"PRE-OPERATIVE SERUM ALBUMIN AND BODY MASS INDEX AS PREDICTORS OF SURGICAL SITE INFECTIONS IN PATIENTS UNDERGOING OPEN MESH REPAIRS FOR INCISIONAL HERNIAS- A LONGITUDINAL STUDY."

BY

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Dissertation

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KAHER, BELAGAVI – 590010
KARNATAKA.

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KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,

BELAGAVI, KARNATAKA.

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Dr. SHRISHAIL C. METGUD, MS
Professor & Head,
Department of General Surgery,
J. N. Medical College,
Belagavi

Date: 30/12/22
Place: Belagavi

Dr. N. S. MAHANTSHETTI, MD
Principal,
J. N. Medical College,
Belagavi

PRINCIPAL
J.N. Medical College,
BELAGAVI- 590 010

Date: 02/01/2023
Place: Belagavi

KAHER
BELAGAVI
J.N. MEDICAL COLLEGE

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Accredited 'A+' Grade by NAAC (3rd Cycle) **Placed in Category 'A' by MHRD (GoI)**

Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

0831 - 2471350 0831 - 2470759 www.jnmc.edu principal@jnmc.edu

Ref No: MDC/PG/ Date: 14-12-2022.

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Chairperson-Antiplagiarism Committee &
Principal,
J. N. Medical College, Belagavi.

To,
Reg. No. BH0120006,
Postgraduate Student,
2020-21 Batch,
Department of General Surgery,
J. N. Medical College, Belagavi.

ETHICAL CLEARANCE

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed - to-be- University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (Govt.)
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http://www.jnmc.edu
E-Mail : dome@jnmc.edu
Phone: (+91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ \0 5 9 Date: 25/01/2021

To,

REG NO: BH0120006

PG student in Surgery,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"PRE-OPERATIVE SERUM ALBUMIN AND BODY MASS INDEX AS PREDICTORS OF SURGICAL SITE INFECTIONS IN PATIENTS UNGERGOING OPEN MESH REPAIRS FOR INCISIONAL HERNIAS – A LONGITUDINAL STUDY"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Smita Sonoli)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi

LIST OF ABBREVIATIONS

SSI	-	Surgical Site Infection
BMI	-	Body Mass Index
A.D.	-	Anno domini
Dr.	-	Doctor
PDS	-	Polydioxanone
PTFE	-	PolyTetraFluroEthylene
PRS	-	Posterior Rectus sheath
UK	-	United Kingdom
MMP	-	Matrix Metallo-Proteinases
kDa	-	kilo Dalton
CDC	-	Centres for Disease Control and Prevention
NHSN	-	National Healthcare Safety Network
RR	-	Risk Ratio
CI	-	Confidence Interval
ASA	-	American Society of Anaesthesiologists
WMD	-	Weighted mean difference
LOS	-	Length of hospital stay
VIHR	-	Ventral incisional hernia repair
MIS	-	Minimally Invasive Surgery
COPD	-	Chronic Obstructive Pulmonary Disease
CCF	-	Congestive Cardiac Failure
CT	-	Computed Tomography
OVHR	-	Open ventral hernia repair
LVHR	-	Laparoscopic ventral hernia repair

Max	-	Maximum
Min	-	Minimum
Upp.	-	Upper
DM	-	Diabetes mellitus
S.D.	-	Standard Deviation
IHD	-	Ischaemic Heart Disease
HTN	-	Hypertension

ABSTRACT

Introduction: Herniation of abdominal contents through a prior surgical incision in the anterior abdominal wall is referred to as incisional hernia. Below the umbilicus, there is a deficiency in the posterior rectus sheath, which increases the pressure in the lower abdomen relative to the upper abdomen and increases the risk of herniations. In this study we have evaluated a grave complication of incisional hernia repair namely Surgical Site Infection and the risk factors which may lead to it. The current study is being conducted to determine a relationship between risk variables namely Body Mass Index and Serum Albumin levels and the post-operative result. Early detection of these risk factors and subsequent implementation of effective preventative measures can help to reduce the incidence of SSIs.

Aims and Objectives: To validate preoperative **Serum Albumin levels** and **Body Mass Index** as predictors/risk factors of post-op SSI in Open Mesh Hernioplasty for incisional hernias in an attempt to reduce post op Surgical site infections.

Materials and Methods: A Total of 60 patients who were admitted to KLES PRABHAKAR KORE HOSPITAL AND MRC, BELAGAVI and undergoing Open Mesh Hernioplasty for incisional hernia were sampled in this longitudinal-prospective study from January 2021 - December 2021

Patient included were- Patients admitted for Open Hernioplasty for incisional hernia in the Department of General Surgery in KLES PRABHAKAR KORE HOSPITAL AND MRC, BELAGAVI. Both adult males and females >18 years who are consenting will be included in the study.

Patients excluded were - Patients younger than 18 years, Hemoglobin < 8 gm/dl, uncontrolled diabetes mellitus, Chronic Kidney Disease, Chronic Liver Disease and patients on steroids or chemotherapy, Non-consenting patients and Pregnant and lactating women.

After admission, a detailed history and clinical examination will be done for all the patients. Basic pre-op investigations were done including pre-operative serum albumin levels. Anthropometry – height and weight recorded. BMI was calculated. Follow up till discharge from the hospital and till 30 days post operatively in out-patient. Wound assessment to be done on Day 3, 5, 7 and 30. South Hampton Wound Grading system was used for wound assessment.

Procedure: All patients underwent Open Mesh Hernioplasty Surgery under General/Spinal Anaesthesia.

Statistical Analysis: Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram.

The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance.

P value < 0.05 was considered statistically significant. Data was analysed by using coGuide software, V.1.01.

Results: 6 (10.00%) participants were male and remaining 54 (90.00%) participants were female. The mean height (cm) was 158.75 ± 7.95 ranging between 146.00 cm to 178.00 cm (95% CI 156.74 to 160.76). The mean weight (kg) was 63.85 ± 11.94 ranging between 46 kg to 90 kg (95% CI 60.83 to 66.87). The mean BMI was 25.26 ± 3.69kg per m^2. 18 (30.00%) participants were in normal range, 11 (18.33%) were in overweight, 24 (40.00%) were in obese I and 7 (11.67%) were in obese II class. 14 (23.33%) out of 60 participants were in low albumin group and remaining 46 (76.67%) participants were in normal albumin group. Among the study population, 3 (5.00%) participants had wound infection and 57 (95.00%) participants had no wound infection. The difference in wound infection between BMI groups was found to be insignificant with a P- value of 0.7391. The difference in wound infection between Serum albumin groups was found to be insignificant with a P- value of 0.5564 with majority of 2 (4.35%) participant were normal serum albumin group.

Conclusion: The association between deranged nutritional indices and Incidence of wound infection could not be significantly proved in the current study. Indicators of Malnutrition such as Low BMI and Low Serum Albumin as well as that of Obesity, namely high BMI may indicate a certain predilection to causing wound infection, however further studies are required to prove its significance.

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INTRODUCTION

"Herniation of abdominal contents through a prior surgical incision in the anterior abdominal wall is referred to as incisional hernia"[1] .The scar gives away, allowing bowel to burst through a space that is lined on the inside and outside by peritoneum, scar tissue, and skin. Celsus is credited with writing the earliest report of an incisional hernia in the first century AD. His hernioplasty involved using sutures to preserve the margins' freshness.[2] Incisional hernias have been effectively treated by Gerdy in 1836. The incidence of incisional hernia is approximately 10 percent. Hernias should be differentiated from eventration and diastasis recti. Eventration develops when a section of the abdominal musculature is paralyzed or is congenitally absent. Lack of muscle tone causes a bulge in the anterior abdominal wall. When the linea alba is thinned out, the rectus abdominis muscles' medial borders separate, causing a midline bulge known as diastasis recti. Hernial sac is typically absent in the above conditions. Because the abdominal wall itself is sensitive to fluctuating pressure from within, abdominal incisions differ from most other incisions. The lower abdominal incisions are those where incisional hernias occur most frequently. The vast majority of gynaecological surgeries are performed only through this incision. Below the umbilicus, there is a deficiency in the posterior rectus sheath, which increases the pressure in the lower abdomen relative to the upper abdomen and increases the risk of herniation.

Surgery is the main stay of treatment for complicated as well as un-complicated hernias. Numerous methods have been described however the complications associated are more or less similar.

In this study we have evaluated a grave complication of incisional hernia repair namely Surgical Site Infection and the risk factors which may lead to it.

The current study is being conducted to determine a relationship between these risk variables and the post-operative result. Early detection of these risk factors and subsequent implementation of effective preventative measures can help to reduce the incidence of SSIs.

AIMS AND OBJECTIVES

To validate preoperative **Serum Albumin levels** and **Body Mass Index** as predictors/risk factors of post-op SSI in Open Mesh Hernioplasty for incisional hernias in an attempt to reduce post operative Surgical site infections.

REVIEW OF LITERATURE

Anatomy

Muscle aponeuroses and fascia are layered intricately to form the anterior abdominal wall. The umbilicus is a visible structure where umbilical cord enters the body in fetal life. The linea alba, which runs from the xiphoid process to the symphysis pubis forms the midline. The External oblique, Internal Oblique, and transversus abdominis travel lateral to medial and unite in midline to produce thick, crisscross-shaped fibrous bands known as the linea alba. Superiorly, the rectus sheath fibers widen and split to implant on the 5th, 6th, and 7th costal cartilages. It widens at the xiphoid and measures 1 cm to 2.5 cm in length. Caudally the linea alba inserts on to the symphysis pubis below the umbilicus. Multiple tendinous junctions which run from linea alba to linea semilunaris form attach the recti to anterior Rectus sheath. The two-layered, intricately woven rectus sheath, which covers the rectus abdominis muscles, is made of aponeuroses of the anterior abdominal wall muscles. The anterior lamina of the internal oblique muscle aponeurosis and the external oblique muscle aponeurosis combine to create the anterior rectus sheath. The posterior slip of the internal oblique and transversus abdominis. aponeurosis fuse to form the posterior rectus sheath. The 3 aponeurotic layers fuse together midway between the pubis and the umbilicus to form the arcuate line, which serves as the caudal boundary of the posterior sheath. The internal oblique and transversus abdominis aponeurosis combine to produce the spigelian fascia, an aponeurosis. It stretches from the pubis to the eighth rib cartilage, between the semilunar line and the rectus abdominis muscle. The fibres of this aponeurosis run parallel to one another below the level of the umbilicus, where it easily splits. The level of the semi-circular line of Douglas is where the

Spigelian fascia is least supported. The inferior epigastric veins also play role in making this part of the wall considerably weak. A peritoneal sac or pre-peritoneal fat that protrudes through the internal oblique and traverses within the space between Internal Oblique and External Oblique aponeurosis is known as a “Spigelian hernia”. The semilunar line, the inferior epigastric artery, and the arcuate line form the superior and inferior borders of the weak area of the spigelian fascia. 3 flat layers of muscles make up the lateral part of the anterior abdominal wall. The External oblique is the most superficial. It forms the inguinal ligament caudally and medially merges with the Internal oblique muscle. It originates from lower costal origins and runs caudally to insert on the iliac crest. The internal oblique muscle, which originates from the lateral half of the inguinal ligament and fans out in the shape of the iliac crest with superior fibres coursing upward toward the terminal 3 or 4 ribs, is located beneath that layer. The internal oblique muscle's fibres make up the superficial portion of the deep inguinal ring. The transversus abdominis, which is the deepest layer of muscle, meets the internal oblique aponeurosis medially and travels horizontally. Numerous inferior fibres contribute to the inguinal area, much to the internal oblique. The pre-peritoneal area, which includes fat that is more noticeable in the lower section of the Abdomen, separates the peritoneum from the deep fascia layer. Numerous vessels feed the anterior abdominal wall. The superior epigastric artery, the terminal branch of the internal thoracic artery, and collateral branches of the lower Ileo-Colic arteries supply the majority of the blood to the upper section of the anterior abdominal wall.

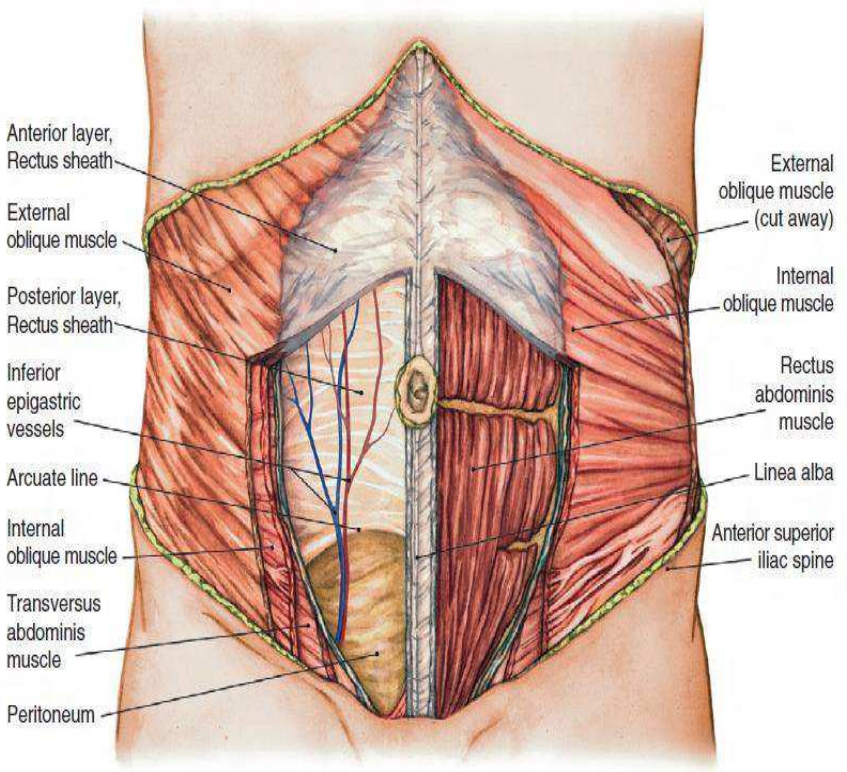


Figure 1: Anatomy of anterior abdominal wall

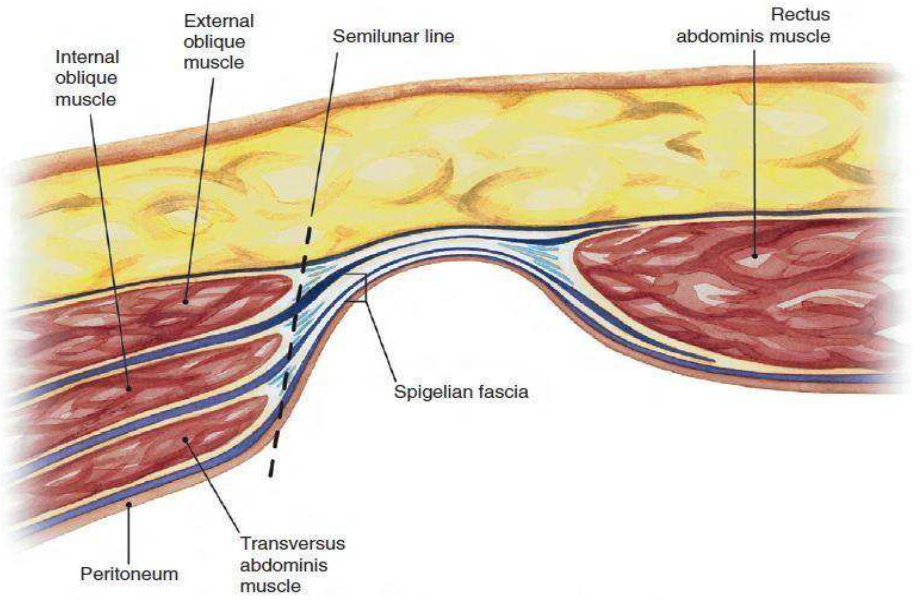


Figure 2: Muscles of Anterior abdominal wall

The inferior epigastric and deep circumflex iliac arteries, which are branches of the external iliac artery, feed the lower section of the abdomen. Deep within the rectus abdominis muscle, the superior and inferior epigastric vessels anastomose with one another. Between the transversus abdominis and internal oblique muscles, there is a course of nerves that supply the anterior abdominal wall. Anterior cutaneous nerves are created when these nerves breach the rectus sheath superficially.

The Umbilicus and the surrounding area is supplied by 7th Thoracic to 1st Lumbar nerve roots.

Causes

Table 1: Causes of Incisional Hernia

Patient factors	Wound factors	Procedure related
1. Type 2 DM	1. Infection	1. Suture Material
2. Obesity	2. Urgency	2. Surgeon Expertise
3. Smoking	3. Type of incision	3. Technique
4. Nutritional Deficit	4. Location	
5. Steroids		
6. Anticoagulants		
7. Size of hernia		

Any abdominal surgical treatment involving an incision in the abdominal wall may result in an incisional hernia. Additionally, severe damage to the abdominal wall have been linked to incisional hernia.[3] The abdominal wall fails to adequately approximate after an incision, which leads to incisional hernias.[4] Despite improvements in abdominal wall closure methods, the percentage of incisional hernias after laparotomies can reach 15% to 20%. Incisional hernias continue to be a problem for surgeons despite continued research into the best closure techniques to

stop them and the publication of current guidelines. Patient-related, disease-related, and technological variables are among the causes of improper closure.[5-7] Incisional hernias are more common due to patient-related variables that hinder adequate wound healing thereby weakening the anterior abdominal wall. The risk of developing an incisional hernia is increased by systemic chronic disorders including diabetes mellitus (T2DM), Chronic Renal failure, obesity, smoking, and nutritional conditions, as well as systemic drugs like steroids and immune-modulators. One frequent risk factor is morbid obesity.[8] Hesselink et al. conducted a retrospective study of patients who mostly had direct open suture procedures to determine the risk variables for developing a recurrent incisional hernia.[9] Hernia size was the sole risk factor for recurrent incisional hernia, with a lower recurrence incidence for hernias less than four centimetres than for hernias bigger than four centimetres (25% versus 41%). Hernia size was discovered by Langer et al. to be a risk factor for recurrent incisional hernia, whereas BMI > 25 and the surgeon's expertise were revealed to be greater risk factors.[10,11]Anthony et al. discovered obesity to be a risk factor for recurrent incisional hernia in a retrospective investigation.[12]

Incisional hernia can arise as a result of a variety of diseases, including those that are directly connected to the site where the incision was taken, timing, and urgency of the surgical intervention, level of difficulty, and the underlying patient factors. A greater prevalence of incisional hernia formation is linked to acute abdominal procedures, midline incisions, infections, and emergency surgeries.[12,13] One risk factor for incisional hernia that is frequently mentioned is wound infection. Technical details pertaining to the surgical procedure or the suture materials utilized to close the wound. Poor surgical technique may cause an incisional hernia or an acute wound dehiscence due to delayed healing failure.[14] Incisional hernia is more

likely due to improper closing technique. Despite improvements in abdominal wall closure methods, a laparotomy's incisional hernia rate of 15% to 20% is still significant.[15,16] Incisional hernias continue to be a problem for surgeons despite continued research into the best closure techniques to stop them and the publication of current guidelines. With the exception of continuous closure being faster, there were no discernible differences between interrupted and continuous closure approaches in terms of hernia development. PDS has the lowest recurrence rates overall. The least amount of incisional hernia occurs with a running, slowly absorbing rectus sheath closure. When compared to conventional closure techniques, it was discovered that following Jenkins rule with bites only 5 to 8 mm from the edge of the wound decreases the occurrence rate of incisional hernia formation from 18% to 5.6% and the rate of SSI by almost half. It is advised that the incision technique be chosen depending on the planned surgery as well as the surgeon's preferences. The prevalence of laparoscopic surgery in all facets of abdominal surgery suggests that the difficulty, if not the frequency, of ventral hernias would be reduced. The prevalence of laparoscopic trocar site hernia ranges from 0.6% to 2.8%. Adults must have facial deformities bigger than 5 mm closed. Some claim that sutures are not required to seal dilating, non-cutting trocar sites up to 1 cm. In 1.2 cm radially dilating, blunt trocars, a recent evaluation examining these ports found a 0.66% hernia risk, justifying the suture closure of these ports. No matter how long the incision was, other variables including contamination, compromised tissue healing, increased abdominal pressure, and others might cause a hernia to develop.

Symptoms

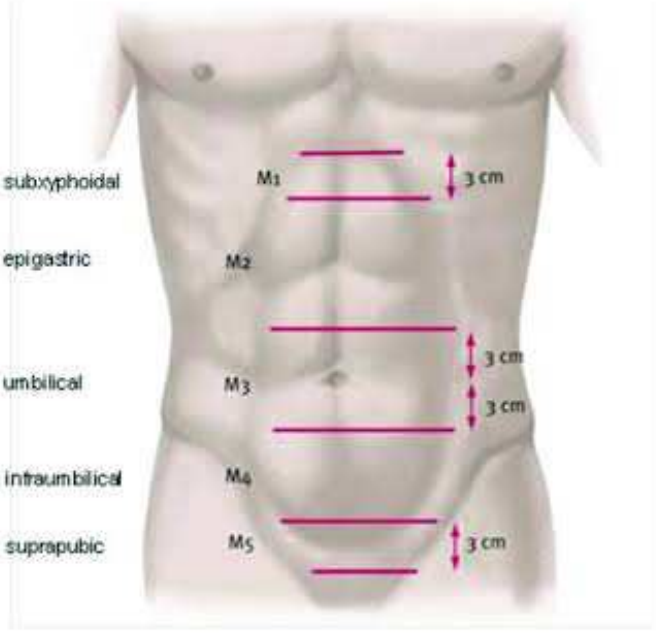
A protrusion in the anterior abdominal wall is what the patient notices as an incisional hernia. They can be aggravated by situations that increase intra-abdominal pressure, such as coughing, executing the Valsalva technique, heavy weight lifting, or by Carnet's test. Patient may sometimes develop complaints of pain and dragging sensation related to their hernia, which frequently goes away with rest or incarceration reduction. This comfort is transient, though. More often than not, smaller hernias do not cause symptoms, though they occasionally do. The most typical initial symptom is discomfort or a ventral bulge, although sometimes, the first sign may be due to complications such as obstruction of large or small intestine in the defect that necessitates a patient's seeking medical help. If the hernia neck defect is tiny and makes it difficult to reduce the hernia contents then irreducibility and strangulation may prevail.

Abdominal wall pathophysiology and incisions

Each historical period saw the gradual development of surgical methods from technical advances. The "quick and simple" access to the targeted organ in the abdominal cavity served as the foundation for many treatments and continues to do so. Although sub-arcuate, transverse abdominal, and lateral oblique incisions are still often used, the conventional location for incisions is the midline. Major consideration must be given to the incision's location. The ideal outcome is to have enough and secure access to the target organ of interest within the abdominal cavity while causing the abdominal wall as little stress as possible. Sometimes a compromise will come from this. In terms of causing the least amount of trauma, the midline is ideal for access to the abdominal cavity. Damage to muscles and nerves that cannot be repaired

is prevented. It is possible to treat a hernia that results from improper wound healing with little risk of nerve and muscle damage. The damage to the abdominal wall has been further reduced by the development of minimally invasive procedures, particularly laparoscopic surgery. An incisional hernia forms when the wound-closing sutures in the aponeuroses of the incision margins fail. Suture thread fractures or, more frequently, the tissue's inability to sustain the stress in the abdominal wall may be to blame for this. Without any opposing forces, the intraabdominal pressure and lateral oblique muscle contraction work together to separate the borders of the incision and encourage the growth of a hernia defect. It is not a viable alternative to insert fresh sutures into the "ragged" tissue margins. The abdominal wall components, which have already acclimated to a new "functional" position, must be under more strain in order to approximate the fascia's boundaries. A wound rupture, burst abdomen, or wound dehiscence is the term used to describe a failure that is observed in the immediate postoperative period. A prompt surgical repair is frequently the preferred course of action if the patient is not plagued by further difficulties. A planned hernia will form and may subsequently be fixed if surgery is not advised owing to other issues or contraindications.

Classification of Incisional Hernias- European Health Society classifies Incisional Hernias as shown in figure



Rectus Diastasis Classification			
Midline	M1 subxiphoidal		
	M2 epigastric		
	M3 umbilical		
	M4 infraumbilical		
	M5 suprapubic		
Length: cm		Width: cm	
Width cm	W1 < 3 cm	W2 3 - ≤ 5 cm	W3 > 5 cm

Figure 3- EHS Classification of Incisional Hernias

Treatment and Management

Incisional hernias can be treated with either conservative non-operative measures or surgical repair.[17]An overview of the therapeutic guiding concepts will be covered in this section. The patient's desire, the severity of the hernia, the patient's symptoms, and other considerations all play a role in the selection between the two methods. Small, asymptomatic hernias can be safely monitored with a 2.6% yearly complication risk, according to certain studies.[13] In order to prevent complications, treat symptoms, and enhance quality of life, big or symptomatic hernias should always be surgically corrected. Abdominal incisional hernias can be repaired using a variety of techniques, including simple suturing, “Shoelace darn repair”, “Cattell's and Maingot's keel repair”, and others.[18,19] Recurrence rates for these fixes range from 15% to 20%. With the invention of Polypropylene, polymer, nylon, polyester, PTFE, polyglactin, and PDS, polymer chemistry has modernised the suture material. The surgical profession has been transformed by prosthetic grafts. Usher's publication on his experience using prolene mesh in 1958 marked the beginning of the modern age of hernia prosthesis repair. Since then, prolene mesh is frequently utilized to conceal substantial incisional hernia abnormalities.[20,21] Prior to the use of natural tissues, repairs of this hernia were performed by implanting foreign materials to bridge the gap. In 1948, Tantalum gauze was utilized by both Thorckomorton and Koontz. Tantalum and stainless steel sheets were also employed. These metal sheets quickly became fragmented, which frequently resulted in recurrence. In addition, the fragments also led to skin and soft tissue complications. Tensor fascia Lata grafts were reportedly utilized by MacArthur in 1898, Kirschner in 1910, and Guttic in 1968. In 1945, Mair used five skin sheets or strips, but they had high recurrence rates

due to absorption. Due to difficulties such sinus formation, cystic lesions, and risk of malignancies, harvesting skin grafts has always been difficult.

Following the development of synthetic plastics, Tempason utilised flexible plastic sheets in 1948 and Schofield utilised polyvinyl alcohol sponge in 1955. Usher's 1958 paper on his experience using prolene mesh marked the beginning of the contemporary era of prosthetic mesh in hernia treatment. Polyamide mesh and, more recently, polytetrafluroethylene were used afterwards. These three types of materials revolutionized the post-operative hernia surgery. One effective way for treating incisional hernias is the Darn technique, which wasn't widely used since there wasn't enough suture material until Abel showed his early successes in using monofilament stainless steel wire to close abdominal wall incisions and repair hernias.

Incisional hernias are frequently repaired using open, laparoscopic, and robotic procedures, which must be customized for each patient and hernia's specific needs.[22] Majority of incisional hernias should, in general, be repaired using mesh since it has a lower recurrence rate than primary suture repair. Mesh acts as a framework for reinforcing tissue and acts as a support for repairs. There are several mesh positioning choices. Deep to the neck/fascia but superficial to the Posterior Rectus Sheath is called a sublay, while onlay or intraperitoneal onlay is above the fascial defect (intraperitoneally below the fascial defect). There are several mesh varieties available. Meshes can be classified as synthetic vs. biologic, and as permanent vs. absorbable. Permanent artificial meshes are frequently employed.[19] In a setting of infection, absorbable meshes are exploited. For similar reasons, as well as for additional unique indications including long-term support, biologic mesh can be employed. The fascial closure should typically be carried out for defects < 10 cm, and

the same should be strengthened with mesh. Other methods, such component separation, have been employed if secondary to stress, fascial closure cannot be attained.

The open procedure may include a straightforward hernioplasty (such as a Mayo duplication or fascia adaptation), a technique for separating the individual components, or mesh repair. The foundation of the components separation approach is the advancement and separation of the muscle layers, which enlarges the surface of the abdominal wall. Onlay (prefascial/subcutaneous, Sandwich, or Chevrel procedures), sublay (retromuscular or preperitoneal), or inlay (bridging) techniques can be used to install the mesh. The mesh can be employed as a bridge mesh between the fascial borders or for augmentation in conjunction with fascia closure. The European Society of Hernia Surgery has adopted the sublay technique as the standard open repair method after Flament, Rives, and Stoppa first described and popularized it. An inlay ("bridging") repair does not involve appointing the fascia. A disastrous side effect of incisional hernia repairs is surgical site infections, especially mesh infections.[24] The reported incidence following open repair is between 6% and 10%.[25] Both the patient and the operating surgeon find it problematic. Numerous risk factors that predispose a person to surgical site infection have been found. These variables may be mesh-related, procedure-related, or patient-related. According to Stremitzer, Bachleitner-Hofmann, Gradl, et al., a high BMI is linked to post-operative mesh infections.[26] According to a research by Dunne, low blood albumin levels at the time of surgery have also been discovered as a personal risk factor for SSI

Complications of Hernia Repair

Table 2: Complications of Hernia repair
1. Infection
2. Chronic Pain
3. Abdominal Compartment Syndrome
4. Recurrence
5. Inadvertent Injury to bowel and other structures
6. Mesh Rejection
7. Mesh Migration
8. Abscess/Seroma formation

Over 100,000 hernia operations are performed annually in the UK alone, making them one of the most prevalent surgical procedures globally. Even though surgery is normally safe, there is a slight chance that problems might arise following the treatment. Infection, numbness at the surgical site, and hernia recurrence are severe issues that might arise following a hernia procedure. Rejection of the mesh used to treat the hernia is another post-operative complication that might happen, in which case the mesh will need to be removed. In most cases, this may be found out by looking for signs like soreness and swelling where the mesh was inserted. After the mesh has been taken out, the surgical wound may continue to leak for a while.

Wound Healing

Every incision made during surgery results in tissue stress that leaves a scar. Coagulation, inflammation, fibroplasia, and remodelling are the four steps that usually make up the dynamic process of wound healing. The duration of these periods is reasonably predictable under typical conditions. As soon as the damage occurs, the first phase (coagulation), which results in bleeding and the exposing of sub-endothelial tissue, starts. The healing process is started when tissue mast cells produce catecholamines and other signalling molecules (cytokines). Platelets generate clotting factors to create fibrin at the conclusion of this phase, and they also release more cytokines (formerly known as "growth factors"). This stage might go on for minutes or hours. The second phase (inflammatory) is when leukocytes migrate into the wound. This stage takes several hours to complete. The first 24 hours are dominated by polymorphonuclear leukocytes, then macrophage invasion. Immune response is triggered. It starts with the recruitment and development of connective tissue cells. The collagen fibres are produced during the third step, called fibroplasia. The extracellular matrix's most crucial element, collagen, contributes stability and tensile strength. Its compliance can be reduced by mineralization, which can also create bone or cartilage. In reality, there are 28 different forms of collagen, of which collagen I and III are crucial for wound healing. In the body, collagen I is the most prevalent type (about 90%). It is created when several collagen fibrils aggregate and crosslink to produce fibres. Proteinases are required for the crosslinking, and vitamin C functions as a cofactor. Long-term vitamin C deficiency leads to inadequate collagen production, which is shown as scurvy. Connective tissue illnesses, such as the Ehler-Danlos syndrome, have been associated with errors in the genes that code for proteinases or collagen. Fibroblasts, a fibril form of the cell, produce collagen III in

the wound. The fibrils are altered by matrix metalloproteinases (MMP) in the extracellular area (Klinge et al., 2001). Collagen III is changed into collagen I in a dynamic process that involves ongoing production and breakdown. The regulation in this stage promotes synthesis. The ideal scenario is one in which no external variables, such as complications, interfere with this period. If contamination occurs, blood supply is reduced, lowering levels of oxygen, nutrients, and immune system support, the wound closure fails (due to excessive tension) to keep the wound edges approximated, allowing the granulation tissue to adhere, then a prolonged fibroplasia phase is required. The fourth phase of healing, known as re-modelling, can begin as soon as 24 hours after an injury and persist for weeks, months, or even years. Collagen III is converted to collagen I when the equilibrium between collagen synthesis and degradation improves. The scar shrinks and gradually gets smaller and softer.

Serum Albumin

The main protein in human blood plasma is human serum albumin. The major job of albumin is to keep the blood's oncotic pressure constant. It binds to cations (such as Ca2+, Na+, and K+), fatty acids, hormones, bilirubin, thyroxine (T4), and medicines (including barbiturates). In healthy people, albumin makes up around half of the total protein. 5. A single chain of 585 amino acids structured into three repeating homolog domains (sites I, II, and III) makes up the tiny globular protein known as human albumin, which has a molecular weight of 66.5 kDa. Each domain has two distinct subdomains (A and B). There are several albumin preparations that are well known and extensively accessible in the therapeutic context.

Body Mass Index (BMI)

The patient's weight in kilograms divided by the square of their height in meters is used to calculate their BMI. Underweight (18.5), normal weight (18.5–24.99), overweight (25–24.99), obesity I (30–34.99), obese II (35–39.99), and obese III (>40) are the categories used to classify the BMI index. Patients under the age of 18 were not included in the study because BMI is not a reliable indicator of childhood obesity.

Role of Serum Albumin in wound healing

Healing a wound is a catabolic process that demands energy. Patients with severe malnutrition have slowed wound healing and an increased risk of infection.[27] They also have impaired immune systems. With the right nutritional assistance, the catabolic consequences or damage can be prevented. Based on physical examination results, plasma protein analysis, and weight loss during the previous six months, the severity of malnutrition is evaluated. There is no agreement on the optimal technique for determining the nutritional status when employed alone, despite the fact that a range of important nutritional indicators may be utilised to predict patient outcome through risk stratification and objective comparison among patients. The most accessible and therapeutically relevant indicator is serum albumin level. Serum albumin levels over 3.5g/dl indicate sufficient protein reserves. Surgery-related problems might arise if the S. Albumin level is < 3.5gm/dl. Physical signs such as temporal wasting, cachexia, poor dentition, ascites, or peripheral oedema may be corroborant. Albumin or prealbumin levels may assist identify individuals with some degree of malnutrition.

Role of BMI in wound healing

Another factor contributing to morbidity is obesity, which also hinders the healing of wounds[28]. A normal nutritional state is indicated by an adult's body mass index, which ranges from 19 kg/m2 to 25 kg/m2. A BMI under 18 kg/m2 indicates an inadequate nutritional state and raises the possibility of surgical complications

Classification of surgical site infections as per CDC/ NHSN surveillance

The "National Academy of Sciences and the National Research Council Cooperative Research Project" created the initial categorization system, which was later modified by the CDC in 1982. This categorization system has been widely utilized, although it has become less common recently but it is still being used at a number of institutions for hospital quality improvement measures, third-party payers, and quality improvement partners.

"Superficial incisional SSI

Infection that occurs within 30 days after any operative procedure or 1 year after Hernia surgery and involve only skin and subcutaneous tissue of incision. The patient must also have one of the following:

(1) Purulent drainage from incision

(2) Organisms identified from an aseptically obtained specimen

(3) Superficial incision that is deliberately opened by a surgeon or other designee and culture or non– culture-based testing is not performed, and at least one of the following signs or symptoms: pain or tenderness; localized swelling; erythema; or heat.

(4) Diagnosis of a superficial incisional SSI by the surgeon or an attending physician or other designee

Deep incisional SSI

Infection must occur within 30 or 90 d after the operative procedure and involve deep soft tissues of the incision (fascial and muscle layers). The patient must also have at least one of the following:

(1) Purulent drainage from the deep incision

(2) A deep incision that spontaneously dehisces or is deliberately opened or aspirated by a surgeon, attending physician, or other designee, and the organism is identified by a culture or non–culture based microbiologic testing method. The patient must also have one of the following: fever, localized pain, or tenderness.

(3) An abscess or other evidence of infection involving the deep incision that is detected on gross anatomic or histopathologic examination or imaging test

Organ/space SSI

Infection occurs within 30 or 90 d after the operative procedure and involves any part of the body deeper than the fascial/muscle layers that is opened or manipulated during the operative procedure and the patient has one of the following:

(1) Purulent drainage from a drain that is placed into the organ/space

(2) Organisms are identified from an aseptically obtained fluid or tissue in the organ/space by a culture or non–culture-based microbiologic testing method.

(3) An abscess or other evidence of infection involving the organ/space that is detected on gross anatomic or histopathologic examination or imaging test."

SOUTHAMPTON WOUND - GRADING SYSTEM

(Bailey and love 25th edition)

Grade	Appearance	
0	Normal healing	
I	Normal healing with mild bruising or erythema	
	Ia	Some bruising
	Ib	Considerable bruising
	Ic	Mild erythema
II	Erythema plus other signs of inflammation	
	IIa	At one point
	IIb	Around sutures
	IIc	Along wound
	IId	Around wound
III	Clear or haemoserous discharge	
	IIIa	At one point only (≤ 2cm)
	IIIb	Along wound (>2 cm)
	IIIc	Large volume
	IIId	Prolonged (> 3 days)
IV	Pus	
	Iva	At one point only (≤ 2cm)
	IVb	Along wound (>2 cm)
V	Deep or severe wound infection with or without tissue breakdown; hematoma requiring aspiration	

Fig 4 : South-Hampton Grading Score for wound Infection

Over the past 20 years, the treatment for incisional hernia has made significant advancements. Despite this, the typical general surgeon is still unsure of the best pre- and postoperative management strategies for patients with an incisional hernia. Incisional hernia repair has changed over time from sutured to mesh repair. Pain is the commonest and noticeable postoperative complication among such patients. A lot of work has been done in this area:

Kaoutzanis C et al (2015) determined risk variables for postoperative surgical site infections (SSIs) and longer hospital stays (LOS) following ventral/incisional hernia repairs (VIHR). Around 28,269 instances of VIHR in total were found, and 25,172 of those cases satisfied the requirements for inclusion. 6,909 of the cases were strangulated or incarcerated hernias, whereas 18,263 involved reducible hernias. Authors prediction model showed that BMI> 30 kg/m^2, smoking, American Society of Anesthesiology (ASA) class III, open repair technique, extended operational hours, and hospital admission following VIHR were significant predictors of postoperative SSIs. Additionally, older individuals, African American race, a history of alcohol consumption, ASA classes III and IV, poor functional status, an operation within 30 days of the first surgery, a history of COPD, CCF, and bleeding disorder, as well as open surgical approach, exclusion of residents, prolonged operative times, recurrent hernias, emergency operations, and serum albumin deficiency and so on were risk factors associated with prolonged hospital stay. They concluded that smoking and being overweight are modifiable risk factors for SSIs following VIHR, whereas a low S. Albumin level is controllable for extended LOS. Preoperative variables can be addressed to potentially enhance patient outcomes and lower VIHR-related medical costs. Laparoscopic surgery should also be seriously explored, if it is practical.

Mavros MN et al (2011) Conducted a study to carefully examine and formulate the information on factors predisposing for synthetic mesh infection following hernia repair surgery. The databases of Scopus and PubMed were thoroughly searched. The meta analysis approach was used to combine the retrieved data. Six appropriate trials with 2,418 mesh hernioplasties were found. The percentage of crude mesh infection was 5%. Smoking (risk ratio [RR] = 1.36, ASA score C3 (RR = 1.40 [1.15, 1.70]; 1,682 hernioplasties), and emergency procedure were statistically significant risk

variables. Additionally, there was a significant relationship between mesh infections and patient age (2,364 hernioplasties; weighted mean difference [WMD] = 2.63 [0.22, 5.04]), ASA score (1,682 hernioplasties; WMD = 0.23 [0.08, 0.38]), and the length of the hernia surgery (833 hernioplasties; WMD = 44.92 [25.66, 64.18]). Patients who were obese had higher mesh infection rates (2,243 hernioplasties; RR = 1.41 [0.94, 2.11]), as did patients who had their operations performed by a resident as opposed to a consultant (982 hernioplasties; RR = 1.18 [0.99, 1.40]). Mesh infections frequently required mesh explantation, and prevalent culture growth included gram-negative bacteria, Staphylococcus spp., and Enterococcus spp. Age of the patient, ASA score, smoking, the length of the procedure and the emergency environment were all revealed to be factors in the development of synthetic mesh infection. It is important to take into account how different the evidence is. Prospective studies with rigorous follow-up are required to learn more about infections connected to mesh.

Itani MF et al (2010)[29] conducted a prospective comparative study on laparoscopic and open repair with mesh for the treatment of ventral incisional hernia. Surgery was performed on 146 of the 162 randomly assigned individuals (73 open and 73 laparoscopic repairs). Complication rate was less by almost 1/3rd in laparoscopic group (31.5%) as compared to the open repair group (47.9%). Through 8 weeks, the laparoscopic group had five times lower rate of infection. The laparoscopic group experienced less recovery time than the open repair group, almost with a 5 day difference in median time before returning to work. Overall recurrence at 2 years was 12.5% in the laparoscopic group and 8.2% in the open repair group. Laparoscopic repair enhanced several patient-centred outcomes and was linked to fewer, albeit more severe, problems.

Novitsky YW et al (2006)[30] in their retrospective assessment of patients who received open preperitoneal retro-fascial mesh surgery for many (greater than 2) recurrent hernias at a tertiary care referral facility. The body mass index ranged from 28.9 to 61.0 kg/m2, with an average of 39.1 8.4 kg/m2. 18.8% of patients smoked, and all patients had substantial comorbidities. There had been average 3.6 prior herniorrhaphy. All patients received Prolene mesh, with 10 (31.2%) receiving lightweight polypropylene. The typical mesh measurements were 937.531 cm2 (225-1,800 sq. cm). Four patients (12.5%) who were all smokers experienced wound infection, necessitating partial mesh excision in one case. Smoking was the sole predictor of wound- or mesh complications, according to a univariate analysis with significant p value. At a median follow-up of 28.1 months (with a range of 8 to 60 months), the patient who needed partial mesh removal experienced 1 recurrence (3.1%). Quitting smoking seems to be crucial for reducing viral problems. Given the technical difficulty, referral hospitals with interest in and experience in complicated hernia repairs may be the ideal places to provide surgical therapy for patients with MRH.

Rana KVS et al (2013)[31] reported their experience with the use of mesh for hernia repair, with respect to the postoperative complications and factors affecting the occurrence of complications. Around 24 individuals experienced at least one complication, with seroma (12 instances) and surgical site infection being the most frequent (9 cases). Diabetes mellitus, obesity, smoking, hypoproteinemia, advanced age, size of fascial defects, and number of defects were the variables that significantly correlated with the development of problems. 3.7% of incidents occurred again (mean follow up: 13.05 months). Mesh hernioplasty produces respectable outcomes for the treatment of incisional hernias. To enhance the effectiveness of the surgery, a

thorough study of the variables influencing the development of problems and recurrence is necessary.

Pauli EM et al (2013)[32] conducted a study on open ventral hernia with component separation. A collection of intricate surgical procedures known as open ventral hernia repair with component separation were created to treat the increasing number of patients who needed abdominal wall restoration. The approaches discussed have a few crucial components in common: Fascial release makes it possible to progress myofascially and reconstruct the linea alba, and the opening up of huge voids inside the abdominal wall ensures that the mesh is overlapped widely in order to optimise surface ingrowth. The placement of this potential space is the primary distinction between anterior and posterior component separation procedures. Large lipocutaneous flaps are produced via anterior separation techniques, which are frequently combined with a mesh onlay. Methods for posterior separation allow for a mesh sublay and don't produce any such flaps. These 2 facts are probably connected in a direct way, as are variations in wound complications and recurrence rates.

Kaoutzanis C et al (2013)[33] compared the prevalence of postoperative SSIs, operation duration (OTs), and length of hospital stay (LOS) following open and laparoscopic Ventral incisional hernia repair (VIHR) using multicentre, prospectively collected data. Out of a total of 26,766 instances fitting inclusion criteria; 5,303 cases were minimally invasive; 3,883 cases were open procedures; and 1,420 patients were complicated. In terms of superficial SSI, deep SSI and wound disruption there were significant differences between open and laparoscopic VIHR for reducible and incarcerated/strangulated hernia. The risk for organ/space SSI was considerably higher for open surgeries for reducible hernias (OR 1.9, $p = 0.02$). For MIS, the OT

was substantially longer. Open repair group stayed in the hospital longer. They concluded that when compared to open repair, laparoscopic VIHR for reducible and incarcerated/strangulated hernias has a shorter LOS, a lower risk of superficial SSI, deep SSI, and wound disruption, but longer duration.

Narkhede R et al (2015)[34] Conducted a review study on postoperative mesh infection and concluded that laparoscopic and open repairs still pose a risk for mesh infection in routine practice, but it can be avoided by using the right mesh material, maintaining sterility in the operating room and with the prosthesis, cleaning and sterilising the scopes properly, and using enough antibiotics when necessary. Even though it has been shown to be beneficial, re-sterilizing mesh is not advised given the morbidity linked to mesh infection. It is feasible to treat contaminated mesh with local debridement, irrigation, mesh removal, and systemic antibiotics, but it is still important to remember that prevention is always preferable than treatment.

Yildirim M et al (2009)[35] undertook a research to examine the risks involved in the intraperitoneal mesh repair operation as well as any issues that may arise after it. 25 individuals who had Intraperitoneal mesh repair surgeries had their records examined. Medical records were used to gather information on the patient's age, sex, hernia size and origin, postoperative mortality, and morbidity with a focus on complications. The initial procedure was a cholecystectomy in 15 cases (60%) of the 25 patients (7 men, 18 women), gynaecological surgery in 2, stomach surgery in 2, and umbilical hernia in 2. Twenty instances (80%) had midline incisions, two had transverse incisions, and three had laparoscopic port sites. The hernia was 150 cm2 on average in size. Four (16%) patients had local problems. Three patients experienced wound infection following surgery, and one patient experienced a haemorrhage. The median

postoperative hospital stay was 6 days, but it might have been as long as 25 days. During the follow-up period of 28 months, there was no recurrence. With acceptable morbidity and no recurrence, tension-free incisional hernia repair with polypropylene mesh in intraperitoneal position is a safe and simple operation.

Fischer J et al (2016)[36] Conducted a study on risk model and cost analysis of incisional hernia after elective, abdominal surgery based upon 12,373 cases. There were 12,373 cases in all with a 3.5% incidence of Incisional Hernias who underwent surgery (follow-up 32.2 26.6 months). Over $17.5 million was spent on the surgical treatment of Incisional Hernias and the care of related comorbidities. Obesity (HR = 1.96) amongst others were notable independent risk factors for Incisional Hernias. Study revealed that an internally verified preoperative risk model of surgically treated Incisional Hernias following 12,000 elective intraabdominal surgeries, which can help with more personalised risk counselling and better guide evidence-based algorithms for the use of synthetic mesh.

Loftus TJ et al (2017)[37] did a four-year retrospective cohort investigation on 50 patients who had hernioplasty for acutely incarcerated Abdominal Wall or Inguinal hernias. They examined the prevalence of chronic diseases, the severity of recent illnesses, CT results, postoperative care, and outcomes specific to hernioplasty within 180 days. More than 80% of the patients fell into an ASA class III or IV, 28% smoked regularly, and the average patient had a BMI 35 or more. 54 percent of the participants had ventral hernias, 40 percent had inguinal hernias, and 6 percent had femoral or inguinal/femoral hernias combined. Preoperative CT scans with characteristics that would indicate intestinal pathology such as free fluid, or fluid in the hernia sac comprised 70% of the images. 32% of patients had SSI. The greatest

indicators of SSI were initial heart rate 90 (OR 6.3, 95% CI 1.1-34), BMI >35 (OR 5.8, 95% CI 1.2-28), and CT evidence of fluid in the hernia sac (OR 8.3, 95% CI 1.7-41). Patients with CT indications of fluid in the hernia sac had substantially higher SSI rates (56% vs. 19%, p=0.012). The best predictor of SSI was CT evidence of fluid in the hernia sac, which was followed by HR and Body Mass Index These variables work together to identify people at high risk for SSI who requires more effective preventative measures without compromising durability.

Basheer et al (2018)[38] compared the short-term outcomes of open ventral hernia repair (OVHR) with laparoscopic ventral hernia repair (LVHR) in a research (OVHR).The average age of the 20 patients who had LVHR was 43.60 8.18 years, and 60% of them were female. 20 patients with a mean age of 48.40 9.45 years underwent OVHR; half of the patients were female. Laparoscopic surgery took less time to complete (86 min) than open surgery (91 min). One example alone had a laparoscopic surgery modified to an open repair. No severe visceral or vascular damage occurred, and neither group experienced a recurrence. When compared to the OVHR group, the percentage of patients who needed extra analgesics was 65%, as opposed to 30% in the LVHR group (P=0.027). The laparoscopic group's mean LOS was shorter than the open hernia group's (1.15 vs. 4.55 days; P=0.002) (1.15 vs. 4.55 days). Compared to the laparoscopic group, more wound infections (15%) occurred in the open group (P=0.292). LVHR is superior to open repair because it has fewer postoperative side effects, a quicker discharge, a quicker return to normal activities, a lower incidence of postoperative problems, and a more pleasing aesthetic result.

Lindmark MK et al (2018)[39] conducted a study to find out the potential danger signs after ventral hernia surgery, such as early surgical complications, the requirement for ICU treatment, and readmission. Their hypothesis was that there is a correlation between certain characteristics, such as the size of the hernia, a BMI greater than 35, concurrent bowel surgery, an ASA class, age, gender, and the kind of hernia repair, and an increased complication rate after ventral hernia repair. Around 81 patients out of 408 had a recorded complication, or 20%. Clavien I-IIIa complications were found in 58 (14% of these), and Clavien IIIb-IV complications in 19 instances. A higher likelihood of an early problem was linked to large hernia size. Hernia size and modified Clavien outcome class have a proportionate connection, according to the Kendall Tau test (p 0.001). Age, concurrent intestinal surgery, hernia recurrence, technique, ASA-class, and morbid obesity were not statistically significant predictors of adverse outcomes. They concluded that prior to surgery, individuals with ventral hernias must have a thorough assessment to determine their risk of post-operative problems, including the size of their hernia aperture. These findings point to the need for caution while using watchful waiting principles and delaying hernia treatment in order to lose weight. Delaying your treatment might put you at risk for consequences from a growing hernia.

Angela KM (2018)[40] performed a review study to identify variables that increase the likelihood of mesh infection following abdominal wall restoration and the best methods for surgical prevention and treatment. They found that smoking, being overweight, having diabetes, and having COPD are all patient-related risk factors for mesh infections. It's important to take into account surgical risk factors such extensive operating times and previous enterotomies. Prevention tactics place a strong emphasis on reducing risk factors that can be changed, such as obesity, diabetes, and other

comorbidities. In polluted fields, biologic or biosynthetic mesh is advised, and high-risk patients may benefit from delayed wound closure or vacuum-assisted closure treatment. Negative-pressure vacuum-based therapy, percutaneous or surgical drainage, and antibiotics have had only sporadic results in mesh salvage. A mesh infection frequently necessitates mesh removal and then abdominal wall repair. Although final hernia repair using biologic mesh has shown promising outcomes, staged treatments are also an option.

Testaldi L (2019)[41] examined the connection between BMI and wound ailments after mesh open ventral hernia repair (OVHR).The included patients had a median age of 58, a median BMI of 31.3 kg/m2, and a median defect diameter of 7 cm. Artificial mesh was frequently used as a sub-lay in repairs (89%).

SSOPI was 6.7%, and the SSI rate was 4.5%. Increases in BMI were correlated with higher relative log-odds for SSI and SSOPI ($p = 0.01$) and proportionally higher relative log-odds for complications. They came to the conclusion that following OVHR, SSI and SSOPI relative log-odds gradually rise with increasing BMI. To find out if preoperative weight loss might lessen the effects of this connection, more research is required.

Zhuo Y et al (2020)[42] Surgical site infections risk variables were examined for those who underwent elective mesh repair of IH. In their retrospective study on 1177 adult patients who underwent elective mesh repair of IH (without prophylactic antibiotic therapy), there were 530 laparoscopic and 647 open IH repairs included. In the absence of antibiotic prophylaxis, the total SSI rate within 1 month of operation was 3.2% (39/1342 hernias). The postoperative duration of SSI was adversely connected with the preoperative NLR and platelet-lymphocyte ratio (PLR) ($r = -0.368$, $P =$

0.021; r = -0.334, P = 0.038, respectively). BMI more than 24.6 kg/m^2 was significantly associated with postoperative SSI on multivariate analysis, as were current smoking , preoperative NLR > 1.97, and open surgery. They concluded that elevated BMI and current smoking are two manageable risk factors that may assist identify individuals who are at high risk of SSI and enable focused preventative actions. A heretofore unreported predictor for SSI following elective mesh repair of IH is preoperative NLR > 1.97. The scope of their impact has to be further investigated.

Wilson RB et al (2022)[43] undertook a research to give a narrative evaluation of Wound infection following hernioplasty and the effect of perioperative prevention measures. They discovered that mesh infection is a highly morbid side effect following hernia surgery and is linked to hospital readmission, elevated medical expenses, re-do surgery, hernia recurrence, diminished QOL, and plaintiff lawsuit. A national programme to improve the quality of surgery is run by the American College of Surgeons. They found that patients with large, complicated ventral hernias that need open surgery and several concurrent systemic diseases, older age, ASA score III, malnutrition, DM, immunosuppression, cigarette use, or BMI>35 kg/m2 are particularly at risk of SSIs. Tobacco cessation, diabetes management, and weight loss are all parts of pre-operative patient optimization. The management of fomite-mediated transmission in the operating room and the avoidance of mesh contamination with S. aureus CFUs are particularly relevant aspects of intraoperative therapies. Strategies for risk management should also focus on the biological niches that support bacterial survival and subsequent biofilm development on implanted mesh.

Quiroga-AC et al (2022)[44] conducted a retrospective cohort study to examine the prevalence, contributing variables, and results in patients having mesh-assisted incisional herniorrhaphy with an early infection diagnosis. All adult patients receiving incisional herniorrhaphy from 2010 to 2015 were identified using hospital discharge information from the National Inpatient Sample (NIS) of the United States of America. Finally, logistic and linear regression models of the "stepwise forward" type, depending on the type of dependent variable, were used to assess the relationship between the diagnosis of mesh infection and unfavourable outcomes. Bivariate and multivariate logistic regression models were used to assess risk factors in early mesh infection. There were 63,925 patients included in all. The prevalence of early mesh infection was 0.59%, with comorbidities (obesity, protein-calorie malnutrition, deficiency anaemia, and depression) and clinical surgical variables as related factors (peritoneal adhesions, intestinal resection, laparoscopic surgery and no surgical site infections) and management of healthcare. They concluded that although uncommon, early infection is linked to a greatly elevated risk of consequences. The frequency and effect of infection in patients with mesh incisional herniorrhaphy are significantly reduced and mitigated by pre-surgical optimization based on risk factors for this undesirable event.

METHODOLOGY

Source of Data

Patients who were admitted to KLES PRABHAKAR KORE HOSPITAL AND MRC, BELAGAVI and undergoing Open Mesh Hernioplasty for incisional hernia

Method of Collection of Data:

- Study Design: Longitudinal study-
- Study Period: January 2021 - December 2021
- Sample Size: Using Cochran's formula

$$n = \frac{18 \times (100 - 18) \times (1.96)^2}{10^2}$$

$$n = 56.70 \approx 57$$

n is the sample size required, p is the percentage occurrence of a state or condition (proportion or prevalence), E is the percentage maximum error required, Z is the value corresponding to level of confidence required.

Prevalence of wound infection assumed as 18%, with 95% confidence and 10% error,

Inclusion Criteria

- Patients admitted for Open Hernioplasty for incisional hernia in the Dept. of Gen. Surg. in KLES PRABHAKAR KORE HOSPITAL AND MRC, BELAGAVI.

- Both adult males and females >18 years who are consenting will be included in the study.

Exclusion Criteria

- Patients younger than 18 years
- Hemoglobin < 8 gm/dl
- Uncontrolled diabetes mellitus.
- Chronic Kidney Disease
- Chronic Liver Disease and patients on steroids or chemotherapy - both malignant and non-malignant cases.
- Non-consenting patients.
- Pregnant and lactating women.

Method

- After admission, a detailed history and clinical examination was done for all the patients.
- Basic pre-op investigations were done including pre-operative serum albumin levels.
- Anthropometry – height and weight recorded. BMI was calculated
- Follow up till discharge from the hospital and till 30 days post operatively in out-patient. Wound assessment to be done on Day 3, 5, 7 and 30. South Hampton Wound Grading system was used for wound assessment.

PROCEDURE:

All patients underwent Open Mesh Hernioplasty Surgery under General/Spinal Anaesthesia.

Follow up of the cases was done post operatively and wound was assessed for signs of infection by a senior consultant surgeon. Wound was graded using South Hampton wound grading system.

Statistical Analysis:

Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram.

The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance.

P value < 0.05 was considered statistically significant. Data was analysed by using coGuide software, V.1.01.

RESULTS

Total subjects-60

Table 3: Age in the study population (N=60)

Name	Mean ± S.D	Median	Min.	Max.	95% CI	
					Low. CI	Upp. CI
Age	50.58±10.15	50.00	25.00	73.00	48.02	53.15

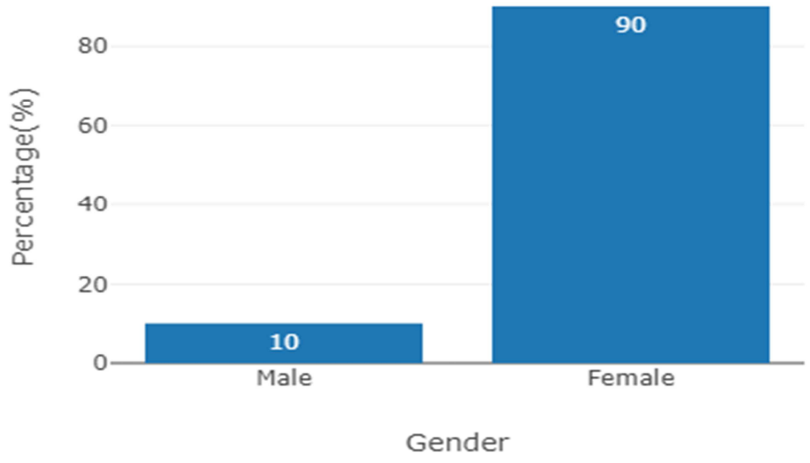
The mean age (years) was 50.58 ± 10.15 in the study population, ranged between 25 to 73 (95% CI 48.02 to 53.15). (Table 3)

Table 4: Gender in the study population (N=60)

Gender	Freq.	Percentage
Male	6	10.00%
Female	54	90.00%

Among the study population, 6 (10.00%) participants were male and remaining 54 (90.00%) participants were female. (Table 4 & Figure 5)

Figure 5: Bar chart of gender in the study population (N=60)



Duration of Complaints

Table 5: Present Duration (years) in the study patients (N=60)

Name	Mean ± S.D	Median	Minimum	Maximum	95% CI	
					Lower CI	Upper CI
Present Duration (years)	1.61±2.52	0.59	0.01	12.00	0.98	2.25

`The mean present duration (years) was 1.61 ± 2.52 in the study population, ranged between 0.01 to 12 (95% CI 0.98 to 2.25). (Table 5)

Table 6: Site of hernia in the study population (N=60)

Site	Freq.	%
L1	2	3.33%
L2	6	10.00%
L3	3	5.00%
M2	8	13.33%
M3	2	3.33%
M4	39	65.00%

Among the study population, majority of 39 (65.00%) participants had M4 site, followed by 8 (13.3%) participants had M2 site, 6 (10.00%) participants had L2 site, 3 (5.00%) participants had L3 site and 2 (3.33%) participants had L1 and M3 site for each respectively. (Table 6)

Table 7: Descriptive analysis of Reducibility in the study population (N=60)

Reducibility	Frequency	Percentage
Yes	47	78.33%
No	7	11.67%
Partially	6	10.00%

Among the study population, 47 (78.33%) participants had reducibility, 7 (11.67%) participants had no reducibility and 6 (10.00%) participants had partially reducibility. (Table 7 & Figure 6).

Figure 6: Pie chart of Reducibility in the study population (N=60)

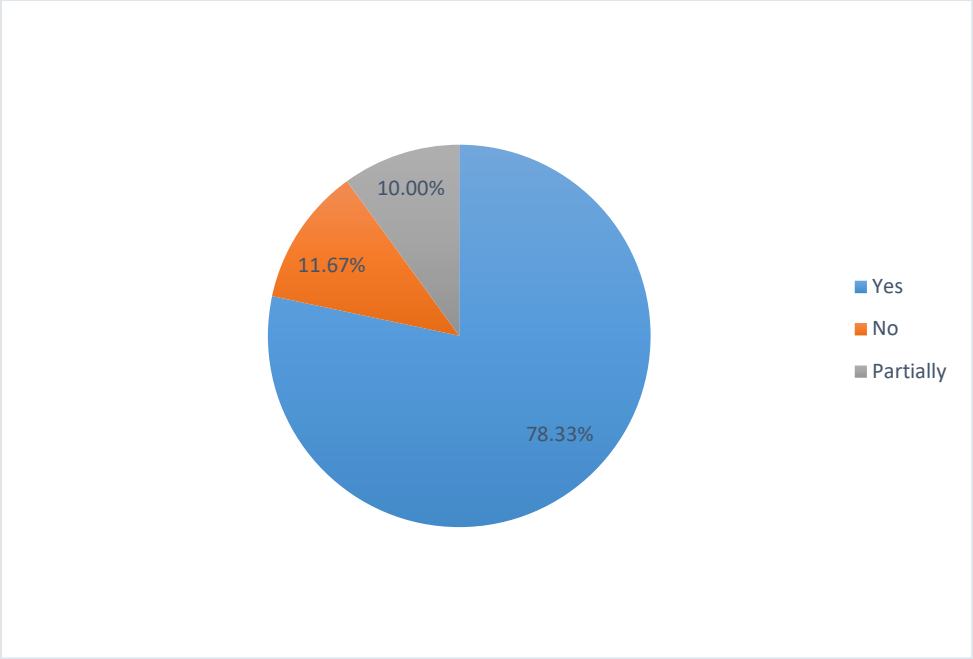


Table 8: Complication in the study population

Complication	Frequency	Percentage
Nil	60	100.00%

Table 9: Descriptive analysis of Previous Duration (years) in the study population (N=60)

Name	Mean ± S.D	Median	Min.	Max.	95% CI	
					Lower CI	Upper CI
Previous Duration (years)	10.32±8.87	8.50	0.50	39.00	8.08	12.56

The mean previous duration (years) was 10.32 ± 8.87 in the study population, ranged between 0.5 to 39 (95% CI 8.08 to 12.56). (Table 9)

Body Mass Index

Table 10: Descriptive analysis of anthropometric parameters in the study population (N=60)

Name	Mean ± S. D	Median	Minimum	Maximum	95% CI	
					Lower CI	Upper CI
Height (cm)	158.75±7.95	158.00	146.00	178.00	156.74	160.76
Weight (kg)	63.85±11.94	61.50	46.00	90.00	60.83	66.87
BMI	25.26±3.69	25.13	19.23	36.50	24.33	26.20

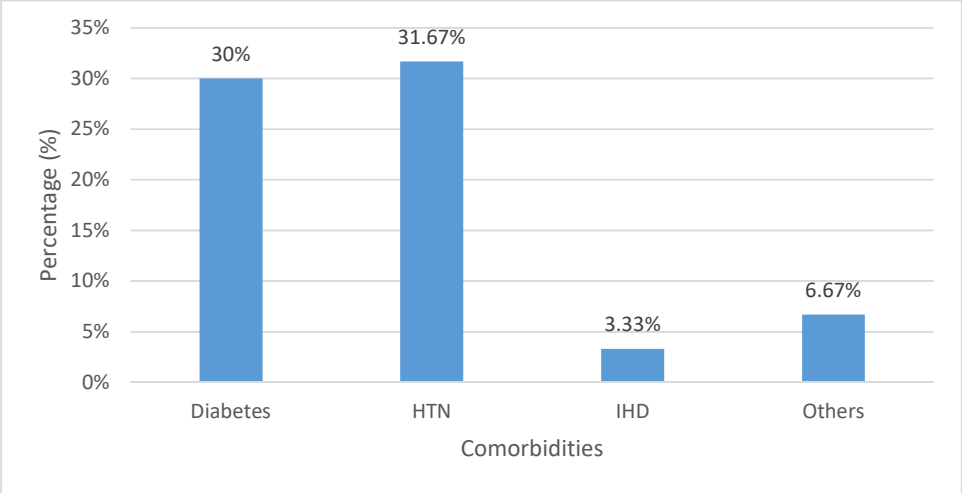
The mean height (cm) was 158.75 ± 7.95 in the study population. Ranged between 146.00 cm to 178.00 cm (95% CI 156.74 to 160.76). The mean weight (kg) was 63.85 ± 11.94 in the study population. Ranged between 46 kg to 90 kg (95% CI 60.83 to 66.87). The mean BMI was 25.26 ± 3.69 in the study population. Range between 19.23 to 36.50 (95% CI 24.33 to 26.20). (Table 10)

Table 11: Comorbidities in the study population (N=60)

Parameter	Freq.	Percentage
Diabetes		
Yes	18	30.00%
No	42	70.00%
Hypertension		
Yes	19	31.67%
No	41	68.33%
Ischaemic Heart Disease		
Yes	2	3.33%
No	58	96.67%
Others		
Yes	4	6.67%
No	56	93.33%

Among the study population, 18 (30.00%) participants had diabetes, 19 (31.67%) participants had hypertension, 2 (3.33%) participants had IHD and 4 (6.67%) participants had other comorbidities. (Table 11 & Figure 7).

Figure 7: Bar chart of comorbidities in the study population (N=60)



Haemoglobin and Blood glucose

Table 12: Descriptive analysis of Parameters in the study population (N=60)

Parameters	Mean ± S.D	Median	Minimum	Maximum	95% CI	
					Lower CI	Upper CI
Haemoglobin (g/dl)	12.56±1.33	12.60	10.00	15.30	12.22	12.89
RBS (mg/dl)	117.92±16.29	118.00	85.00	155.00	113.79	122.04

The mean Haemoglobin (g/dl) was 12.56 ± 1.33 in the study population. Ranged between 10.00 to 15.30 (95% CI 12.22 to 12.89). The mean RBS (mg/dl) was 117.92 ± 16.29 in the study population. Ranged between 85 to 155 (95% CI 113.79 to 122.04). (Table 12).

Table 13: Descriptive analysis of Anti-Coagulant use in the study population (N=60)

Anti-Coagulant use	Frequency	Percentage
Yes	5	8.33%
No	55	91.67%

Among the study population, 5 (8.33%) participants were used anticoagulants and remaining 55 (91.67%) did not. (Table 13)

Factors under evaluation

Table 14: Descriptive analysis of BMI groups in the study population (N=60)

BMI groups	Frequency	Percentage
Underweight (<18.5)	0	0.00%
Normal range (18.5-22.9)	18	30.00%
Overweight (23-24.9)	11	18.33%
Obese I (25-29.9)	24	40.00%
Obese II (>30)	7	11.67%

Among the study population, 18 (30.00%) participants were in normal range, 11 (18.33%) were in overweight, 24 (40.00%) were in obese I and 7 (11.67%) were in obese II. (Table 14 & Figure 8)

Figure 8: Pie Chart of BMI groups in the study population (N=60)

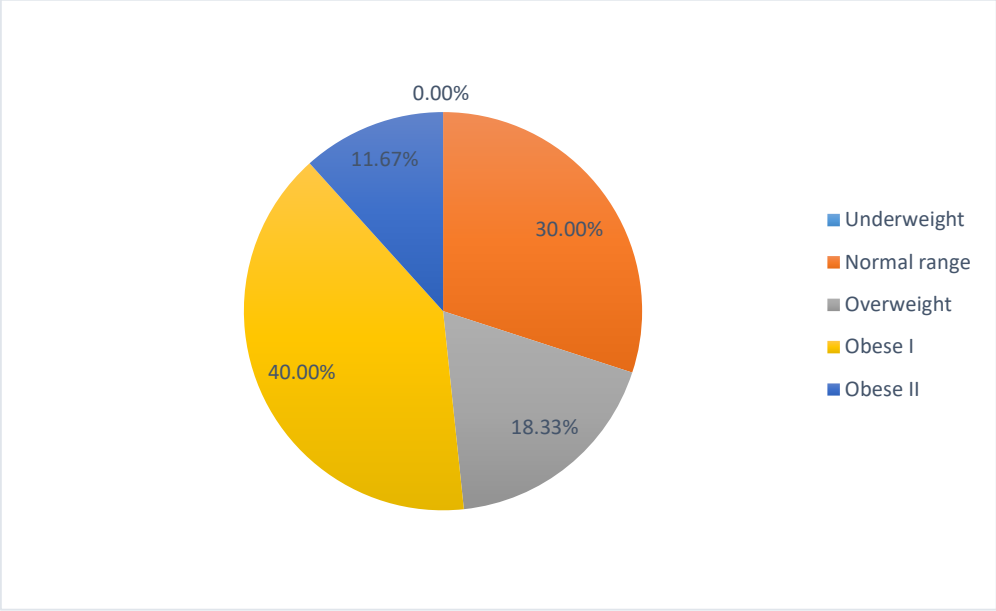


Table 15: Descriptive analysis of Serum albumin group in the study population (N=60)

Serum albumin group	Frequency	Percentage
Low	14	23.33%
Normal	46	76.67%

Among the study population, 14 (23.33%) participants were in low albumin group and remaining 46 (76.67%) participants were in normal albumin group. (Table 15 & Figure 9)

Figure 9: Bar Chart of Serum albumin group in the study population (N=60)

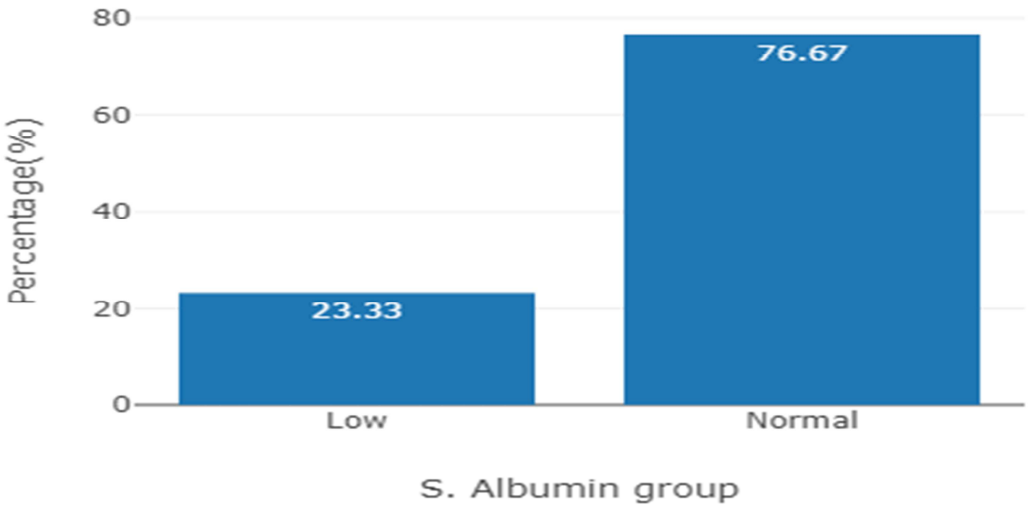


Table 16: Descriptive analysis of Wound Infection in the study population (N=60)

Wound Infection	Frequency	Percentage
Yes	3	5.00%
No	57	95.00%

Among the study population, 3 (5.00%) participants had wound infection and 57 (95.00%) participants had no wound infection (Table 16).

Wound Score

Table 17: Descriptive analysis of Wound Score in the study population (N=60)

	Wound score at Day 3	Wound score at Day 5	Wound score at Day 7	Wound score at Day 30
Some bruising	8(13.33%)	18(30.00%)	0(0.00%)	0(0.00%)
Considerable bruising	8(13.33%)	4(6.67%)	0(0.00%)	0(0.00%)
Mild erythema	2(3.33%)	0(0.00%)	0(0.00%)	0(0.00%)
At one point	4(6.67%)	5(8.33%)	0(0.00%)	0(0.00%)
Around sutures	0(0.00%)	1(1.67%)	0(0.00%)	0(0.00%)
Along wound	0(0.00%)	2(3.33%)	0(0.00%)	0(0.00%)
Around wound	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)
At one point only (<=2cm)	0(0.00%)	0(0.00%)	1(1.67%)	0(0.00%)
Along wound (>2cm)	0(0.00%)	0(0.00%)	2(3.33%)	2(3.33%)
Normal healing	34(56.67%)	30(50.00%)	54(90.00%)	57(95.00%)
Normal healing with mild bruising	4(6.67%)	0(0.00%)	0(0.00%)	0(0.00%)
Normal bruising	0(0.00%)	0(0.00%)	3(5.00%)	
Deep or serve wound infection with or without tissue	0(0.00%)	0(0.00%)	0(0.00%)	1(1.67%)

Among the study population the majority of 34 (56.67%) and 30 (50.00%) participants had normal healing at day 3 and day 5. The majority of 54 (90.00%) and 57 (95.00%) participants had normal healing at day 7 and day 30. (Table 17)

Table 18: Descriptive analysis of Previous Surgery in the study population (N=60)

Previous Surgery	Frequency	Percentage
Ovarian Surgery		
Right Ovarian Mass	1	1.67%
Oopherectomy	1	1.67%
Ovarian mass excision	2	3.33%
Ovarian cystectomy	2	3.33%
Exploratory Laparotomy	11	18.33%
Caesarian Sections		
LSCS	1	1.67%
Prev. 3 LSCS	1	1.67%
LSCS/ Appendicectomy	1	1.67%
LSCS/Hysterectomy	1	1.67%
Classical LSCS	7	11.67%
Appendicectomy	4	6.67%
Other		
Hysterectomy	14	23.33%
Cystogastrostomy	1	1.67%
Myomectomy	4	6.67%
Ileal Resection	1	1.67%
AWR	1	1.67%
Tubal Ligation	1	1.67%

? Diaphragmatic Hernia Repair	1	1.67%
TAH+ Appendicectomy	2	3.33%
Hysterectomy with Colostomy	1	1.67%
Tubectomy	1	1.67%
Open Cholecystectomy	1	1.67%

Among the study population, 6 (10.01%) participants were in ovarian surgery, 11 (18.34%) participants were in exploratory laparotomy surgery, 11 (18.35%) participants were in LSCS surgery, 4 (6.67%) participants were in appendicectomy surgery and 28 (46.69%) participants were in other surgery. (Table 18 & Figure 10).

Figure 10: Bar chart of Previous Surgery in the study population (N=60)

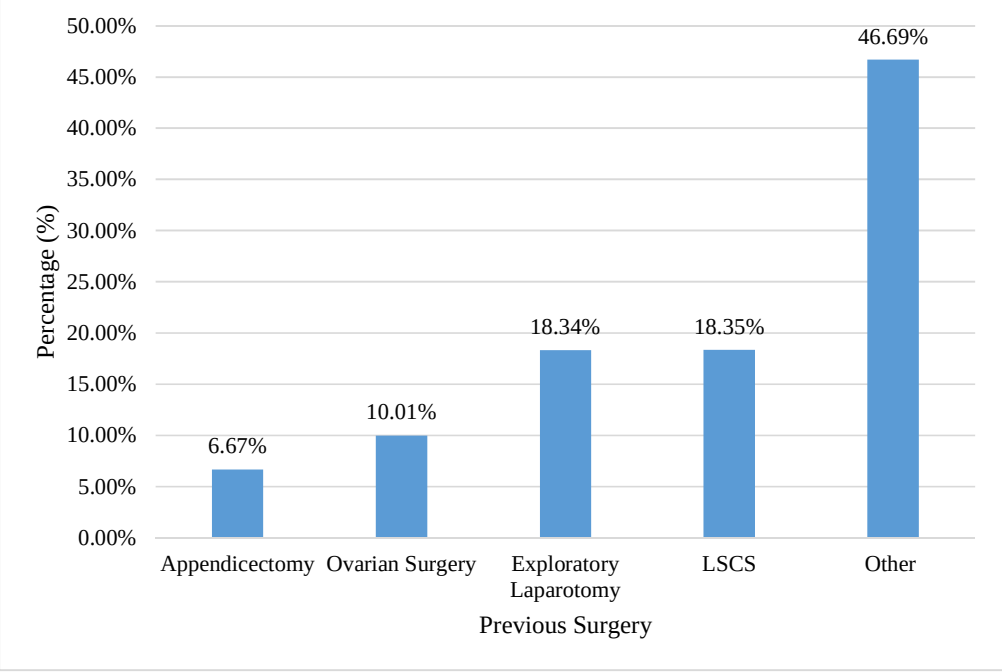


Table 19: Comparison of BMI group with wound infection in the study population (N=60)

BMI group	Wound Infection		Chi square value	P value
	Yes	No		
Normal range (N = 18)	1 (5.56%)	17 (94.44%)	0.60	0.7391
Overweight (N = 11)	1 (9.09%)	10 (90.91%)		
Obese (N=31)	1 (3.23%)	30 (96.77%)		

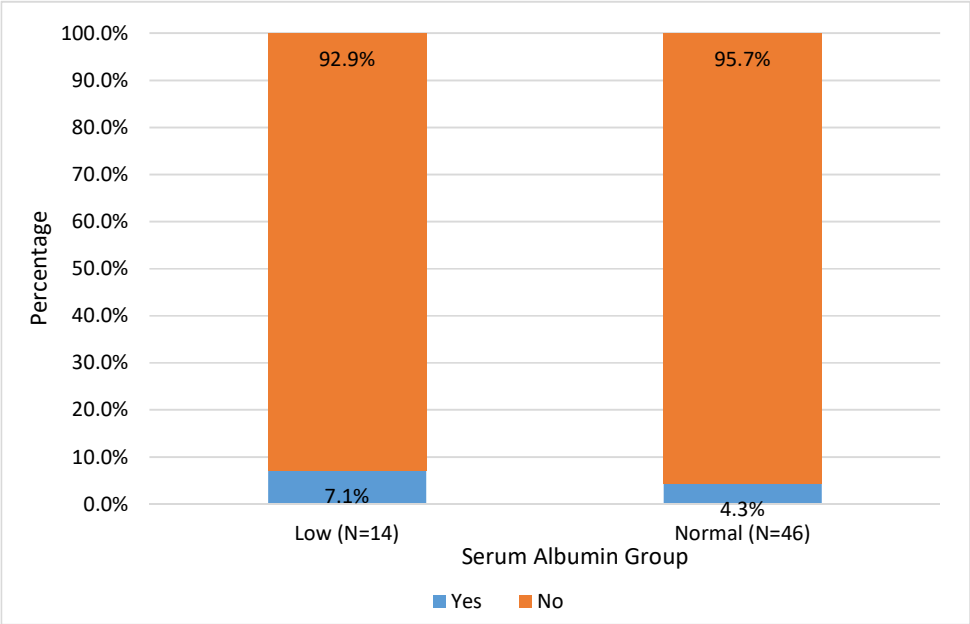
The difference in wound infection between BMI group was found to be insignificant with a **P- value of 0.7391.** (Table 19)

Table 20: Comparison of Serum albumin group with wound infection in the study population (N=60)

Serum albumin group	Wound Infection		Chi square value	P value
	Yes	No		
Low (N = 14)	1 (7.14%)	13 (92.86%)	0.18	0.5564
Normal (N = 46)	2 (4.35%)	44 (95.65%)		

The difference in wound infection between Serum albumin group was found to be insignificant with a **P- value of 0.5564** with majority of 2 (4.35%) participant were normal serum albumin group (Table 20 & Figure 11)

Figure 11: Grouped bar chart of comparison of Serum albumin group with wound infection in the study population (N=60)



DISCUSSION

Hernias are one of the most common entity which a General surgeon comes across in modern medicine. With an ever evolving timeline, the surgical options available in management of Hernias is vast. Introduction of Minimal Invasive surgery as well as Robotic Surgery has widened the spectrum of management modalities to another extent. In a country like our, where resources in Public health sector are limited, Open hernia repairs is still widely practised. There have been studies which have shown the superiority of these newer modalities in terms of complications, however its extrapolation in the Indian population is still not well documented.

Incisional hernias which account for 2-20% of ventral hernias [45-49] require an advanced surgical management as the anatomy is distorted and history of previous surgery renders the tissue weak and susceptible as compared to a virgin abdominal wall. Various complications such are recurrence and even life threatening complications such as surgical site infections pose a serious burden to the patient, the doctor and the health care system. The mortality associated with this particular complication poses a 2-3 times increased mortality.[50]

We conducted a 1 year prospective cohort study at a tertiary care centre in Southern part of Karnataka, India, the aim of which was to assess the impact of certain risk factors on the post-operative complication rates. Correction of these risk factors especially in elective surgical scenario can help reduce the risk of such complications. A total of 60 patients were studied.

Most of the patients were females with the previous surgical scar in lower abdomen -70%. Lower abdomen scars tend to be weaker than those above the umbilicus due to its thinner character and high pressure characteristics.

5% patients developed Surgical Site infection which was within the incidence of many previous studies, however a wide range ranging from 3% to 30 % has been described.

Wound healing is a complex procedure and involved many factors. These factors are distributed unevenly amongst different populations, thus explaining this wide range.

70% of our patients had a BMI of over 24, classifying them at either risk of obesity or Obese which was similar to many other studies quoted previously. This can be attributed to the fact that Obesity in itself is a risk factor for developing of Incisional hernias in the first place.

Incisional hernias in low BMI populations have also been noted, but mostly in the Eastern population.

This is in concordance with study conducted by Testaldi L. [41] which had an average BMI of 31.3% and similar wound infection rates to our study (4.5%). Zhuo et all demonstrated similar rates of SSI in obese patients and attributed higher BMI as a risk factor for SSIs.

2 patients belonging to High BMI groups developed wound infection with a p value of 0.7391. Even though Significance has been documented in the aforementioned studies, our study failed to prove any statistical significance.

The reason for this might be a varied population and presence of other variables which have not been taken into consideration by us and many others.

There are many plausible explanations how obesity can contribute to development of wound infections. Tissue hypo-perfusion, Difficult surgeries, longer operating time, involved fat necrosis and dead space formation etc.

Usage of Indwelling devices such as vacuum drains for post op drainage also pose a risk of infection and can be avoided in leaner individuals as opposed to obese patients.

Works of Dunne, Kaoutzanis C. et al, Wilson et al, suggest that malnutrition also plays an important role in occurrence of wound infection in Hernia surgeries. Low S. Albumin levels is one correctable entity that can effectively indicate the nutritional status of a patient. 14% of the patient population in this study had Low Serum Albumin levels. 1 patient developed wound infection which might suggest a predilection with support of other mentioned studies, however the statistical significance of the same could not be proved in our study.

Proteins act as the building blocks of the body and its utilisation in wound healing is very well known. Malnutrition can affect wound healing as any surgical stress to the body is a catabolic phenomenon. Thus the already low protein levels can be further depleted and may sometimes be insufficient for what is required to heal effectively.

Factors such as emergency surgery, complicated hernias, obstructions and bowel perforations have also been shown to adversely affect wound healing. No such patient reported to us and hence these factors have been excluded from this discussion.

Our data, even though suggests a vague association between the risk factors under study and the outcome, statistical significance was not proved.

The study warrants further discussion in domain of case collection and Interpretation. The prospective nature of this study allowed better diagnosis of SSI as compared to a retrospective diagnosis as no incomplete variable points were noted. The usage of a standard system and protocol for wound assessment i.e. the South Hampton Wound grading system also prevented any inaccuracies.

Correction of Obesity before surgery leads to better Glycaemic values, early mobilization and ambulation, lower nosocomial infections and an improvement in general post-operative recovery.

Similarly adequate nutrition may help in better post-operative recovery, better response of the body to any surgical stress and faster wound healing.

Correction of these factors along with other factors should always be considered, especially in an elective setting such as Uncomplicated Hernias.

CONCLUSION

The association between deranged nutritional indices and Incidence of wound infection could not be significantly proved in the current study. Indicators of Malnutrition such as Low BMI and Low Serum Albumin as well as that of Obesity, namely high BMI may indicate a certain predilection to causing wound infection, however further studies are required to prove its significance.

SUMMARY

Wound healing is a complex process, the fate of which is dictated by many factors. Recognition and Correction of factors which may interfere with proper wound healing can help prevent post-operative complications such as wound infection. This is important, especially in a setting of prosthetic mesh placement such as Incisional Hernia repairs.

This study was conducted in a tertiary Care centre in North Karnataka where an attempt was made to correlate the preoperative BMI and Serum Albumin levels to incidence of post operative wound infection. A total of 60 patients were enrolled between January 2021 and December 2021. Pre-operative Nutritional status assessment was done using Body Mass Index and Serum Albumin levels. All patients had uncomplicated Hernias and underwent Open Hernia repair surgery. Post operatively wound was assessed using South Hampton Wound scoring system and wounds were inspected for signs of infections.

3 out of 60 patients developed wound infection out of which one belonged to Normal BMI group and 2 had high BMI. 1 out of 3 patients had low Serum Albumin levels.

Statistical analysis revealed no significant association between BMI, Serum Albumin and incidence of wound infections in patient undergoing Hernioplasty for Incisional hernias.

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ANNEXURE I- INFORMED CONSENT

CONSENT FOR PARTICIPATION IN RESEARCH STUDY

Mr/Mrs/Miss. _____, we are requesting you to enroll yourself in study titled." **PRE-OPERATIVE SERUM ALBUMIN AND BODY MASS INDEX AS PREDICTORS OF SURGICAL SITE INFECTIONS IN PATIENTS UNGERGOING OPEN MESH REPAIRS FOR INCISIONAL HERNIAS**", conducted by Dr._____, Post Graduate in M.S. General Surgery under the guidance of Dr._____, Professor, Department of General Surgery, J.N. Medical College, Belagavi under KAHER, Belagavi.

Respected Sir/Madam,

We request you to participate in our study. Your participation in the research is voluntary. Your decision to participate in the study or otherwise will not affect the relationship with KLES Prabhakar Kore Hospital. If you decide not to participate, you are free to withdraw at any time. During the study, your operative outcome will be assessed by some questions.

Purpose of the study: To validate preoperative serum albumin and Body Mass Index as predictors of postoperative surgical site infection in Open Mesh Hernioplasty for incisional hernias. The principal investigator of the study is Dr._____, under the guidance of Dr._____.

Procedure Involved: If you agree to enroll yourself in this study, your detailed history will be taken and you will be clinically examined in detail. Investigations like Hemoglobin, Total Count, Differential Count, Platelet Count, RBS, Blood Urea, Serum Creatinine, Blood Grouping, Chest X-ray, ECG, USG Abdomen and Pelvis, required

for confirmation of your diagnosis and for your pre-operative work up will be done accordingly. After admission, a detailed history and clinical examination will be done for all the patients. Basic pre-op investigations will be done including pre-operative serum albumin levels. Anthropometry – height and weight recorded. BMI will be calculated Follow up till discharge from the hospital and till 30 days post operatively in out-patient. Wound assessment to be done on Day 3, 5, 7 and 30. South Hampton Wound Grading system will be used for wound assessment. Post-operative Surgical Site Infection will be assessed using Southampton Scoring System.

Risks and Benefits: There is no increased risk involved in being a part of this study and the complications are those which are normally anticipated. The results derived at the end of the study will possibly benefit all similar patients admitted in this hospital and elsewhere.

Withdrawing/removal from the study: The participant has freedom to withdraw from the study whenever he/she wishes and without any prior notice. Even if you decline to participate, there will not be any change in the line of your management or the relationship with your doctor. You will be told about all the information that affects your decision to participate in the study. The investigator may also exclude a participant from the study at any point of time.

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

1. In emergency to protect your rights and welfare.
2. If required by law.

Institutional/sponsors policy: If any unforeseen complications or injury occurs during the period of study, the participant will be given treatment within the limitations of KLES Prabhakar Kore Hospital.

Financial Incentives for participation: The participant neither gets any financial incentives during the period of study nor will be asked to pay for this study.

Authorization to Publish Results: When the results of the research are published, or discussed in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in this study that can be associated with your identity will remain confidential.

CONSENT STATEMENT

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

Subject Name : _____

Signature or Left Thumb Print of Subject : _____

Witness Name: _____ Signature: _____

Investigators Name: _____ Signature: _____

Date: _____

Place: _____

ANNEXURE II- PROFORMA

1. Patient name:
2. Patient IP no. ☐☐☐☐☐☐
3. Age (in years) ☐☐
4. Gender: 1. Male 2. Female ☐
5. Height (in cms): ☐
6. Weight (in kgs): ☐☐
7. BMI(kg/m^2): ☐
8. DOA (dd/mm/yy) ☐☐ ☐☐ ☐☐☐☐
9. DOD (dd/mm/yy) ☐☐ ☐☐ ☐☐☐☐
10. Date of interview (dd/mm/yy) ☐☐ ☐☐ ☐☐☐☐
11. Co-morbidities
12. BP :
13. Pulse Rate:
14. Pallor:
15. Icterus:

16. History: Swelling present (no. of days) ☐

Nature of swelling: 1. Reducible ☐

2. Non reducible ☐

17. Previous surgery:

18. Date of previous surgery:

19. On Examination: On palpation size of swelling (in cms) ☐

20. Nature: 1. Reducible ☐

2. Non-reducible ☐

21. Pain/tenderness: 1. Yes ☐

2. No ☐

22. CT/USG: Defect size: ☐

23. Serum Albumin level- ☐

Diagnosis:

ANALYSIS

BMI:

S. ALBUMIN

WOUND STATUS: BY POST OP DAY 30

INFECTED-

NOT INFECTED-

SOUTH-HAMPTON GRADE:

GRADE 0 Normal Healing

GRADE I Normal Healing with mild bruising or erythema

A Some bruising

B Considerable bruising

C Mild erythema

GRADE II Erythema plus other signs of inflammation

A At one point

B Around sutures

C Along wound

D Around wound

GRADE III Clear or Haemoserous discharge

A At one point only (<2cm)

B Along wound (>2cm)

C Large volume

D Prolonged (>3days)

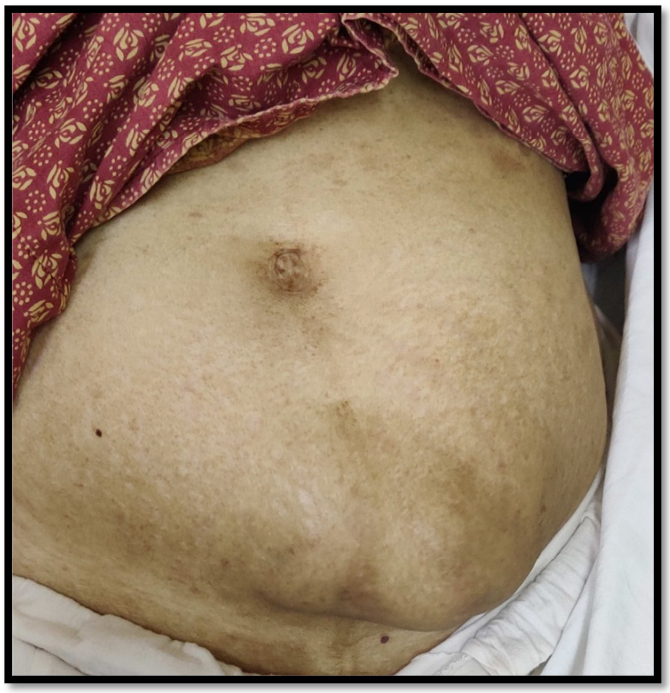
GRADE IV Pus

A At one point only (<2cm)

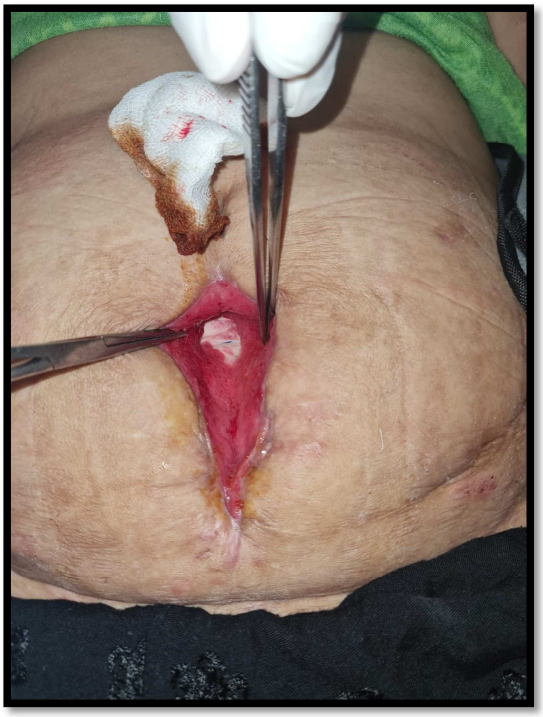
B Along wound (>2cm)

GRADE V Deep or severe wound infection with or without tissue breakdown; hematoma requiring aspiration

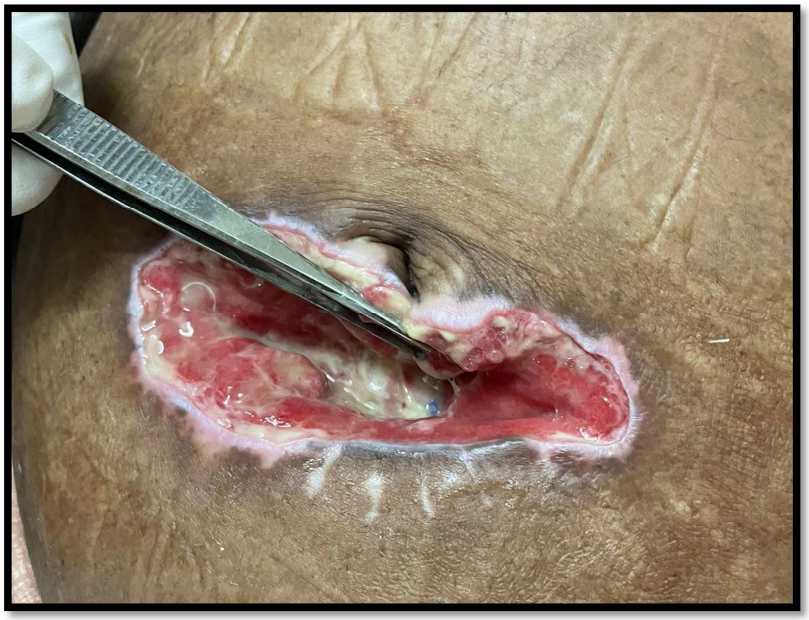
ANNEXURE III- PHOTOGRAPHS



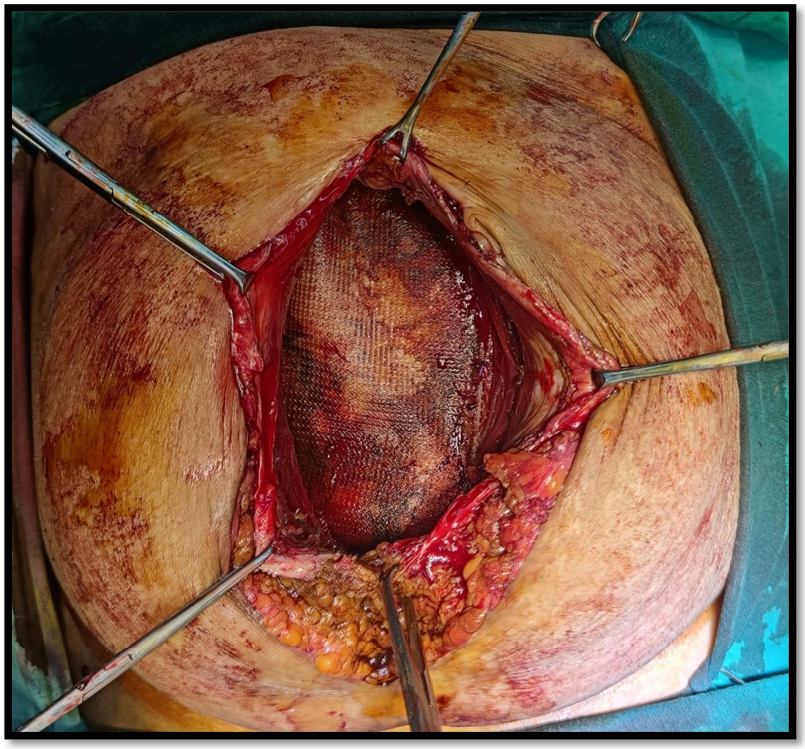
Incisional hernia from a lower midline scar



Wound Infection in an operated case of Incisional Hernia



Wound Infection in an operated case of Incisional hernia



Pre-peritoneal Mesh repair for incisional Hernia

ANNEXURE IV – MASTER CHART

Patient Details					Present complain- hernia					Previous Surgery				Co-morbidities				Other factors			Factors under evaluation		Outcome	Wound Score			
S.No	Name	Age	Sex	IP Number	Duration	Site	Size	Reducibilty	Complication		Duration	Height cms	Weight kgs	DIABETES	HTN	IHD	OTHERS	Hemoglobin	RBS	AC use	BMI	S. Albumin	Wound Infection	Day 3	Day 5	Day 7	Day 30
1	SP	55	F	1047388	1 year	L2	12x 13 cm	No	Nil	Hysterectomy	9 years	157	90	NO	YES	NO	NO	14.1	129	NO	36.5	3.9	No	0	1a	0	0
2	J T	60	F	1035605	2 months	M4	5 x 5 cm	Yes	Nil	Classical LSCS	20 years	154	76	NO	NO	NO	NO	13.2	145	NO	32	4.1	No	0	1a	0	0
3	S BA	60	F	1044130	2 months	L2	4 x 4 cm	Yes	Nil	Right Ovarian Mass	22 years	148	57	NO	NO	NO	NO	11.8	135	NO	26	4.1	No	1	1a	0	0
4	M K	50	F	1032983	1 month	M4	5 x 5 cm	Yes	Nil	Classical LSCS	23 years	158	67	NO	NO	NO	NO	12.5	138	NO	26	4.7	No	0	0	0	0
5	SLS	43	M	1038492	2 months	M2	3x 3 cm	Yes	Nil	Cystogastrostomy	11 years	170	77	YES	NO	NO	NO	13.6	129	NO	26	3.2	No	1a	1a	0	0
6	HD	57	F	1038781	3 months	M4	5 x 4 cm	Yes	Nil	Classical LSCS	12 years	159	70	NO	YES	NO	NO	11.6	118	NO	28	4.1	No	0	1a	0	0
7	MG	55	F	1045577	2 years	M4	6 x 7 cms	yes	Nil	Myomectomy	8 years	160	86	NO	NO	NO	NO	14.2	96	NO	33	3.9	No	0	0	0	0
8	MSB	38	F	1040855	2 months	M4	4 x 5 cms	No	Nil	Oopherectomy	1 year	148	50	NO	NO	NO	NO	13.9	91	NO	22.8	4.1	No	1b	1b	0	0
9	MD	66	F	1044764	7 days	M2	5x 3 cms	No	Nil	Ileal Resection	2 years	151	48	YES	YES	NO	NO	10.1	125	YES	21.1	3.7	No	1a	1a	0	0
10	LD	44	F	1044067	2 years	M4	3 x 4 cms	Yes	Nil	Hysterectomy	2.5 years	150	46	NO	NO	NO	NO	12.3	110	NO	23.4	4	Yes	2a	2c	3b	4b
11	JB	33	F	1066431	2 years	M2	9 x 8 cms	Partially	Nil	Exploratory Laparotomy	2.5 years	152	56	NO	NO	NO	NO	13.8	136	NO	24.2	3.9	No	0	0	0	0
12	LM	52	F	1061838	1 month	M2	15x 10 cms	Partially	Nil	Exploratory Laparotomy	3 years	158	61	YES	NO	NO	NO	12.9	147	NO	24.4	4.5	No	2a	2a	1a	0
13	NP	52	F	1058113	3 years	M4	6x 4 cms	Yes	Nil	Left ovarian cystectomy	5 years	161	54	YES	NO	NO	NO	12.5	139	NO	20.8	2.9	No	0	1a	0	0
14	ST	59	F	1056996	10 years	M4	4 x 3 cms	Yes	Nil	Classical LSCS	35 years	170	88	NO	YES	NO	YES	10.8	104	NO	30.4	4.4	No	0	0	0	0
15	JSH	46	F	1038906	6 months	M4	6 x 4 cms	Yes	Nil	Hysterectomy	2 years	149	53	NO	NO	NO	NO	13.2	115	NO	23.9	4.2	No	1b	1a	0	0
16	GP	63	M	1065148	6 years	L3	10x 7	NO	Nil	AWR	6 years	168	78	NO	NO	NO	NO	12.8	132	NO	27.6	5	No	1b	0	0	0
17	ASD	53	F	1068902	15 days	M4	6x6 cms	Yes	Nil	Hysterectomy	15 years	153	57	NO	NO	NO	NO	14.3	118	NO	24.3	4	No	0	0	0	0
18	SNA	50	F	1062775	2 years	M4	3x3cms	Yes	Nil	Hysterectomy	2.5 years	150	58	YES	NO	NO	NO	10.3	106	NO	25.8	3.8	No	0	0	0	0
19	KB	43	F	1057457	2 months	M4	2 x 2 cms	Yes	Nil	Tubal Ligation	20 years	148	54	NO	NO	NO	NO	12.6	125	NO	24.7	3.9	No	1a	0	0	0
20	SDE	57	M	1046947	12 years	L1	6 x 4 cms	Partially	Nil	? Diaphragmatic Hernia Repair	14 years	176	90	YES	YES	YES	NO	13.5	105	YES	29.1	3.8	No	0	0	0	0
21	SMT	51	F	1040005	15 days	L2	10x 10 cms	No	Nil	LSCS/ Appendicectomy	11 years	152	61	NO	NO	NO	NO	13.7	102	NO	26.4	3.9	No	1b	0	0	0
22	SH	50	F	1059982	15 days	M4	4x2 cms	Yes	Nil	Classical LSCS	15 years	151	46	YES	NO	NO	NO	11.7	108	NO	20.2	4.2	No	0	1a	0	0
23	RAC	44	F	1071524	15 days	M4	4 x 3 cms	Yes	Nil	Classical LSCS	15 years	148	47	NO	YES	NO	NO	12.8	129	NO	21.5	3.6	No	1	0	0	0
24	AMG	25	F	1084202	3 months	M4	5 x 5 cms	Yes	Nil	Ovarian mass excision	6 months	156	48	NO	NO	NO	NO	12.2	118	NO	19.7	4.2	No	0	1b	0	0
25	SHU	38	F	1090117	1 year	M4	3 x 2 cms	Yes	Nil	LSCS/Hysterectom	10 years	160	61	NO	NO	NO	NO	14.8	117	NO	23.8	4.1	No	2a	2a	1a	0
26	NK	66	F	1092431	1 year	M4	4x5 cms	No	Nil	Ovarian mass excision	5 years	158	75	NO	NO	NO	NO	13.8	104	NO	30.6	3.8	No	0	1a	0	0

27	SS	50	F	1092644	1 year	M4	20x 15 cms	No	Nil	Hysterectomy	39 years	166	64	NO	NO	NO	YES	14.5	108	YES	23.2	3.3	No	0	0	0	0
28	KMT	50	F	1097522	2 months	M4	6 x 5 cms	Yes	Nil	Hysterectomy	8 years	170	66	NO	NO	NO	YES	10	142	NO	22.8	2.9	No	0	0	.	0
29	SAK	51	F	1100325	1 year	M4	3x1.5 cms	Yes	Nil	TAH+ Appendicectomy	20 years	159	70	YES	YES	NO	NO	12	135	NO	27.7	3.2	No	1a	2a	1a	0
30	MDV	44	F	1100353	1 year	M4	4 x 3 cms	Yes	Nil	TAH+ Appendicectomy	1 year	161	56	NO	NO	NO	NO	13	126	NO	21.6	3.1	No	1b	1a	0	0
31	BSH	54	M	1087179	2 months	M2	10 x 10 cms	Yes	Nil	Exploratory Laparotomy	12 years	172	70	NO	NO	YES	NO	10.6	130	YES	23.7	4.7	No	1a	0	0	0
32	SHI	34	F	1075781	7 years	M2	8x6 cms	Yes	Nil	Emergency Laparotomy	30 years	165	77	NO	NO	NO	NO	13.4	124	NO	28.3	5.1	No	1a	1a	0	0
33	SHO	62	F	1071309	8 years	L3	8x 6 cms	Yes	Nil	Open Appendiciectomy	7 years	165	71	YES	YES	NO	NO	15.1	111	NO	26.1	3.9	No	0	1a	0	0
34	GSJ	61	F	1116600	8 months	M4	15 x 10 cms	Yes	Nil	Hysterectomy with Colostomy	8 months	159	64	NO	NO	NO	NO	12.1	110	NO	25.3	4.1	No	1b	0	0	0
35	Y	48	F	1119495	1 year	M4	20x10 cms	Yes	Nil	Myomectomy	22 years	157	53	NO	NO	NO	NO	12.8	88	NO	215	2.8	No	0	0	0	0
37	YLW	50	F	1113654	3 years	M4	7 x 4 cms	Yes	Nil	Hysterectomy	11 years	156	68	NO	NO	NO	NO	10.3	96	NO	27.9	3.2	No	0	0	0	0
38	PC	53	F	1109145	2 years	M4	4 x 5 cms	Yes	Nil	Hysterectomy	12 years	154	53	NO	YES	NO	NO	11.2	98	NO	22.3	3.6	No	1b	1a	0	0
39	SBH	62	F	1113651	2 months	M4	10 x 10 cms	Yes	Nil	Exploratory Laparotomy	6 months	156	61	YES	NO	NO	NO	10.9	115	NO	25.1	3.4	No	0	1b	0	0
40	IG	65	F	1119260	15 days	M2	5 x 5 cms	Yes	Nil	Exploratory Laparotomy	11 years	148	47	NO	NO	NO	NO	12.3	128	NO	21.5	2.7	Yes	1c	2a	3b	5
41	AS	32	F	1091147	3 years	M4	8x6 cms	Partially	Nil	Hysterectomy	7 years	161	82	NO	NO	NO	NO	10.6	123	NO	31.6	4.4	No	0	0	0	0
42	GBM	41	F	1093201	6 months	M4	4x5 cms	Yes	Nil	Prev. 3 LSCS	10 years	163	62	NO	NO	NO	NO	13.6	88	NO	23.3	4.8	No	0	0	0	0
43	MZ	45	F	1104299	1 year	M4	20 x 10 cms	Partially	Nil	Tubectomy	3 years	165	58	YES	YES	NO	NO	10.5	124	NO	21.3	4.2	No	1b	1b	0	0
44	PJS	42	F	1103304	3 years	L3	15x 11 cms	Yes	Nil	Open Appendicectomy	15 years	157	59	NO	NO	NO	NO	11.1	96	NO	23.9	4.6	No	1a	0	0	0
45	AKD	53	F	1097717	6 months	M4	15 x 15 cms	Yes	Nil	Exploratory Laparotomy	1 year back	149	57	YES	NO	NO	NO	12.2	110	NO	25.7	4.7	No	0	0	0	0
46	VIM	73	F	1077165	1 year	M4	5 x 5 cms	Yes	Nil	Myomectomy	18 years	169	57	NO	YES	NO	NO	11.3	114	YES	20	3.2	No	0	0	0	0
47	ARR	50	F	1117687	5 months	M4	4 x 5 cms	Yes	Nil	Hysterectomy	6 months	166	70	NO	NO	NO	NO	12.7	126	NO	25.4	3.4	No	0	0	0	0
48	GOR	53	F	1120589	2 months	M4	4x 3 cms	Yes	Nil	Hysterectomy	6 years	146	62	NO	NO	NO	NO	11.5	115	NO	29.1	3.6	No	1a	0	0	0
49	SBH	48	F	1037298	2 months	M4	4 x 2 cms	Yes	Nil	Classical LSCS	19 years	154	53	YES	YES	NO	YES	13.7	123	NO	22.3	4.3	No	0	1a	0	0
50	MGN	59	F	1037631	3 months	L2	8 x 5 cms	Yes	Nil	Exploratory Laparotomy	4years	156	65	YES	YES	NO	NO	15.3	118	NO	26.71	4.9	No	0	0	0	0
51	LJ	53	F	1011256	3 years	M4	4 x 7 cms	Yes	Nil	Hysterectomy	7 years	164	57	Yes	YES	NO	NO	11.5	85	NO	21.1	5.1	No	0	1a	0	0
52	PSM	42	M	1012347	2 months	L2	10 x 10 cms	Yes	Nil	Exploratory Laparotomy	18 months	148	58	YES	NO	NO	NO	12.6	96	NO	26.48	3.7	No	0	0	0	0
53	IGN	63	F	1102568	25 days	M2	15X8 CMS	Yes	Nil	Exploratory Laparotomy	14 years	175	66	NO	YES	NO	NO	14	142	NO	21.5	4.1	No	0	0	0	0
54	AGH	29	F	1103458	3 years	M4	8x7 cms	Partially	Nil	Appendicectomy	8 months	158	48	NO	NO	NO	NO	13.9	155	NO	19.23	4.8	No	0	0	0	0
55	BML	47	F	1101102	8 months	M3	5x5 cms	Yes	Nil	LSCS	16 years	167	78	Yes	NO	NO	NO	14.1	124	NO	27.97	3.1	No	0	1a	0	0
56	AHJ	39	M	1107526	1 year	L1	6 x 4 cms	yes	Nil	Open Cholecystectomy	4 years	162	53	YES	YES	NO	NO	12.4	135	NO	20.2	3.5	No	1	2a	0	0
57	SCK	48	F	1108597	2 months	L2	15x 11 cms	Yes	Nil	Open Appendicectomy	9 years	157	62	NO	NO	NO	NO	11.9	129	NO	25.15	3.6	No	1	2b	0	0
58	SHD	60	F	1108452	6 months	M4	16 x 15 cms	Yes	Nil	Exploratory Laparotomy	5 years	150	68	NO	YES	NO	NO	13.4	127	NO	30.2	4.5	No	0	1a	0	0
59	NP	73	F	1123687	1.5 year	M3	4 x 4 cms	Yes	Nil	Ovarian cystectomy	25 years	161	75	NO	YES	NO	NO	11.3	115	NO	28.9	4.2	No	0	0	0	0
60	SRJ	43	F	1128954	7 years	M4	6x7 cms	Yes	Nil	Hysterectomy	6 months	166	82	NO	NO	NO	NO	12.9	102	NO	29.7	3.9	Yes	2a	2c	4a	4b
61	MT	48	F	1100488	7 months	M4	4x 3 cms	Yes	Nil	Myomectomy	7 years	178	85	NO	YES	NO	NO	11.7	96	NO	26.83	2.8	No	1c	0	0	0