the ideal protein intake for surgery patients has not yet been established, current nutrition guidelines recommend that stressed patients consume at least 1.2–2.0 g of protein/kg/d. 37 It is currently unknown how long it will take to optimize preoperative nutrition appropriately and what the gold standard is for measuring optimization progress. In order to promote adequate nutritional status during the perioperative period, nutritional treatment should be provided preoperatively for both malnourished and normally nourished patients, according to recent consensus recommendations from the North American Surgical Nutrition Summit.[41]

It is recommended that patients with minimal risk of perioperative malnutrition (i.e., PONS <1 and Albumin [ALB] >3.0) eat complex carbohydrate-rich, high-protein diets prior to surgery. 37 The recommended perioperative energy targets of 25 kcal/kg/d and 1.5–2 g/kg/d of protein from food intake alone will be beyond the reach of many patients. Therefore, it is advised to promote the use of high-protein oral nutritional supplements (HP-ONSs) among patients.

Numerous studies conducted over a long period of time have supported the use of immunonutrition (IMN, which contains arginine/fish oil) in all patients undergoing major GI, heart, and ENT surgery. This advantage, which is independent of nutritional risk, should be used for all patients undergoing major surgery because it has been demonstrated to dramatically shorten length of stay and reduce infections and problems by around 40%. This correlation has been demonstrated in a large prospective cohort study with a propensity score-matched comparative effectiveness evaluation, in addition to when IMN is utilized in ERAS routes. [42]

For two to six weeks before any elective surgery, patients who have been found to be at risk of malnutrition (i.e., PONS >1 or ALB <3.0) should be taken HP-ONS. Protein intake for these patients should be at least 1.2 g/kg/d, and the HP-ONS should include >18 g/protein/serving, given at least twice daily. For the benefit, patient compliance with ONS consumption must be monitored. [37]

Dieticians are essential members of the perioperative care team as the anesthesiologist's duty broadens to include optimizing perioperative nutrition. A dietician should be consulted and home enteral nutrition (EN) started for at least seven days prior to surgery for malnourished patients who are unable to achieve their protein and calorie needs through oral nutrition. When ON or EN are unable to meet more than 50% of the necessary kcal/protein requirement, preoperative parenteral nutrition (PN) should be used in malnourished individuals. [37]

Postoperative Nutrition Management Following major surgery, especially GI surgery, early oral feeding is linked to lower rates of hospital expenses, length of stay, and postoperative problems. In particular, there is strong evidence that feeding within 24 hours post gastrointestinal surgery reduces significant morbidities and mortality. 43 Diets high in protein are crucial for helping to preserve lean muscle mass after surgery. Consequently, a high-protein diet should be started within 24 hours of surgery, with the exception of patients who have bowel discontinuity, ischemia, or blockage. During the postoperative phase, overall protein intake objectives are more significant than total calorie intake. [37]

To achieve their protein demands, patients who can tolerate 50% to 100% of their dietary objectives can take HP-ONS twice a day. A recent high-impact study of patients undergoing colorectal surgery within an ERAS/ERP pathway showed that patients receiving HP-ONS after surgery were able to consume more than 60% of their protein needs during the first three post-operative days, which was linked to a 4.4-day decrease in length of stay ($p<0.001$). 44 EN should be given and a dietitian should be contacted for patients who consume less than 50% orally. When possible, PN should be given in conjunction with EN for more than seven days to any patient who is unable to meet the ONS or EN requirements for protein and calories by more than 50%. [37]

## REVIEW OF RELATED ARTICLES

**Cullinane C. and associates (2023)**[45] In order to investigate the impact of obesity on perioperative outcomes for general surgery procedures in various obesity subtypes, a systematic review and meta-analysis were conducted. They came to the conclusion that higher BMI by itself is not linked to higher perioperative mortality in general surgery, emphasizing the need for more precise body composition measurements, like computed tomography anthropometrics, to aid in perioperative risk assessment and decision-making.

In order to evaluate postoperative surgical site wound problems in patients who had emergency exploratory laparotomy, **Naga Rohith V et al.** (2022)[46] employed preoperative serum albumin levels. They came to the conclusion that in patients who had emergency exploratory laparotomies, preoperative serum albumin value is a powerful predictor of wound dehiscence, postoperative surgical site infections, and length of hospital stay.

**Kassahun, W.T. et al. (2022)**[33] carried out a retrospective investigation at a single center. According to the World Health Organization's (WHO) weight classification criteria, 886 individuals with BMIs of less than 18.5 (underweight; n = 50), 18.5-24.9 (normal weight; n = 306), 25-29.9 (overweight; n = 336), and > 30 (obesity; n = 194) satisfied the inclusion requirements. Patients who were overweight or obese were older and more likely to be male than those who were normal weight. Compared to patients of normal weight, patients with obesity had higher rates of comorbidity (100% vs 91.2%, p = < 0.0001), morbidity (77.8% vs 65.6%, p = 0.003), and in-hospital mortality (44.8% vs 30.4%, p = 0.001).Obese patients experienced longer ventilation (39.1% vs 19.6%, p = 0.003), longer hospital stays (21.4 days vs 18.1 days, p = 0.081), and longer intensive care unit stays (ICU LOS) (13 days vs 9 days, p = 0.019). Morbidity and mortality rates rose gradually as BMI shifted away from the normal range; individuals who were severely obese (BMI > 40) had the highest rates of morbidity (87.9%) and mortality (54.5%). They came to the conclusion that the highest rates of concomitant illnesses, postoperative complications, and death during the initial hospitalization after EL for high-risk abdominal emergencies were found in obese patients.

The potential of preoperative blood albumin and body mass index as indicators of morbidity and mortality in patients with perforated peptic ulcers was evaluated by

**Bhanu PKR et al. (2021)**[47]. The mean albumin level, according to the results, was 3.01. Patients with serum albumin levels below 3.5 g/dl experience more complications than those with levels above 3.5 g/dl. The more severe the hypoalbuminemia, the higher the morbidity and fatality rate. A p-value of less than 0.05 indicated that this study was statistically significant. Although it is statistically insignificant with a p-value >0.05, we also discovered in our study that patients with aberrant BMIs experience more complications than patients with normal BMIs. They came to the conclusion that serum albumin is a reliable predictor of postoperative morbidity and death in cases of peptic ulcer disease-related peritonitis.

**Issangya CE et al. (2020)** [48] Investigating perioperative serum albumin as a predictor of unfavorable outcomes in large abdominal surgery was the goal of this investigation. The study included sixty-one patients; the mean age was 51.6 (SD=16.3), forty (65.6%) were male, and 28 (45.9%) had post-operative unfavorable effects. Forty (67.8%) had serum albumin levels below 3.4 g/l prior to surgery, and 51 (91%) had albumin levels below 3.4 g/l following surgery. The median percentage value for high delta albumin was 14.77%, and only 15 (27.3%) had it. With a decent predictive power and an area under the ROC curve (AUC) of 0.72 (95% CI 0.55 0.89), delta albumin was an independent significant factor linked to a poor outcome (OR: 6.68; 95% CI: 1.59, 28.09).. With a sensitivity of 76.92% and a specificity of 51.72%, the optimal cutoff value was 11.61%. They came to the conclusion that early perioperative drops in blood albumin levels could be a useful, easy, and affordable way to forecast unfavorable results from major abdominal surgery.

Serum albumin levels and their relationship to postoperative morbidity and mortality were investigated by **Belim, Sahista et al. (2020)**[49]. Patients undergoing emergency laparotomy frequently have hypoalbuminemia. Seroma, wound dehiscence, infection, incisional hernia, and mortality are among the post-operative unfavorable events that are strongly positively correlated with hypoalbuminemia. They came to the conclusion that in patients having laparotomies, hypoalbuminemia is a major and reliable predictive risk factor that predicts worse post-operative outcomes.

The purpose of **Lalhruaizela, S. et al. (2020)**[50] was to determine the association between the development of complications and the mortality rate among patients who had laparotomies for gastrointestinal (GI) disorders and a blood albumin level less than 3 g/dL. The majority of patients were between the ages of 40 and 59, and 59 of them (59.60%) experienced difficulties following surgery. Wound dehiscence was the most frequent late event (9.09%), and surgical site infection (SSI) was observed in the majority of patients (32.32%) as an early post-operative problem. Serum albumin levels between 2.1 and 2.7 gm/dL (43.43%) were present in the majority of early post-operative problems.Early and late post-operative problems were found to be statistically significantly correlated with pre-operative serum albumin. Age, BMI, and problems were significantly correlated. The study included four deaths. They came to the conclusion that BMI is a reliable predictor of post-operative problems and that pre-operative hypoalbuminemia <3.0 gm/dL is a significant and independent risk factor for post-operative morbidity and death in GI procedures.

Hypoalbumenia and postoperative problems were connected in patients undergoing emergency abdominal surgery by **V., S. K., Prakash, D. G. et al. (2019)**[51]. Of the 190 patients in total, 27 (14.2%) suffered mortality and 93 (48.9%) had morbidity. 120 (63.1%) of the patients had preoperative serum albumin levels below 3.5 g/dl, and 70 (36.7%) had levels at or above 3.5 g/dl. Morbidity was higher in 87 (45.8%) patients with preoperative serum albumin levels below 3.5 g/dl than in 6 (3.1%) patients with normal preoperative serum albumin levels (p=<0.0001, chi-square = 72.31).There is a total of 27 (14.2%) deaths, all of which occur in the low albumin group as opposed to those who have normal serum albumin levels. The risk of morbidity and mortality rises with decreasing albumin levels; in this investigation, the majority of complications occurred in individuals with albumin levels between 2.5g/dl and 3g/dl. They came to the conclusion that, following emergency abdominal surgery, preoperative serum albumin is a reliable indicator of the surgical outcome.

Serum albumin was evaluated as a predictor of post-operative morbidity and death in a study by **Sharma, L. et al. (2017)**[52]. The age group of 41–60 years had the highest number of problems among patients with blood albumin levels below 3 gm/dl. There was statistical significance in this finding. They came to the conclusion that low serum albumin is a useful indication of post-operative morbidity and death because patients with low levels have more post-operative complications than those with normal levels.

**Livingston DH et al. (2013)**[53] carried out a review of the past. Four groups were created based on the patients' BMI: underweight (16–22 kg/m(2)), normal (23–27 kg/m(2)), overweight (28–34 kg/m(2)), and obese (35 kg/m(2) or more). Laparotomies were performed on 1,297 individuals in total. Twenty-four percent of the study group were underweight, and seven percent were fat. The percentage of patients who arrived in shock, the mean number of units of packed red blood cells given during their hospital stay, and the mean Injury Severity Score did not change. Patients who were obese spent more time in the hospital and intensive care unit. There were no variations in mortality or ventilator days..Obese patients were more likely to experience respiratory and renal failure, bacteremia with or without septic shock, and abdominal wound dehiscence, according to univariate data. When logistic regression analysis was performed on the data, BMI was no longer a reliable indicator of any complications. greater BMI is not a reliable indicator of greater morbidity or death following trauma laparotomy, despite the fact that obese trauma patients do have higher infectious morbidity, wound dehiscence, and a longer duration of stay.

**Bae HJ and associates (2011)**[54] This study aims to assess the potential of preoperative prealbumin levels as a predictor of post-gastric surgical problems. According to the results, the complication rate was 24% in the normal prealbumin group (n = 160; p = 0.005) and 52% in the aberrant prealbumin group (n = 23). Patients with aberrant BMI (<18.5 kg/m(2)) and low preoperative albumin levels (<3.5 g/dL) had a greater complication risk, although the differences were not statistically significant. Complications were linked to prealbumin levels, TNM stage, combined resection, resection extent, and comorbidity of diabetes mellitus (DM). Complications were substantially linked with both DM and combination resection in multivariate analysis (p = 0.001 for each).Resection extent, approach, combined resection, TNM stage, and prealbumin levels were all substantially linked to infectious consequences in subgroup analysis. Prealbumin levels (p = 0.032) and combined resection (p = 0.001) were found to be independent variables by multivariate analysis. They came to the conclusion that preoperative prealbumin levels would be a helpful indicator for anticipating post-gastric surgical problems, particularly those related to infection.

A prospective, multi-institutional, risk-adjusted cohort research was carried out by **Mullen JT et al. (2008)**[55] to ascertain the effect of body mass index (BMI) on perioperative outcomes in patients undergoing major intra-abdominal cancer surgery. They came to the conclusion that obesity is not a risk factor for significant complications or postoperative mortality in individuals having major intra-abdominal cancer surgery. Significantly, patients who are underweight had a five-fold higher chance of dying after surgery, which may be related to their underlying nutritional state.

## MATERIAL AND METHODS

- **Study design:** Prospective observational study
- **Study area:** Department of General Surgery, Sri B M Patil college hospital and research center, Vijayapura., Karnataka, India.
- **Study period:** Research study was conducted from April 2023 to March 2025.
- **Sample size**: As per the study done by Banu Prakash and et al. postoperative complications were seen in at least 15.4 % patients with normal albumin .The sample size computed using the following formula

  Sample size (n) = (Z 2 *p*(1-p)) /d 2

  Where,

  z is the z score= 1.96

  d is the margin of error= 0.05

  n is the population size

  p is the population proportion =0.057

  The estimated sample size of this study is 83.

- **Sampling method**: Purposive convenient sampling method
- **Inclusion criteria:**

1. Patients of both gender of age group above 18 years who underwent both emergency and elective laparotomy.

- **Exclusion criteria:**

1. Patients who suffer from severe anemia, Diabetes Mellitus, chronic renal disease, chronic liver disease are at a higher risk of experiencing adverse postoperative outcomes.

2. Patients who are taking steroids or undergoing chemotherapy, regardless of whether they have malignant or non- malignant cases.

## METHODOLOGY:

A prospective observational study was conducted at the Department of Surgery. Eligible patients undergoing laparotomy in the inpatient department were enrolled after obtaining written informed consent. Prior to the commencement of the study, ethical clearance was obtained from the Institutional Ethics Committee.

### Data Collection and Patient Assessment

A pretested structured proforma was utilized to collect comprehensive patient information. Detailed medical histories were obtained from all participants, including demographic data, presenting complaints, comorbidities, previous surgical history, and current medications. The proforma was designed to ensure standardized data collection across all cases.

### Preoperative Assessment and Laboratory Investigations

All patients who met the inclusion criteria underwent preoperative blood sampling for the following biochemical parameters:

- Serum albumin, measured using the bromocresol green method
- Serum prealbumin, assessed through immunoturbidimetric analysis
- Serum transferrin, determined by immunoturbidimetric assay

### Anthropometric Measurements

Body Mass Index (BMI) was calculated for all patients using the formula: weight (kg) / height ($m^2$). Height was measured using a standard stadiometer, and weight was recorded using a calibrated digital scale. Measurements were taken with patients wearing light clothing and no footwear.

**Postoperative Monitoring and Outcome Assessment**

Following laparotomy, patients were monitored closely for various outcomes. The following parameters were systematically assessed and documented:

**Surgical Site Infections (SSI):**

- Daily wound examination was performed
- Infections were classified according to CDC criteria
- Wound cultures were obtained when indicated
- Type and severity of infection were documented

**Hospital Stay Duration:**

- Length of postoperative stay was recorded in days
- Factors contributing to extended stays were documented
- Readmission rates, if any, were noted

**Surgical Complications:**

- Anastomotic leaks
- Wound dehiscence
- Post-operative ileus
- Respiratory complications
- Other surgery-related complications

**Mortality Assessment:**

- 30-day postoperative mortality was recorded

- Cause of death was documented when applicable
- Contributing factors were analyzed

**Quality Control Measures To ensure data reliability:**

- All laboratory tests were performed in a single, accredited laboratory
- Standard operating procedures were followed for sample collection and processing
- Regular calibration of measuring instruments was maintained
- Double-entry of data was performed to minimize errors

**Follow-up Protocol**

Patients were followed up for a minimum period of 30 days post-surgery. Follow-up visits were scheduled at:

- Day 7-10 for suture removal
- Day 15 for initial outcome assessment
- Day 30 for final outcome evaluation

**Documentation**

Detailed records were maintained for each patient, including:

- Preoperative assessment findings
- Surgical details
- Postoperative course
- Complications and their management
- Follow-up visit findings

## STATISTICAL ANALYSIS

Data was entered in excel sheet and analyzed using SPSS version 21. Results were presented in tabular and graphical forms Mean, median, standard deviation and ranges were calculated for quantitative data. Qualitative data were expressed in terms of frequency and percentages. Student t test (Two Tailed) was used to test the significance of mean and P value $<0.05$ was considered significant.

# RESULTS

The present study was conducted in the department of general surgery at B.M.Patil college hospital and research center, Vijayapura from April 2023 to March 2025 to Study the efficacy of preoperative serum albumin, Serum prealbumin, serum transferrin and Body Mass Index as predictors of postoperative morbidity and mortality in laparotomy cases. Total of 83 patients were included in the study.

Following are the results of the study:

**Table 1: Distribution of patients according to age**

| Age (in years) | Frequency | Percentage |
|---|---|---|
| **20-40** | 17 | 20.5% |
| **41-60** | 34 | 41% |
| **61-80** | 29 | 34.9% |
| **>80** | 3 | 3.6% |
| **Total** | **83** | **100%** |

The age distribution shows that the majority of patients 34 (41%) were between 41-60 years old, followed by29 (34.9%) in the 61-80 year range. Only 17( 20.5%) were younger (20-40 years), and a small percentage 3(3.6%) were over 80 years old.

**Graph 1: Distribution of patients according to age**

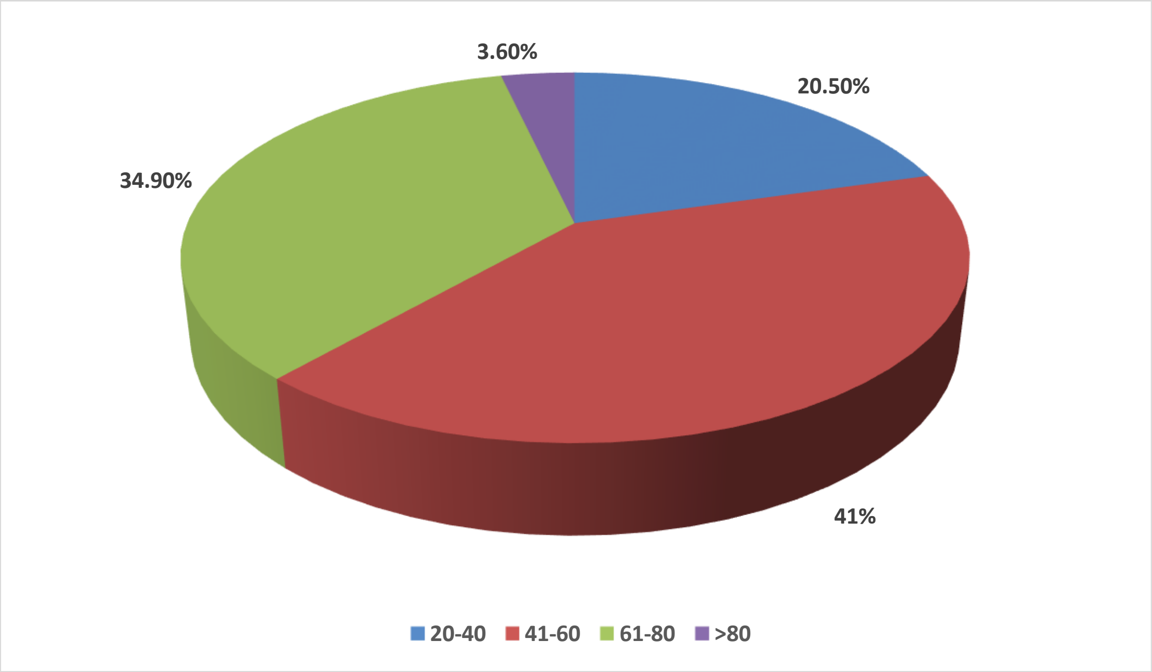



**Table 2: Distribution of patients according to gender**

| Gender | Frequency | Percentage |
|---|---|---|
| **Female** | 25 | 30.1% |
| **Male** | 58 | 69.9% |
| **Total** | **83** | **100%** |

The study sample was predominantly male, with 69.9% (58 patients) being male and 30.1% (25 patients) being female.

**Graph 2: Distribution of patients according to gender**

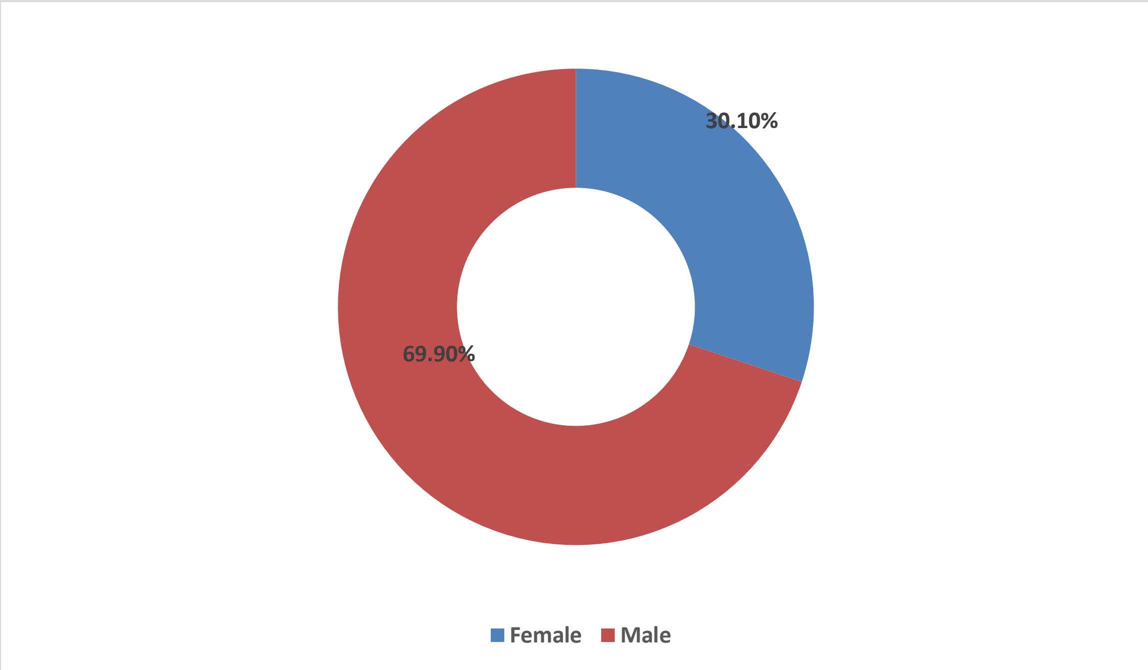



**Table 3: Distribution of patients according to diagnosis**

| Diagnosis | Frequency | Percentage |
|---|---|---|
| Acute intestinal obstruction | 11 | 13.3% |
| Blunt abdomen | 5 | 6% |
| Enterocutaneous fistula | 1 | 1.2% |
| Hernia | 4 | 4.8% |
| Ileal perforation | 22 | 26.5% |
| Ileo ileal intususception | 4 | 4.8% |
| Meckel’s diverticulum | 1 | 1.2% |

| | | |
|---|---|---|
| **Mesentric ischemia with gangrenous bowel** | 2 | 2.4% |
| **Necrotising pancreatitis** | 1 | 1.2% |
| **Penetrating abdominal injury** | 3 | 3.6% |
| **Perforated gallbladder** | 2 | 2.4% |
| **Jejunal perforation** | 5 | 6% |
| **Prepyloric perforation** | 12 | 14.5% |
| **Rectal perforation** | 2 | 2.4% |
| **Sigmoid volvulus** | 3 | 3.6% |
| **Splenic abscess** | 1 | 1.2% |

Ileal perforation was the most common diagnosis at 26.5% (22 patients), followed by prepyloric perforation at 14.5% (12 patients) and acute intestinal obstruction at 13.3% (11 patients).

**Graph 3: Distribution of patients according to diagnosis**

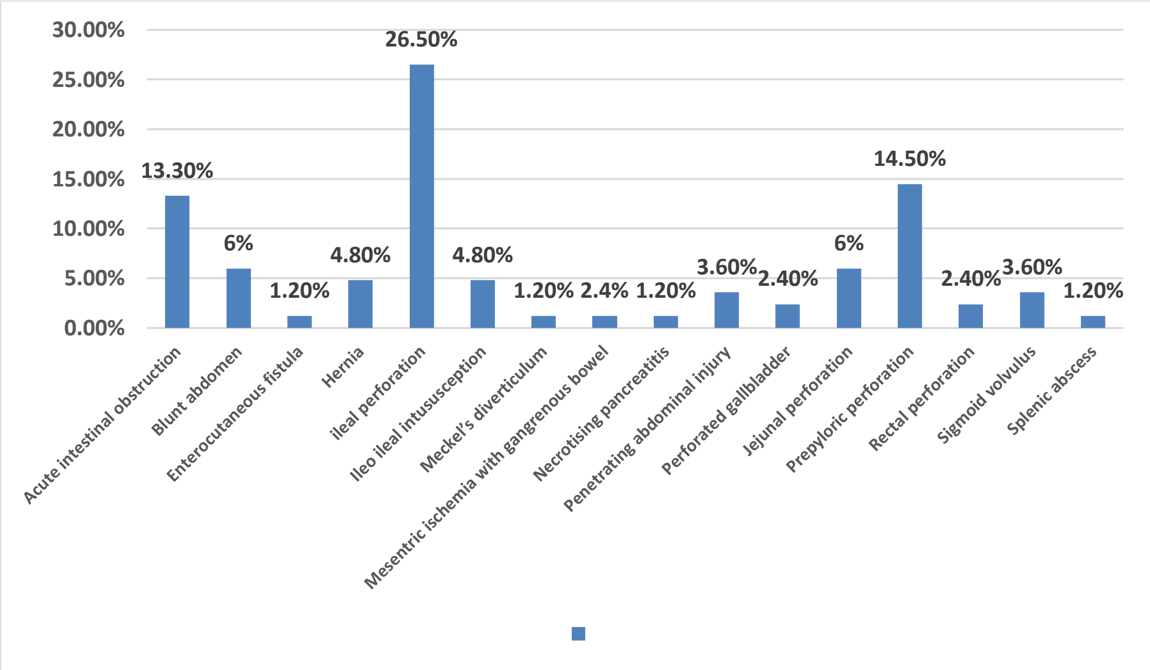



**Table 4: Distribution of patients according to BMI**

| BMI | Frequency | Percentage |
|---|---|---|
| **18.5-24.9** | 65 | 78.3% |
| **25-29.9** | 16 | 19.3% |
| **>30** | 2 | 2.4% |
| **Total** | **83** | **100%** |

Most patients (78.3%) had a BMI between 18.5-24.9, which is considered normal weight. 19.3% were overweight (25-29.9), and only 2.4% were obese (>30)

**Graph 4: Distribution of patients according to BMI**

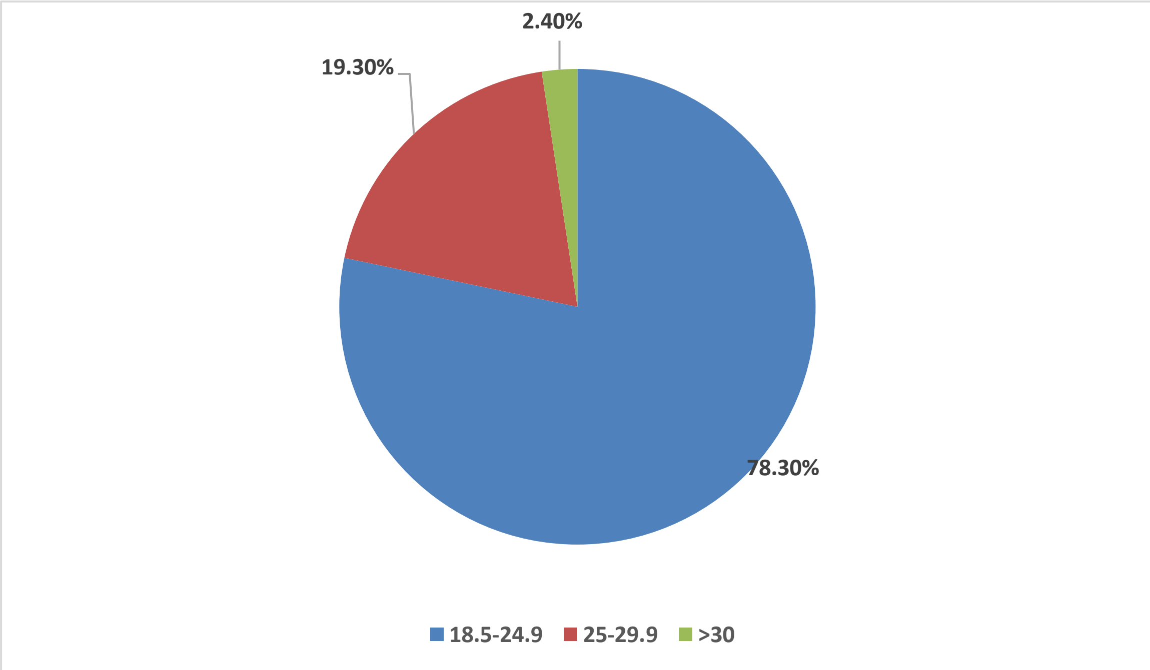



**Table 5: Distribution of patients according to pre albumin**

| Pre albumin (mg/dl) | Frequency | Percentage |
|---|---|---|
| **<16** | 68 | 81.9% |
| **16-30** | 15 | 18.1% |
| **>30** | - | - |
| **Total** | **83** | **100%** |

A significant majority (81.9%) of patients had pre-albumin levels below 16 mg/dl, with 18.1% in the 16-30 mg/dl range. No patients had levels above 30 mg/dl.

**Graph 5: Distribution of patients according to pre albumin**

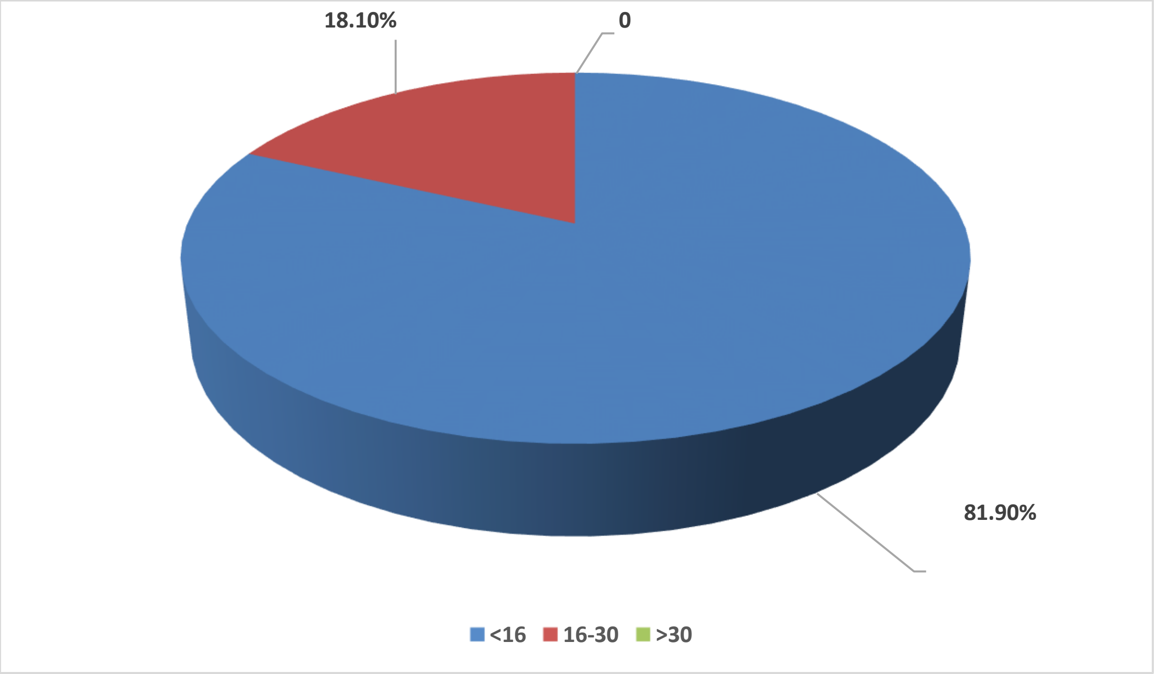



**Table 6: Distribution of patients according to albumin**

| Albumin (mg/dl) | Frequency | Percentage |
|---|---|---|
| **<2.5** | 27 | 32.5% |
| **2.5-3.5** | 48 | 57.8% |
| **>3.5** | 8 | 9.6% |
| **Total** | **83** | **100%** |

Most patients (57.8%) had albumin levels between 2.5-3.5 mg/dl, 32.5% had levels below 2.5 mg/dl, and only 9.6% had levels above 3.5 mg/dl.

**Graph 6: Distribution of patients according to albumin**

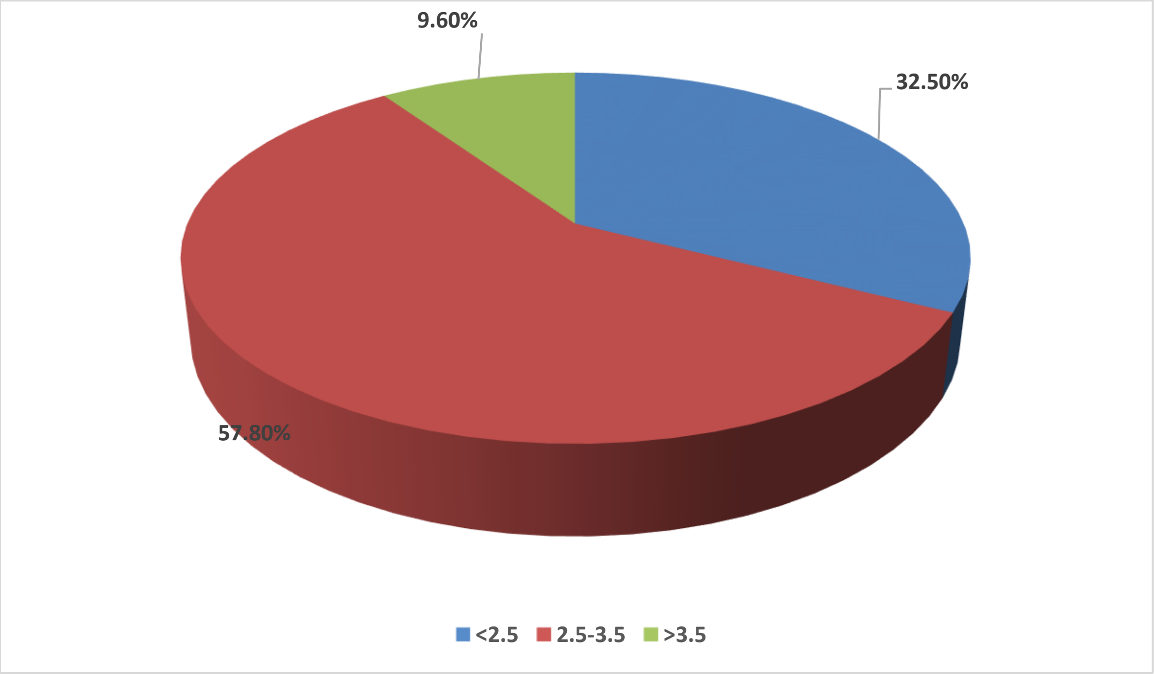



**Table 7: Distribution of patients according to transferrin**

| Transferrin (mcg/dl) | Frequency | Percentage |
|---|---|---|
| **<160** | 37 | 44.6% |
| **160-200** | 39 | 47% |
| **>200** | 7 | 8.4% |
| **Total** | **83** | **100%** |

Transferrin levels were mostly distributed between 160-200 mcg/dl (47%) and below 160 mcg/dl (44.6%), with only 8.4% above 200 mcg/dl.

**Graph 7: Distribution of patients according to transferrin**

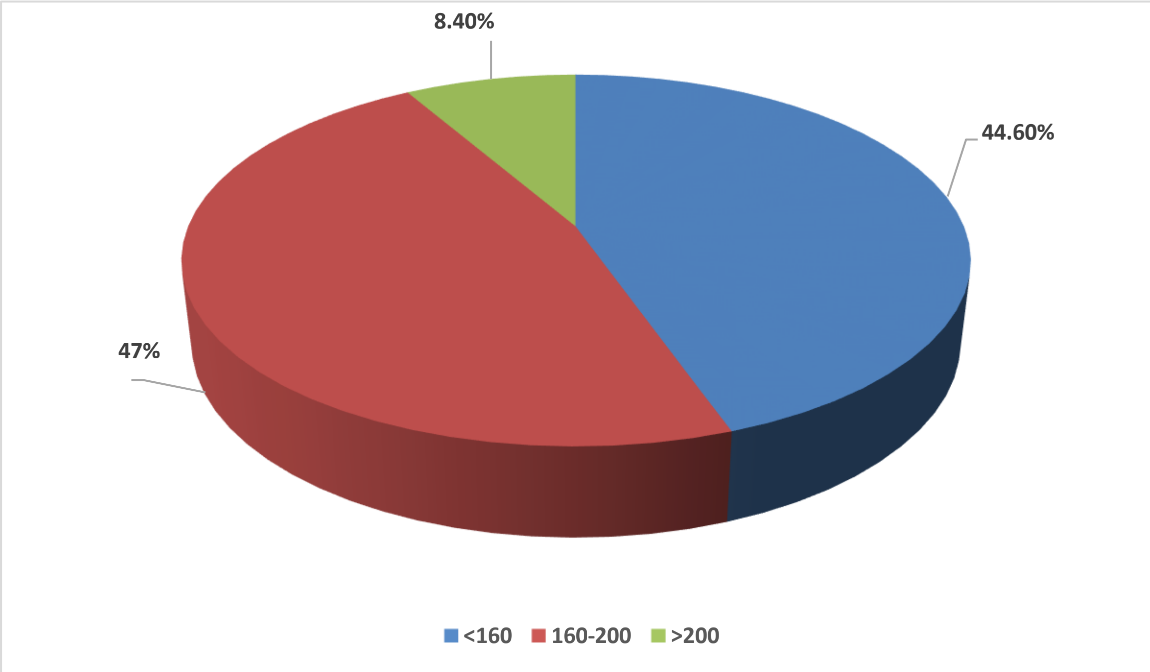



**Table 8: Distribution of patients according to hospital stay**

| Hospital stay (days) | Frequency | Percentage |
|---|---|---|
| **<15** | 61 | 73.5% |
| **15-30** | 21 | 25.3% |
| **>30** | 1 | 1.2% |
| **Total** | **83** | **100%** |

The majority of patients (73.5%) had a hospital stay less than 15 days, 25.3% stayed 15-30 days, and only 1.2% stayed over 30 days.

**Graph 8: Distribution of patients according to hospital stay**

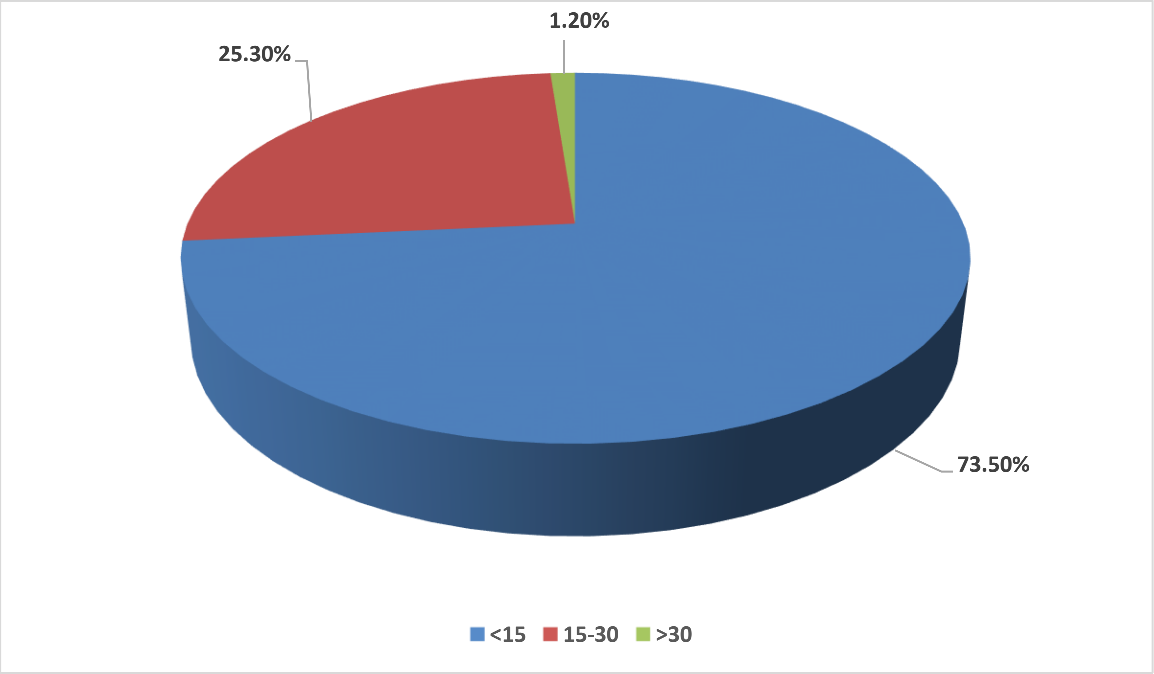



**Table 9: Distribution of patients according to complications**

| Complications | Frequency | Percentage |
|---|---|---|
| **Wound infection** | 40 | 48.2% |
| **Wound dehiscence** | 6 | 7.2% |

Wound infection was the most common complication, affecting 48.2% of patients, while wound dehiscence occurred in 7.2% of cases.

**Graph 9: Distribution of patients according to complications**

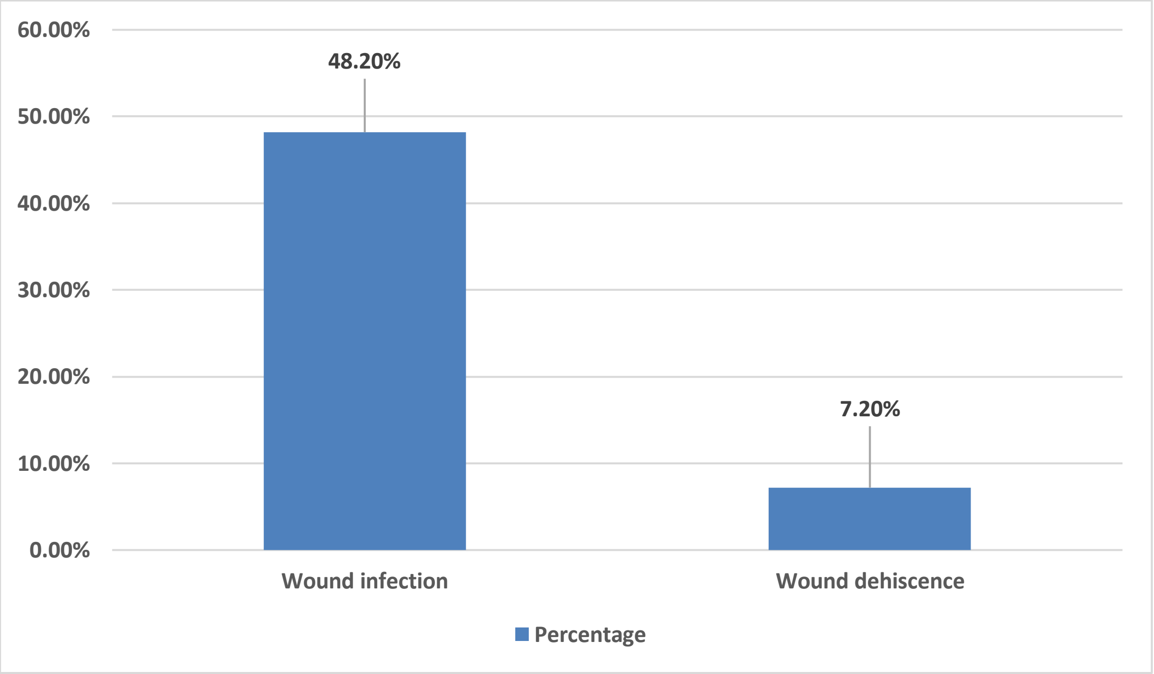



**Table 10: Distribution of patients according to mortality**

| Mortality | Frequency | Percentage |
|---|---|---|
| **Present** | 8 | 9.6% |
| **Absent** | 75 | 90.4% |
| **Total** | **83** | **100%** |

Mortality was seen in 9.6% of the patients in the study.

**Graph 10: Distribution of patients according to mortality**

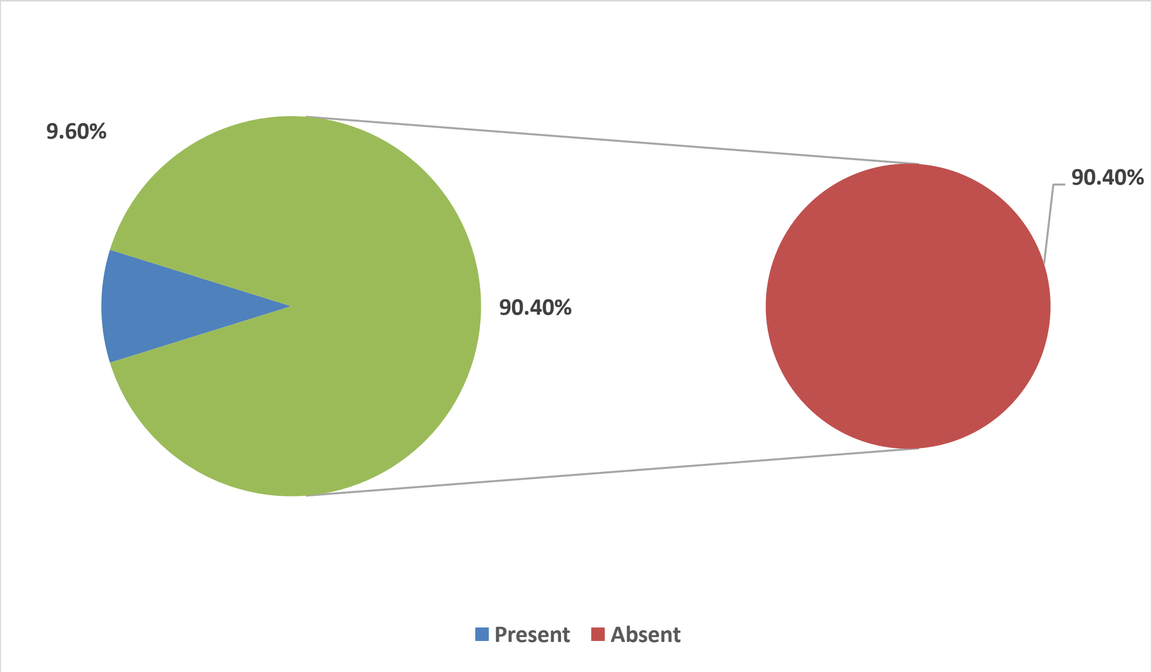
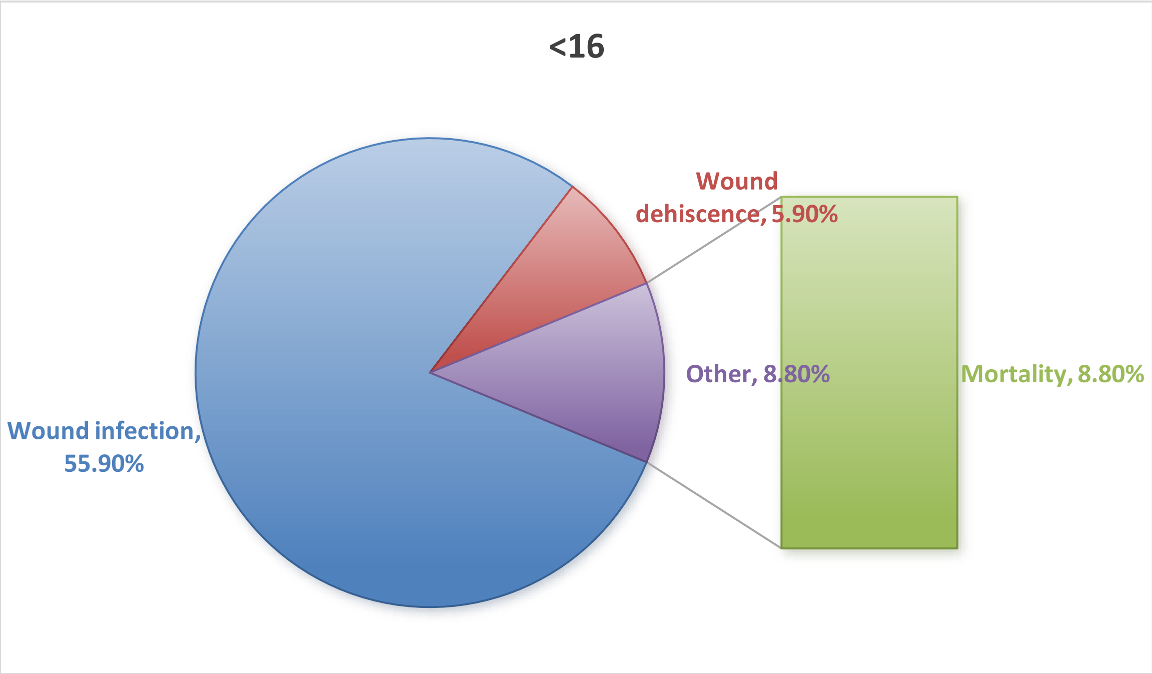



**Table 11: Association of prealbumin with complications and hospital stay**

| Parameters | Pre albumin (mg/dl) | | p-value |
|---|---|---|---|
| | <16 | 16-30 | |
| **Wound infection** | 38 (55.9%) | 2 (13.3%) | **0.002** |
| **Wound dehiscence** | 4 (5.9%) | 2 (13.3%) | 0.31 |
| **Mortality** | 6 (8.8%) | 2 (13.3%) | 0.59 |
| **Length of hospital stay (days) (mean±SD)** | 13.7±6.7 | 11.6±1.3 | 0.24 |

Patients with pre-albumin <16 mg/dl had significantly more wound infections (p=0.002). There was no significant association with wound dehiscence, mortality, or hospital stay length.

## Graph 11A: Association of prealbumin with complications




## Graph 11B: Association of prealbumin with hospital stay

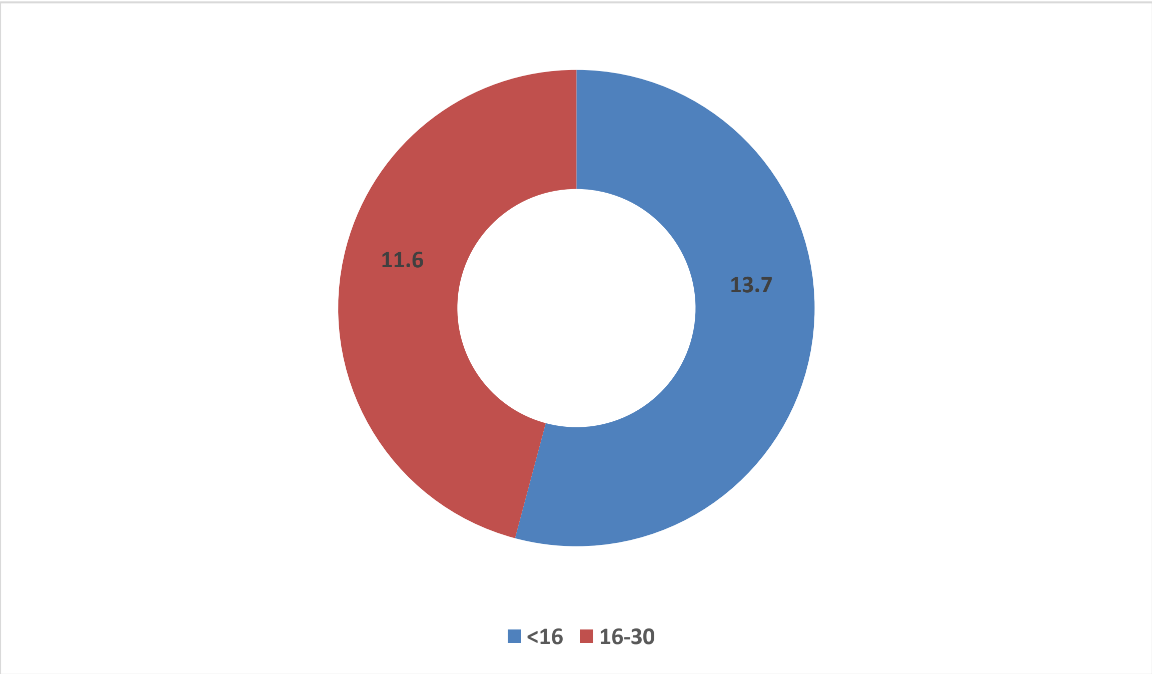


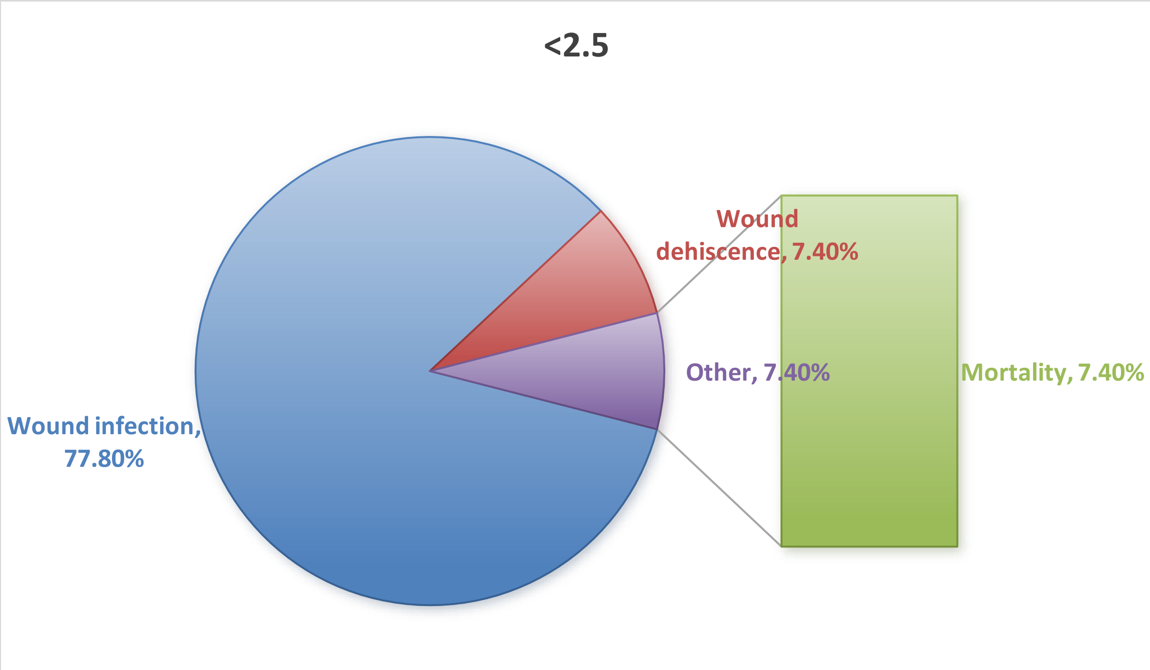
**Table 12: Association of albumin with complications and hospital stay**

| Parameters | Albumin (mg/dl) | | | p-value |
|---|---|---|---|---|
| | **<2.5** | **2.5-3.5** | **>3.5** | |
| **Wound infection** | 21 (77.8%) | 17 (35.4%) | 2 (25%) | **<0.001** |
| **Wound dehiscence** | 2 (7.4%) | 3 (6.2%) | 1 (12.5%) | 0.81 |
| **Mortality** | 2 (7.4%) | 6 (12.5%) | 0 | 0.48 |
| **Length of hospital stay (days) (mean±SD)** | 14.7±6.6 | 12.8±6.5 | 11.9±4.7 | 0.35 |

Patients with albumin levels below 2.5 mg/dl had significantly higher wound infection rates at 77.8% compared to other groups. Albumin levels between 2.5-3.5 mg/dl showed wound infections in 35.4% of patients. Patients with albumin above 3.5 mg/dl had the lowest wound infection rate at 25%, with a statistically significant p-value of <0.001. Wound dehiscence rates remained relatively consistent across albumin levels (6.2-12.5%). Mortality rates varied slightly between groups, ranging from 0-12.5%, without statistical significance.

The mean hospital stay slightly decreased with increasing albumin levels, from 14.7 days in the lowest group to 11.9 days in the highest albumin group.

### Graph 12A: Association of albumin with complications




### Graph 12B: Association of albumin with hospital stay

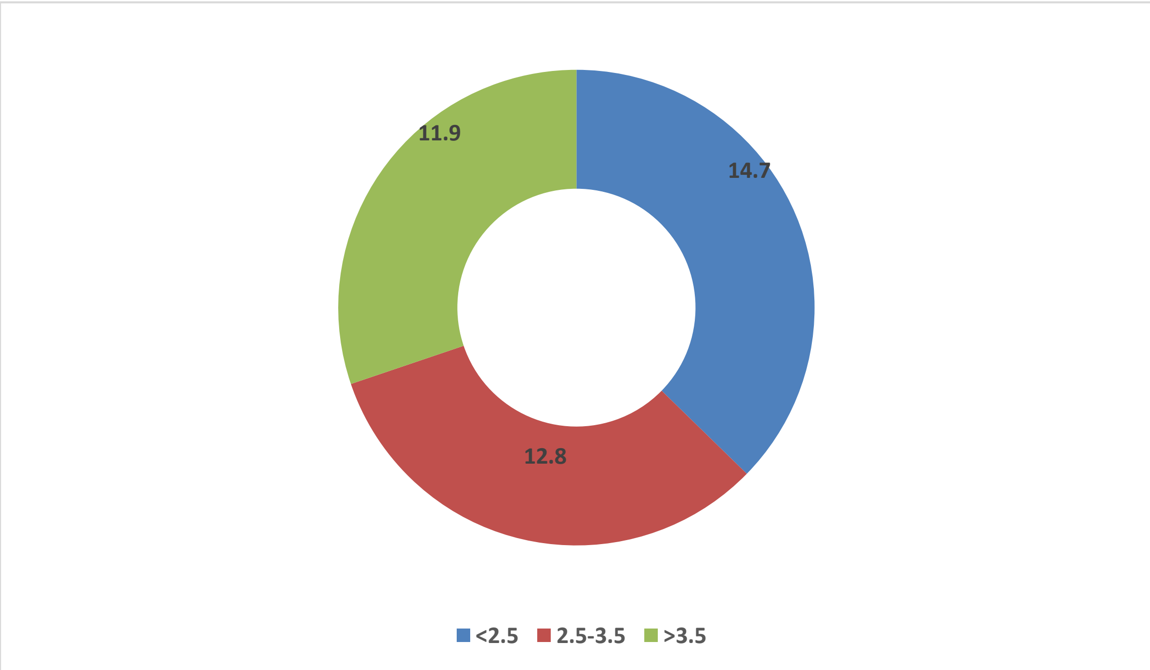


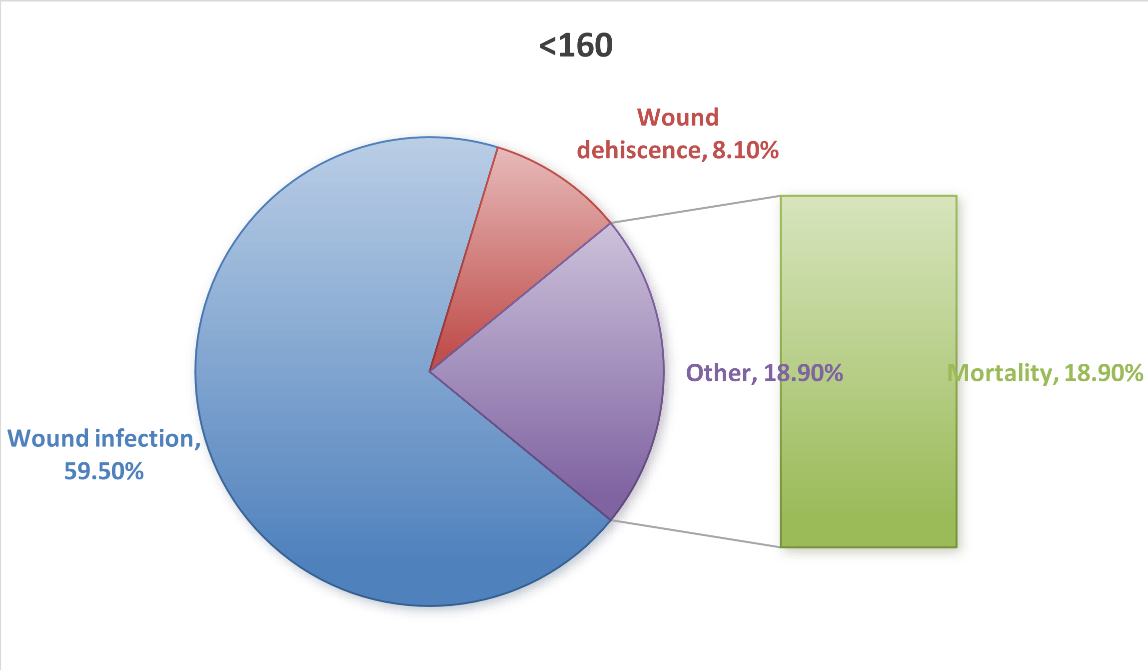
**Table 13: Association of transferrin with complications and hospital stay**

| Parameters | Transferrin (mcg/dl) | | | p-value |
|---|---|---|---|---|
| | <160 | 160-200 | >200 | |
| **Wound infection** | 22 (59.5%) | 17 (43.6%) | 1 (14.3%) | 0.06 |
| **Wound dehiscence** | 3 (8.1%) | 2 (5.1%) | 1 (14.3%) | 0.66 |
| **Mortality** | 7 (18.9%) | 1 (2.6%) | 0 | **0.04** |
| **Length of hospital stay (days) (mean±SD)** | 14.9±6.2 | 12.1±6.7 | 11.9±4.9 | 0.12 |

Wound infection rates demonstrated a clear downward trend with increasing transferrin levels, dropping from 59.5% in the <160 mcg/dl group to 14.3% in the >200 mcg/dl group. Mortality rates showed a dramatic decline, with the lowest transferrin group experiencing 18.9% mortality, the middle group 2.6%, and the highest group 0% mortality, which was statistically significant (p=0.04). Wound dehiscence rates remained low and not statistically significant across transferrin levels.

The mean hospital stay correspondingly decreased from 14.9 days in the lowest transferrin group to 11.9 days in the highest group.

**Graph 13A: Association of transferrin with complications**




**Graph 13B: Association of transferrin with complications and hospital stay**

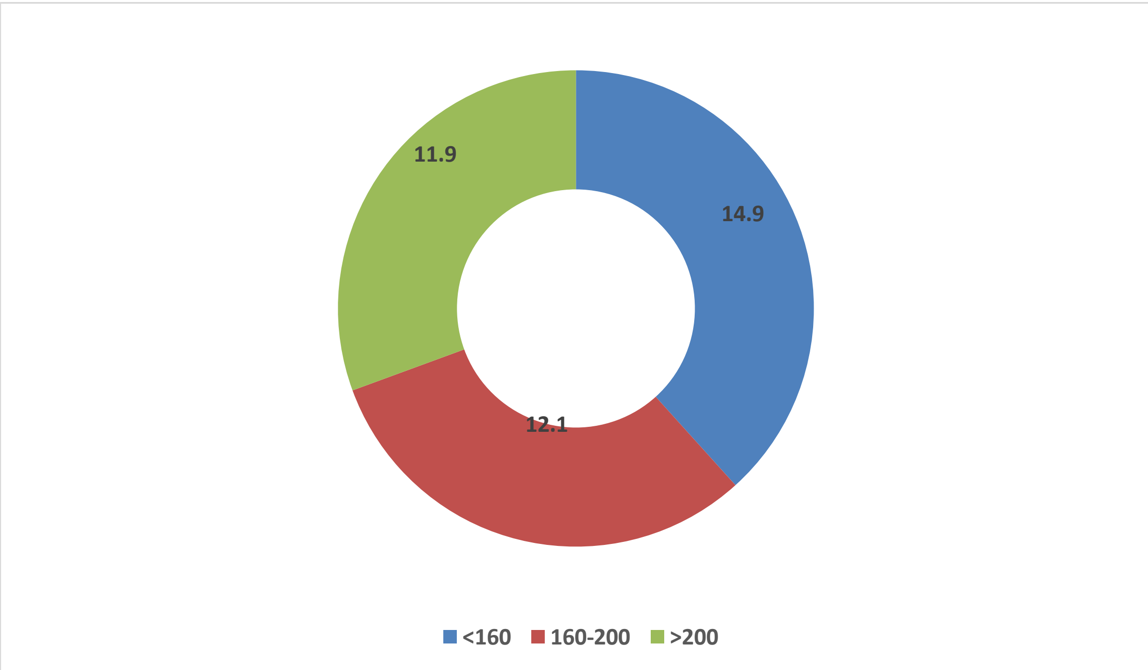
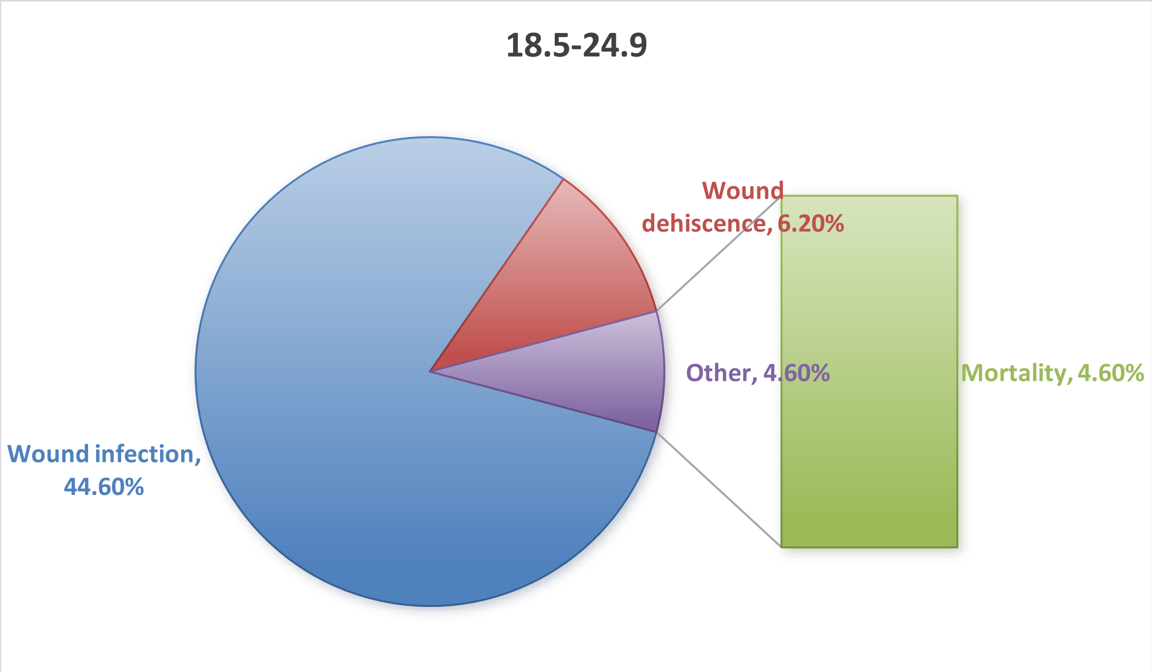


**Table 14: Association of BMI with complications and hospital stay**

| Parameters | BMI | | | p-value |
|---|---|---|---|---|
| | **18.5-24.9** | **25-29.9** | **>30** | |
| **Wound infection** | 29 (44.6%) | 10 (62.5%) | 1 (50%) | 0.24 |
| **Wound dehiscence** | 4 (6.2%) | 2 (12.5%) | 0 | 0.62 |
| **Mortality** | 3 (4.6%) | 4 (25%) | 1 (50%) | **0.007** |
| **Length of hospital stay (days) (mean±SD)** | 12.7±5.2 | 15.5±9.7 | 17±11.3 | 0.21 |

Wound infection rates varied across BMI categories, with the highest rate of 62.5% observed in the 25-29.9 BMI range. Mortality rates increased significantly with BMI, rising from 4.6% in the normal weight range to 50% in the obese category, which was statistically significant (p=0.007). The mean hospital stay increased with higher BMI, from 12.7 days in the normal weight range to 17 days in the obese category. Wound dehiscence rates remained minimal and not statistically significant across BMI groups.

**Graph 14A: Association of BMI with complications**




**Graph 14B: Association of BMI with complications and hospital stay**

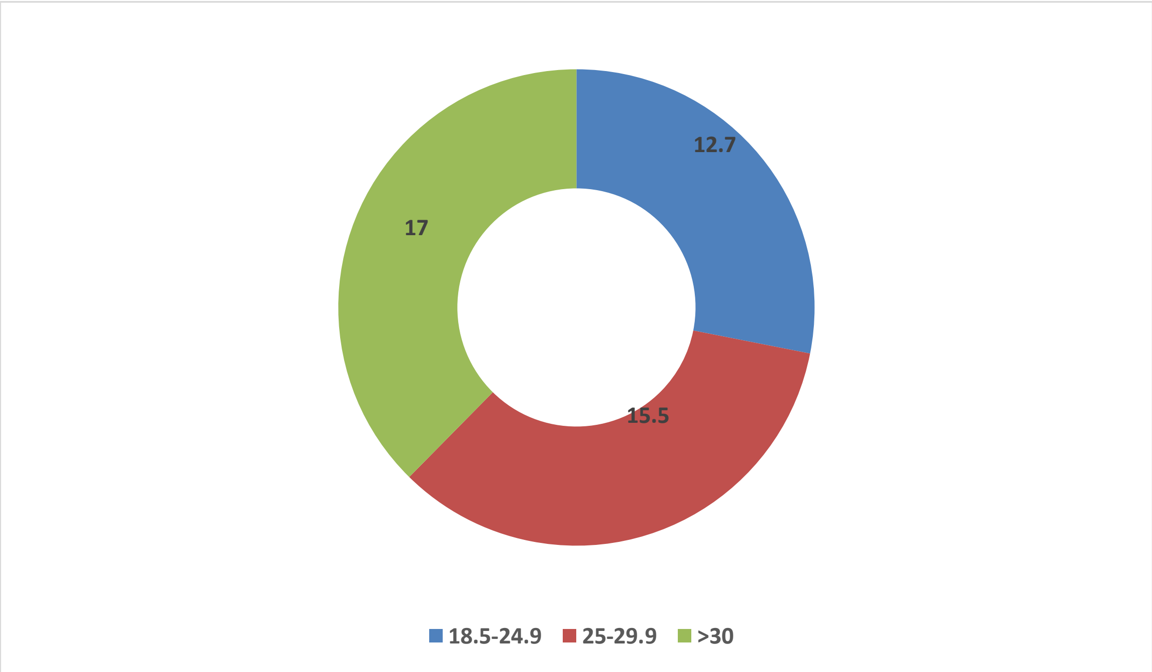
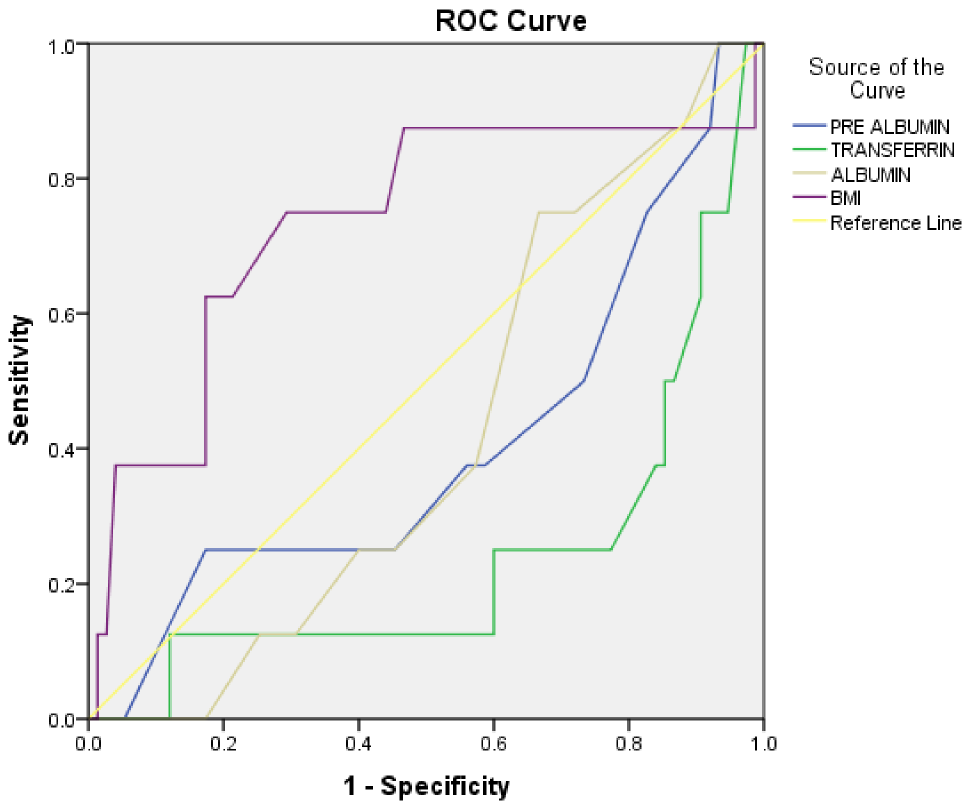


**Table 15: ROC Curve analysis of serum pre albumin, albumin and transferrin to predict mortality**

| Parameters | Area under the curve |
|---|---|
| **Pre albumin** | 0.406 |
| **Albumin** | 0.420 |
| **Transferrin** | 0.238 |
| **BMI** | 0.735 |

The predictive performance for mortality varied significantly among the parameters. BMI demonstrated the highest predictive performance with an Area Under the Curve (AUC) of 0.735. Albumin showed moderate predictive performance with an AUC of 0.420, similar to pre-albumin at 0.406. Transferrin had the lowest predictive performance with an AUC of 0.238.

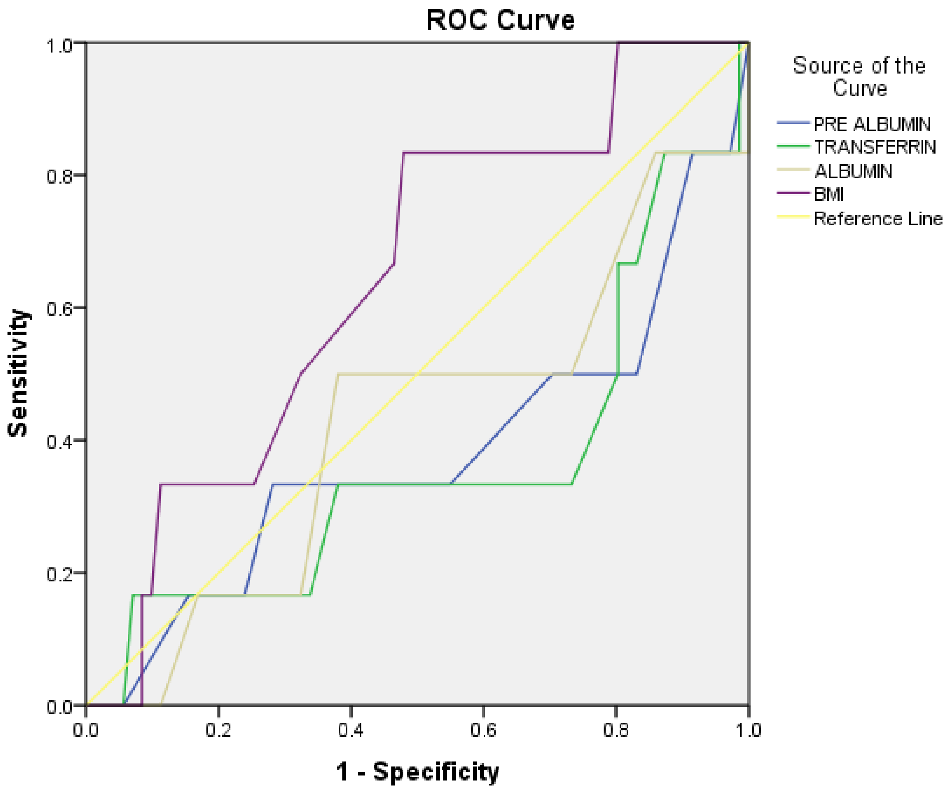



Diagonal segments are produced by ties.

**Table 16: ROC Curve analysis of serum pre albumin, albumin and transferrin to predict wound infection**

| Parameters | Area under the curve |
|---|---|
| **Pre albumin** | 0.37 |
| **Albumin** | 0.36 |
| **Transferrin** | 0.42 |
| **BMI** | 0.64 |

The ROC curve analysis indicates that among the nutritional parameters tested (pre-albumin, albumin, transferrin, and BMI), BMI showed the highest predictive ability for wound infection with an area under the curve (AUC) of 0.64, while pre-albumin (AUC=0.37), albumin (AUC=0.36), and transferrin (AUC=0.42) all demonstrated poor predictive performance with AUC values below 0.5




Diagonal segments are produced by ties.

# DISCUSSION

Malnutrition remains a critical yet often underrecognized problem in surgical patients, with profound implications for postoperative outcomes. Studies across different surgical populations have consistently demonstrated prevalence rates of 30-50% among hospitalized patients, with even higher rates in emergency surgical cases.[56] This widespread prevalence of malnutrition presents a significant challenge in surgical practice, particularly in emergency settings where preoperative optimization is limited by time constraints. The impact of nutritional status on surgical outcomes has been extensively studied over the past four decades, leading to the development of various assessment tools and markers.[57]

Traditionally, nutritional assessment relied heavily on anthropometric measurements and dietary history. However, the emergence of biochemical markers has revolutionized the approach to nutritional assessment in surgical patients. Serum proteins, particularly albumin, prealbumin, and transferrin, have emerged as objective indicators of nutritional status, offering quantifiable measures that can be tracked over time[58]. These markers not only reflect nutritional status but also serve as acute phase reactants, providing valuable information about the patient's overall metabolic and inflammatory state.[3]

The evolution of nutritional assessment in surgical practice has been marked by several landmark studies. The work of Studley in 1936 first established the connection between preoperative weight loss and surgical mortality, setting the foundation for nutritional assessment in surgery.[59] Subsequently, the National VA Surgical Risk Study by Gibbs et al. in 1999 demonstrated the profound impact of serum albumin levels on surgical outcomes, establishing it as a crucial preoperative marker.[60] Recent advances in understanding the complex relationship between nutrition, inflammation, and surgical stress have led to the development of more comprehensive assessment protocols.[61]

## Demographic profile

The age distribution in this study predominantly featured patients between 41-60 years (41%), which aligns with findings from Bhelim SH et al.[62] (45.2% in 31-45 years) and Uday KS et al.[63] (majority in 41-60 years). The gender distribution showed male predominance (69.9%), consistent with Bhelim SH et al.[62] (73.8% male) and Bhuvyan K et al.[64] (77% male).

Diagnostic patterns varied slightly across studies. This study identified hollow viscous perforation as the most common diagnosis (26.5%), followed by prepyloric perforation (14.5%) and acute intestinal obstruction (13.3%). While different from the National Emergency Laparotomy Audit (NELA) data[65], which reported intestinal obstruction at 54%, it closely resembled Bhuvyan K et al.[64]'s findings of perforated duodenal ulcer (43%) and Naga RV et al.[66]'s hollow viscus perforation (41.8%).

The mean hospital stay in our study (73.5% staying <15 days) compares favorably with international data. The ACS-NSQIP database[67] analysis reported a median stay of 11 days for emergency laparotomy. A study by Uday KS et al[63] demonstrated longer hospital stays with lower albumin (22.8 days for <3.2 g/dL vs 4.81 days for >3.6 g/dL).

## Serum Prealbumin

The study found 81.9% of patients had prealbumin levels below 16 mg/dl, indicating widespread nutritional deficiency. This is notably higher than Robinson MK et al[68]'s study, where 51% were classified as malnourished. The high prevalence of low prealbumin was attributed to the emergency nature of surgeries and associated metabolic stress.

## Serum albumin

The study's findings on serum albumin closely correlated with other research. Low serum albumin (<2.5 mg/dl) was associated with high wound infection rates (77.8%), comparable to Bhelim SH et al.[62]'s findings of increased postoperative morbidity. Kudsk A et al. reported a 73% complication rate for patients with albumin below 2.5 mg/dl.

The stepwise decrease in wound infection rates with increasing albumin levels (77.8% to 25%) aligned with meta-analyses[69] showing a linear relationship between serum albumin and surgical complications. This pattern was similar to Bhuvyan K et al.[64] (36% SSI with <3.2 g/dl albumin), Uday KS et al.[63] (54.5% complications), and Naga RV et al.[66] (65% hypoalbuminemia).

## Serum transferrin

The significant relationship between transferrin levels and mortality (p=0.04) echoed Swayama H et al.[70]'s findings. Both studies emphasized transferrin's importance in understanding patient outcomes, particularly in predicting survival rates and suggesting the need for aggressive perioperative nutritional support.

## BMI and Surgical Outcomes

Our study revealed a significant association between increased BMI and mortality (p=0.007), with mortality rates rising from 4.6% in normal-weight patients to 50% in obese patients. A study by Baderiya V et al[71] found no significant correlation between BMI and post-operative outcomes. In contrast to our study, Mullen JT et al found the highest mortality in underweight and morbidly obese patients, with underweight patients having a 5.24-fold increased mortality risk. Regarding wound infections, Mullen JT et al.[55] observed a steady increase with BMI, while your study found the highest infection rate (62.5%) in the overweight category, which is slightly different from their linear progression.

## Complications

Complication rates were remarkably consistent across studies. This study reported a 48.2% wound infection rate and 9.6% mortality, closely matching Bhelim SH et al.[62] (41.07% wound infection), Uday KS et al.[63] (36% overall complications), and Bhuvyan K et al. (51.8% overall morbidity).

## Predictive Value Analysis

Interestingly, the ROC curve analysis revealed differences from previous studies. While Robinson MK et al[68] 's study found prealbumin superior for nutritional assessment, this study showed similar predictive performance for mortality between prealbumin (AUC=0.406) and albumin (AUC=0.420). BMI emerged as the strongest mortality predictor (AUC=0.735).

## Clinical Implications and Future Directions

Our findings have several important implications for clinical practice. The high prevalence of low prealbumin levels among patients suggests a critical need for routine preoperative nutritional screening in emergency surgical patients to identify those at risk for postoperative complications. Additionally, the strong association between albumin levels and wound infections indicates that optimizing preoperative albumin levels, when feasible, could be a valuable strategy to reduce infection rates. Furthermore, the predictive value of transferrin for mortality highlights its potential utility in risk stratification, allowing healthcare providers to better assess and manage patients undergoing laparotomy. Lastly, the relationship between BMI and mortality underscores the necessity for special considerations and tailored management strategies for obese patients undergoing emergency surgery.

Future research directions should focus on several key areas to enhance our understanding and management of nutritional status in surgical patients. Prospective studies evaluating the impact of preoperative nutritional optimization on outcomes in emergency surgery are essential to establish effective interventions. Additionally, investigating novel nutritional markers with better specificity could improve the accuracy of risk assessments. The development of integrated scoring systems that combine multiple nutritional parameters may provide a more comprehensive approach to patient evaluation. Finally, studies examining the cost-effectiveness of routine nutritional marker screening could help justify its implementation in clinical practice, ultimately leading to improved patient outcomes and resource allocation in surgical settings.

## Limitations

Despite the valuable insights gained from this study, several limitations should be considered. First, the single-center nature of the study may limit the generalizability of the findings to broader populations or different healthcare settings. Second, the relatively small sample size may affect the statistical power and reliability of some results. Third, the inability to control for all confounding variables could introduce bias and limit causal interpretations of the associations observed. Lastly, the emergency nature of cases restricted preoperative assessments and interventions, which may have influenced patient outcomes and highlights the need for further research in more controlled settings.

## Conclusion

This study provides important insights into the predictive value of various nutritional parameters in emergency laparotomy outcomes. The findings support the use of a multimodal approach to nutritional assessment, incorporating both biochemical markers and anthropometric measurements. The strong associations observed between nutritional parameters and surgical outcomes emphasize the importance of nutritional assessment and optimization in surgical practice.

# CONCLUSION

The findings of the present study highlight the significant role of preoperative nutritional parameters—specifically serum albumin, prealbumin, transferrin, and Body Mass Index (BMI)—as predictors of postoperative morbidity and mortality in patients undergoing laparotomy. The results indicate that lower levels of albumin and prealbumin are associated with higher rates of complications, particularly wound infections, while increased BMI correlates with elevated mortality rates. The study emphasizes the importance of assessing these nutritional markers prior to surgery, as they can provide valuable insights into a patient's risk profile and potential postoperative outcomes.

Moreover, the analysis revealed that BMI had the highest predictive performance for mortality among the evaluated parameters, suggesting that maintaining a healthy weight could be crucial for improving surgical outcomes. These findings advocate for a multidisciplinary approach to preoperative care, including nutritional optimization, which may lead to reduced morbidity and mortality rates in surgical patients. Future research should focus on interventions aimed at improving nutritional status preoperatively to further enhance patient outcomes in laparotomy cases.

# SUMMARY


We have conducted a study titled **"Preoperative serum albumin, serum prealbumin, serum transfferin and body mass index as predictors of postoperative morbidity and mortality in laparotomy cases"**

A present study was conducted among 83 patients undergoing both emergency and elective laparotomy.

The **objective** of the study were:

To determine the association of serum albumin, BMI, serum prealbumin and transferrin with postoperative morbidity and mortality in patients undergoing laparotomy cases.

**Following are the observations in our study:**

- The majority of patients (41%) were aged between 41-60 years, indicating that middle-aged individuals are more commonly undergoing laparotomy.
- The study sample was predominantly male, with 69.9% being male and 30.1% female.
- Ileal perforation was the most common diagnosis, affecting 26.5% of patients, followed by prepyloric perforation at 14.5%.
- Most patients (78.3%) had a BMI classified as normal weight (18.5-24.9), while 19.3% were overweight and only 2.4% were obese.
- Patients with prealbumin levels below 16 mg/dl had significantly more wound infections (p=0.002). However, no significant associations were found between prealbumin levels and wound dehiscence or mortality.

- Patients with albumin levels below 2.5 mg/dl experienced higher wound infection rates at 77.8%. In contrast, those with higher albumin levels showed lower infection rates, emphasizing the importance of maintaining adequate albumin levels preoperatively ($p<0.001$).
- Wound infection rates decreased significantly with increasing transferrin levels, from 59.5% in lower groups to just 14.3% in higher groups ($p=0.04$). Mortality rates also declined dramatically across transferrin categories.
- Wound infection rates peaked at a BMI range of 25-29.9 (62.5%), while mortality increased significantly from normal weight to obesity (4.6% to 50%) ($p=0.007$). This suggests that higher BMI is associated with worse surgical outcomes.
- ROC curve analysis revealed that BMI had the highest predictive performance for mortality with an AUC of 0.735, while albumin and prealbumin showed moderate performance (AUCs of 0.420 and 0.406 respectively). Transferrin exhibited the lowest predictive performance (AUC = 0.238).

This study underscores the critical role of preoperative nutritional parameters—particularly BMI, albumin, and prealbumin—in predicting postoperative complications and mortality in laparotomy cases. The findings suggest that optimizing these parameters before surgery could potentially improve patient outcomes and reduce morbidity and mortality rates following surgical interventions.

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BLDE

(DEEMED TO BE UNIVERSITY)

Declared as Deemed to be University u/s 3 of UGC Act, 1956

Accredited with 'A' Grade by NAAC (Cycle-2)

The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 922/2023-24

10/4/2023

## INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Saturday, 18th March, 2023 at 11.30 a.m. in the CAL Laboratory, Dept. of Pharmacology,** scrutinizes the Synopsis/ Research Projects of Post Graduate Student / Under Graduate Student /Faculty members of this University /Ph.D. Student College from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

**TITLE: "PREOPERATIVE SERUM ALBUMIN, PREALBUMIN, SERUM TRANSFERRIN & BODY MASS INDEX AS PREDICTORS OF POSTOPERATIVE MORBIDITY & MORTALITY IN LAPAROTOMY CASES".**

**NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR:** DR.GARLAPATI SAI TEJA

**NAME OF THE GUIDE:** DR.DAYANAND BIRADAR, ASSOCIATE PROFESSOR, DEPT. OF GENERAL SURGERY.

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA

**Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University)
Vijayapura**

Dr.Akram A. Naikwadi
Member Secretary
IEC, BLDE (DU),
VIJAYAPURA

**MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka**

Following documents were placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
**BLDE (DU):** Phone: +918352-262770, Fax: +918352-263303, Website: www.bldedu.ac.in, E-mail:office@bldedu.ac.in
**College:** Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

## B.L.D.E. (DEEMED TO BE UNIVERSITY)

## SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCHCENTER, VIJAYAPURA-586103

## INFORMED CONSENT FOR PARTICIPATION IN DISSERTATION/RESEARCH

I, the undersigned, , S/O D/O , aged years, resident of do hereby state/declare that Dr**.** GARLAPATI SAI TEJA of Shri. B. M. Patil Medical College Hospital and Research Centre have examined me thoroughly on at (place) and it has been explained to me in my language about the study. Further Dr. GARLAPATI SAI TEJA informed me that he is conducting a dissertation/research titled — "PREOPERATIVE SERUM ALBUMIN, SERUM PREALBUMIN, SERUM TRANSFFERIN AND BODY MASS INDEX AS PREDICTORS OF POSTOPERATIVE MORBIDITY AND MORTALITY IN LAPAROTOMY CASES" Under the guidance of Dr. DAYANAND BIRADAR requesting my participation in the study. I will also be contacted on phone at times necessary to ask regarding my condition. Further Doctor has informed me that my participation in this study will help in the evaluation of the results of the study which is a useful reference to the treatment of other similar cases in the future.

The Doctor has also informed me that information given by me, observations made/ photographs/ video graphs taken upon me by the investigator will be kept secret and not assessed by a person other than me or my legal hirer except for academic purposes.

The Doctor did inform me that though my participation is purely voluntary, based on the information given by me, I can ask any clarification during the treatment/study related to diagnosis, the procedure of treatment, the result of treatment, or prognosis. At the same time, I have been informed that I can withdraw from my participation in this study at any time if I want or the investigator can terminate me from the study at any time but not the procedure of treatment and follow-up unless I request to be discharged.

After understanding the nature of dissertation or research, diagnosis made, mode of treatment. I am giving consent for the blood and other essential investigations and also for the follow-up.

I the undersigned Shri/Smt under my full conscious state of mind agree to participate in the said research/dissertation.

Signature of the patient: Signature of doctor:

Date: -

Place: -

## CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital record and will be subjected to the confidentiality and privacy regulation of this hospital. Information of a sensitive, personal nature will not be a part of the medical records but will be stored in the investigator‘s research file and identified only by a code number. The code key connecting name to the numbers will be kept in a separate secure location.

If the data are used for publication in the medical literature or teaching purposes, no names will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission

## REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. **Dr. GARLAPATI SAI TEJA** is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during this study, which might influence my continued participation. If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me for careful reading.

**REFUSAL OR WITHDRAWAL OF PARTICIPATION:**

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand that **Dr. GARLAPATI SAI TEJA** will terminate my participation in this study at any time after he has explained the reasons for doing so and has helped arrange for my continued care by my physician or therapist if this is appropriate

**INJURY STATEMENT:**

I understand that in the unlikely event of injury to me/my ward, resulting directly to my participation in this study, if such injury were reported promptly, then Medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving any of my legal rights.

I have explained the purpose of this research, the procedures required, and the possible risks and benefits, to the best of my ability and the patient‘s language.

DATE: -

DR DAYANAND BIRADAR DR.GARLAPATI SAI TEJA

(GUIDE) (INVESTIGATOR)

STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr. GARLAPATI SAI TEJA has explained to me the purpose of this research, the study procedure that I will undergo, and the possible discomforts and benefits that I may experience, in my language. I have been explained all the above in detail in my language and I understand the same. Therefore, I agree to give my consent to participate as a subject in this research project.

(PARTICIPANT) (WITNESS)

DATE DATE

## PROFORMA

SL NO :

NAME :

AGE :

IP NO :

SEX :

UNIT:

PHONE:

RELIGION:

OCCUPATION:

ADDRESS :

DOA:

DOD:

WARD NO:

SOCIO-ECONOMIC STATUS :

COMPLAINTS;

HISTORY OF PRESENT ILLNESS;

PAST HISTORY:

PERSONAL HISTORY:

GENERAL PHYSICAL EXAMINATION BUILT:
WELL/MODERATE/POOR

BODY MASS INDEX:

PALLOR ICTERUS CYANOSIS CLUBBING PEDAL EDEMA

GENERAL LYMPHADENOPATHY

VITAL DATA:

TEMPERATURE:

PULSE :

RESPIRATORY RATE :

BLOOD PRESSURE:

SYSTEMIC EXAMINATION PER ABDOMEN:

RESPIRATORY SYSTEM :

CARDIOVASCULAR SYSTEM:

CENTRAL NERVOUS SYSTEM:

PER ABDOMEN:

RECTAL EXAMINATION :

CLINICAL DIAGNOSIS:

INDICATION FOR EMERGENCY SURGERY:

PLAN OF TREATMENT:

INVESTIGATIONS :

- COMPLETE BLOOD COUNT
- SR ALBUMIN
- SR PRE ALBUMIN
- SR TRANSFERRIN
- URINE ROUTINE
- BLOOD GROUPING AND TYPING
- HIV AND HBSAG AND HCV
- RANDOM BLOOD SUGAR
- COAGULATION PROFILE
- CULTURE AND SENSITIVITY IF PUS FOUND
- CHEST X-RAY, IF RELEVANT
- ECG IF RELEVANT
- ANY OTHER INVESTIGATIONS IF RELEVANT

COMPLICATION

WOUND INFECTION:

WOUND DEHISCENCE:

DURATION OF HOSPITAL STAY:

| SL NO | NAME | age | Gender | DIAGNOSIS | PRE ALBUMIN | TRANSFERRIN | ALBUMIN | weight (kg) | height (m) | BMI | HOSPITAL STAY | WOUND INFECTION | WOUND DEHISCENCE | Mortality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | KAMALABAI (IV) | 60 | F | ILEO ILEAL INTUSUSCEPTION | 8 | 143 | 3 | 88.1 | 1.6 | 24 | 15 | PRESENT | PRESENT | no |
| 2 | RAMANAGOUDA (II) | 45 | M | ILEO ILEAL INTUSUSCEPTION | 15 | 226 | 3.4 | 60.7 | 1.7 | 23 | 10 | ABSENT | ABSENT | no |
| 3 | BHIMARAY | 68 | M | JEJUNAL PERFORATION | 9 | 234 | 2 | 50.2 | 1.81 | 21 | 14 | PRESENT | ABSENT | no |
| 4 | GOVIND | 28 | M | ACUTE INTESTINAL OBSTRUCTION | 8 | 140 | 2.4 | 58.8 | 1.73 | 22 | 8 | PRESENT | ABSENT | no |
| 5 | DASU(III) | 68 | M | ACUTE INTESTINAL OBSTRUCTION | 18 | 185 | 4 | 56.3 | 1.65 | 19 | 9 | ABSENT | ABSENT | no |
| 6 | NARSAPPA (IV) | 59 | M | MESENTRIC ISCHEMIA WITH GANGRENOUS SMALL BOWEL | 7 | 132 | 2.6 | 73.9 | 1.73 | 25 | 8 | PRESENT | ABSENT | yes |
| 7 | MALLAWWA(IV) | 71 | F | JEJUNAL PERFORATION | 10 | 165 | 4.2 | 42.7 | 1.69 | 20.2 | 11 | PRESENT | ABSENT | no |
| 8 | DHARMARAJ(II) | 24 | M | ILEAL PERFORATION | 14 | 147 | 3.9 | 64.3 | 1.63 | 24.3 | 7 | ABSENT | ABSENT | no |
| 9 | BHIMA WATHARE(II) | 32 | M | ILEAL PERFORATION | 11 | 159 | 4.3 | 59.4 | 1.63 | 22.4 | 9 | PRESENT | ABSENT | no |
| 10 | LAXMAN TELI (IV) | 75 | F | MESENTRIC ISCHEMIA WITH GANGRENOUS SMALL BOWEL | 9 | 142 | 3.2 | 44.6 | 1.63 | 26.2 | 9 | PRESENT | ABSENT | yes |
| 11 | SAI BANNA(III) | 55 | M | MESENTRIC ISCHEMIA WITH GANGRENOUS SMALL BOWEL | 18 | 175 | 3 | 57.6 | 1.65 | 24.6 | 16 | PRESENT | PRESENT | no |
| 12 | KAMALABAI (IV) | 60 | F | ILEAL PERFORATION | 19 | 256 | 4 | 74.7 | 1.8 | 23.4 | 10 | ABSENT | ABSENT | no |
| 13 | PARASAPPA(IV) | 60 | M | Hernia | 18 | 216 | 3.9 | 82.2 | 1.69 | 21.2 | 22 | ABSENT | PRESENT | no |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | SHIVAYOGPPA( IV) | 70 | M | PREPYLORIC PERFORATION | 4 | 111 | 2.5 | 75.2 | 1.68 | 22 | 19 | PRESENT | ABSENT | no |
| 15 | LAXMI BORATAGI (V) | 22 | F | PREPYLORIC PERFORATION | 6 | 171 | 2.3 | 85.6 | 1.6 | 24.2 | 7 | PRESENT | ABSENT | no |
| 16 | MALLU GURRAPPA ( | 32 | M | ILEAL PERFORATION | 21 | 186 | 2.5 | 37.6 | 1.58 | 25.8 | 7 | ABSENT | ABENT | no |
| 17 | SIDDANAGOUDA(II) | 29 | M | ILEAL PERFORATION | 12 | 166 | 3.1 | 58.1 | 1.74 | 21.5 | 14 | PRESENT | ABSENT | no |
| 18 | BASANAGOUDA (V) | 64 | M | PERFORATED GALLBLADDER | 10 | 134 | 2.1 | 79 | 1.57 | 23 | 20 | PRESENT | ABSENT | no |
| 19 | NINGOWDA PUJARI(II) | 45 | M | ILEAL PERFORATION | 4 | 121 | 1.7 | 59.1 | 1.63 | 25.9 | 24 | PRESENT | ABSENT | no |
| 20 | MAHADEV (II) | 43 | M | ILEAL PERFORATION | 8 | 144 | 2.9 | 44.4 | 1.51 | 26 | 10 | PRESENT | ABSENT | no |
| 21 | BAGAVAN RAO (V) | 66 | M | PREPYLORIC PERFORATION | 10 | 136 | 2.1 | 69.1 | 1.66 | 24.6 | 8 | PRESENT | ABSENT | no |
| 22 | SHARANNAPPA(II) | 58 | M | ILEAL PERFORATION | 8 | 154 | 2.2 | 89.8 | 1.34 | 20.2 | 15 | PRESENT | ABSENT | no |
| 23 | BHOURAWWA(V) | 71 | F | ACUTE INTESTINAL OBSTRUCTION | 14 | 141 | 3.8 | 60.1 | 1.65 | 24 | 15 | ABSENT | ABSENT | no |
| 24 | SHANKARAYYA (V) | 75 | M | JEJUNAL PERFORATION | 4 | 144 | 2.6 | 78.9 | 1.7 | 19.4 | 14 | PRESENT | ABSENT | no |
| 25 | BASANIGAPPA (v) | 48 | M | GANGRENOUS BOWEL SECONDARY TO SMA | 8 | 147 | 2.4 | 76.2 | 1.67 | 25.4 | 5 | PRESENT | PRESENT | no |
| 26 | TEJU LOKU JADHAV (III) | 60 | M | ACUTE INTESTINAL OBSTRUCTION | 5 | 161 | 3.4 | 71.6 | 1.62 | 23.4 | 14 | PRESENT | ABSENT | no |
| 27 | HANUMANTH (IV) | 30 | M | ILEAL PERFORATION | 9 | 172 | 3.2 | 87.9 | 1.78 | 22.2 | 11 | PRESENT | ABSENT | no |
| 28 | BASSAPPA(II) | 82 | M | ILEAL PERFORATION | 8 | 138 | 2.6 | 53.8 | 1.53 | 19.2 | 15 | DEATH | | yes |
| 29 | AMOGI (V) | 80 | M | PREPYLORIC PERFORATION | 10 | 170 | 3.1 | 49.7 | 1.67 | 20.4 | 17 | PRESENT | ABSENT | no |
| 30 | ANNAPURNA (III) | 65 | F | ILEO ILEAL INTUSUSCEPTION | 15 | 169 | 2.4 | 57.2 | 1.65 | 24.2 | 6 | ABSENT | ABSENT | no |
| 31 | BHAGAVAN | 66 | M | ILEAL PERFORATION | 10 | 136 | 2.1 | 45 | 1.7 | 26.3 | 10 | PRESENT | ABSENT | no |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | SUSHILA | 32 | F | ILEAL PERFORATION | 8 | 166 | 2.4 | 79.4 | 1.5 | 25.4 | 9 | PRESENT | ABSENT | no |
| 33 | DHAREPPA | 33 | M | ILEAL PERFORATION | 18 | 183 | 2.8 | 64.6 | 1.7 | 22.4 | 8 | ABSENT | ABSENT | no |
| 34 | MALLAPA | 34 | M | PREPYLORIC PERFORATION | 21 | 186 | 3.1 | 86.4 | 1.55 | 23.6 | 7 | ABSENT | ABSENT | no |
| 35 | MUTTAPPA TALWAR | 35 | M | MESENTRIC ISCHEMIA WITH GANGRENOUS SMALL BOWEL | 8 | 136 | 2.5 | 74.7 | 1.62 | 25.6 | 25 | PRESENT | ABSENT | no |
| 36 | NEELAKANTH | 36 | M | ILEAL PERFORATION | 9 | 144 | 2.2 | 59.2 | 1.6 | 24.3 | 16 | PRESENT | ABSENT | no |
| 37 | NILAVVA | 37 | F | PREPYLORIC PERFORATION | 11 | 168 | 2.6 | 81.7 | 1.62 | 20.2 | 5 | ABSENT | ABSENT | no |
| 38 | NINGAPPA | 38 | M | PREPYLORIC PERFORATION | 10 | 158 | 2.2 | 21.7 | 1.67 | 23.2 | 12 | ABSENT | ABSENT | no |
| 39 | PRAKASH | 39 | M | PREPYLORIC PERFORATION | 10 | 163 | 3.6 | 79.3 | 1.57 | 24.4 | 12 | ABSENT | ABSENT | no |
| 40 | RATANAWWA | 40 | F | ACUTE INTESTINAL OBSTRUCTION | 14 | 166 | 2.8 | 56.4 | 1.69 | 22.4 | 7 | ABSENT | ABSENT | no |
| 41 | SAVITA | 41 | F | JEJUNAL PERFORATION | 12 | 170 | 2.4 | 81.3 | 1.46 | 23.2 | 28 | PRESENT | ABSENT | no |
| 42 | SHARANABHAI | 42 | F | ACUTE INTESTINAL OBSTRUCTION | 9 | 144 | 2.6 | 85.9 | 1.75 | 24.3 | 30 | PRESENT | ABSENT | no |
| 43 | SIDDAPA | 43 | M | ILEAL PERFORATION | 9 | 164 | 2.9 | 61.8 | 1.54 | 26.2 | 42 | PRESENT | PRESENT | no |
| 44 | SHRISHAIL | 44 | M | PENETRATING ABDOMINAL INJURY | 18 | 195 | 3 | 84.8 | 1.67 | 24.2 | 15 | ABSENT | ABSENT | no |
| 45 | SUDHABHAI | 45 | F | ACUTE INTESTINAL OBSTRUCTION | 10 | 144 | 2.4 | 66.3 | 1.43 | 25.6 | 24 | ABSENT | ABSENT | no |
| 46 | SIVA | 55 | M | PREPYLORIC PERFORATION | 12 | 164 | 2.8 | 68.4 | 1.76 | 23.4 | 14 | PRESENT | ABSENT | no |
| 47 | DAYANAND | 47 | M | ILEAL PERFORATION | 7 | 163 | 2.5 | 58.8 | 1.68 | 24.2 | 20 | PRESENT | ABSENT | no |
| 48 | AISHWARYA | 48 | F | MECKELS DIVERTICULUM | 16 | 184 | 3.4 | 64.7 | 1.82 | 21.4 | 7 | ABSENT | ABSENT | no |
| 49 | IRAPPA | 49 | M | JEJUNAL PERFORATION | 14 | 170 | 3.2 | 60.6 | 1.62 | 24.2 | 9 | PRESENT | ABSENT | no |
| 50 | CHANDABAI | 50 | F | PREPYLORIC PERFORATION | 10 | 134 | 2.4 | 64.6 | 1.73 | 25.2 | 10 | PRESENT | ABSENT | yes |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | LAXMAN | 51 | M | BLUNT ABDOMEN | 18 | 212 | 3.4 | 68.8 | 1.79 | 24.3 | 10 | ABSENT | ABSENT | no |
| 52 | GANGAMMA | 52 | F | ACUTE INTESTINAL OBSTRUCTION | 15 | 180 | 2.8 | 58.8 | 1.55 | 22.6 | 9 | ABSENT | ABSENT | no |
| 53 | KAMALABAI | 53 | F | Hernia | 16 | 172 | 2.6 | 36.9 | 1.62 | 25.4 | 10 | PRESENT | ABSENT | no |
| 54 | PARASPPA | 54 | M | ILEAL PERFORATION | 21 | 188 | 3.1 | 69.4 | 1.57 | 21.2 | 8 | PRESENT | ABSENT | no |
| 55 | NINGAPPA | 55 | M | PENETRATING ABDOMINAL INJURY | 18 | 210 | 3.2 | 81.3 | 1.85 | 22.1 | 10 | ABSENT | ABSENT | no |
| 56 | MANJUNATH | 56 | M | ENTEROCUTANEOUS FISTULA | 14 | 158 | 2.4 | 95.9 | 1.71 | 24.2 | 20 | PRESENT | PRESENT | no |
| 57 | PARASHURAM | 57 | M | PENETRATING ABDOMINAL INJURY | 16 | 180 | 3.2 | 77.8 | 1.73 | 22.1 | 15 | ABSENT | ABSENT | no |
| 58 | AKASH | 58 | M | ILEAL PERFORATION | 14 | 140 | 2.4 | 36.3 | 1.42 | 24.2 | 16 | PRESENT | ABSENT | no |
| 59 | SIDARAM | 59 | M | PREPYLORIC PERFORATION | 12 | 152 | 2.6 | 87.8 | 1.56 | 25.3 | 15 | PRESENT | ABSENT | no |
| 60 | CHANDAPPAGOUDA | 60 | M | PERFORATED GALLBLADDER | 10 | 166 | 2.8 | 81 | 1.76 | 23.4 | 8 | ABSENT | ABSENT | no |
| 61 | NAGAPPA | 61 | M | NECROTISING PANCREATITIS | 9 | 140 | 2.2 | 68.4 | 1.74 | 20.2 | 20 | PRESENT | ABSENT | no |
| 62 | DHAREPPA | 62 | M | ACUTE INTESTINAL OBSTRUCTION | 12 | 156 | 2.8 | 52.6 | 1.7 | 24.2 | 15 | ABSENT | ABSENT | no |
| 63 | NARASAPPA | 63 | M | MESENTRIC ISCHEMIA WITH GANGRENOUS SMALL BOWEL | 9 | 140 | 2.8 | 47.1 | 1.6 | 30.2 | 25 | PRESENT | ABSENT | yes |
| 64 | MALLAWWA | 64 | F | PREPYLORIC PERFORATION | 16 | 172 | 2.6 | 57.5 | 1.55 | 24.3 | 14 | ABSENT | ABSENT | no |
| 65 | ANIL | 65 | M | BLUNT ABDOMEN | 18 | 212 | 3.4 | 69.2 | 1.57 | 23.2 | 7 | ABSENT | ABSENT | no |
| 66 | GOUDAPPA | 66 | M | BLUNT ABDOMEN | 16 | 195 | 3.2 | 99.6 | 1.64 | 24.2 | 8 | ABSENT | ABSENT | no |
| 67 | MALLAPPA | 67 | M | ILEO ILEAL INTUSUSCEPTION | 14 | 180 | 3 | 77.8 | 2.03 | 22.2 | 10 | ABSENT | ABSENT | no |
| 68 | SUSHILABAI | 68 | F | ILEAL PERFORATION | 10 | 154 | 2.8 | 82.2 | 1.79 | 23.2 | 10 | PRESENT | ABSENT | no |
| 69 | S B PATIL | 69 | M | SIGMOID VOLVULUS | 14 | 166 | 2.6 | 44.8 | 1.6 | 21.4 | 12 | PRESENT | ABSENT | no |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | NAFISABANU | 70 | F | SPLEENIC ABSCESS | 16 | 184 | 3 | 73.6 | 1.58 | 24.3 | 14 | ABSENT | ABSENT | no |
| 71 | KALAMESH | 71 | M | hernia | 12 | 156 | 3.2 | 80 | 1.51 | 22.4 | 5 | ABSENT | ABSENT | no |
| 72 | SUSHILA | 72 | F | SIGMOID VOLVULUS | 15 | 170 | 3 | 46.8 | 1.55 | 24.2 | 9 | ABSENT | ABSENT | no |
| 73 | RAMZANSAB | 73 | F | hernia | 9 | 132 | 2.4 | 82.9 | 1.84 | 22.4 | 13 | PRESENT | ABSENT | no |
| 74 | SARSWATHI | 74 | F | ACUTE INTESTINAL OBSTRUCTION | 14 | 176 | 2.8 | 91.1 | 1.79 | 24.2 | 10 | ABSENT | ABSENT | no |
| 75 | KEERU | 75 | M | ILEAL PERFORATION | 10 | 146 | 2.4 | 69.7 | 1.65 | 23.4 | 14 | PRESENT | ABSENT | no |
| 76 | RUKMINI | 76 | F | RECTAL PERFORATION | 12 | 154 | 2.9 | 69.7 | 1.55 | 25.4 | 20 | PRESENT | ABSENT | no |
| 77 | MAHADEVI | 45 | F | ILEAL PERFORATION | 12 | 144 | 2.2 | 80.1 | 1.66 | 26.2 | 20 | ABSENT | ABSENT | yes |
| 78 | UMESH | 44 | M | BLUNT ABDOMEN | 18 | 192 | 3 | 74.8 | 1.56 | 22.3 | 7 | ABSENT | ABSENT | no |
| 79 | BHAGYASREE | 21 | F | ILEAL PERFORATION | 12 | 166 | 2.4 | 85.1 | 1.8 | 30.4 | 9 | PRESENT | ABSENT | no |
| 80 | NEELAWWA | 48 | F | SIGMOID VOLVULUS | 16 | 154 | 2.8 | 75.2 | 1.53 | 22.4 | 12 | ABSENT | ABSENT | no |
| 81 | SHASANK | 66 | M | ACUTE INTESTINAL OBSTRUCTION | 14 | 180 | 2.9 | 60.6 | 1.57 | 23.4 | 16 | ABSENT | ABSENT | no |
| 82 | GOPAL | 82 | M | RECTAL PERFORATION | 18 | 160 | 2.6 | 79.1 | 1.6 | 24 | 20 | PRESENT | ABSENT | yes |
| 83 | ANIL | 83 | M | BLUNT ABDOMEN | 18 | 194 | 3 | 48.7 | 1.61 | 24.3 | 18 | ABSENT | ABSENT | yes |