"A COMPARATIVE STUDY OF ONLAY AND SUBLAY MESH REPAIR IN THE MANAGEMENT OF INCISIONAL HERNIAE"

BY

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DISSERTATION SUBMITTED TO

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

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SURGERY

IN

GENERAL SURGERY

Under the guidance of

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LIST OF ABBREVIATIONS

(in alphabetical order)

IH	-Incisional Hernia
USG	-Ultrasonography
SA	-Spinal Anaesthesia
GA	- General Anaesthesia
SSI	-Surgical Site Infection
TEP	-Totally Exteraperitonial
TAPP	-Transabdominal Preperitonial
IPOM	-Intraperitonial Onlay Mesh
AR	- Anatomical Repair
BTV	- Bilateral Truncal Vagotomy
COPD	- Chronic Obstructive Pulmonary Disease.
CVS	- Cardio Vascular System.
CxR	- Chest X-Ray.
DM	- Diabetes Mellitus.
DU	- Duodenal Ulcer
DVT	- Deep Vein Thrombosis.
ECG	- Electro Cardiogram.
FBS	- Fasting Blood Sugar.
GI	- Gastrointestinal
GJ	- Gastrojejunostomy
Hb	- Haemoglobin.
HTN	- Hypertension
LSCS	- Lower Segment Caesaerian Section

MR	- Mesh Repair
PTFE	- Poly Tetra Fluoro Ethylene.
RBS	- Random Blood Sugar.
SL : WL	- Suture Length to Wound Length.

ABSTRACT

TITLE: "A COMPARATIVE STUDY OF ONLAY AND SUBLAY MESH REPAIR IN THE MANAGEMENT OF INCISIONAL HERNIAE "

INTRODUCTION: Incisional hernia (IH)is the only hernia considered to be truly iatrogenic. It is defined as the diffuse protrusion of the peritoneum, and abdominal cavity contents through a weak / poor scar of an operation or an accidental wound.Incisional hernia is a significant complications after laparotomy and can result in bowel strangulation, enterocutaneous fistula and affects quality of life. These hernias enlarge over time and make the repair difficult. Hence elective repair is indicated to avoid these complications.

AIM: The aim of this present study is to compare and analyze the result of two methods of surgical/operative treatment of IH that is open retromuscular mesh mesh placement (sublay) and onlay mesh placement in terms of difficulty in facial closure ,post operative pain,seroma formation, hematoma formation and surgical site infection and recurrence over a period of 3 months.

METHODS: 30 patients presenting with incisional hernia admitted to Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar, in between the study period of December 2018 to June 2020 were preoperatively Examined clinically and evaluated by USG to confirm the diagnosis. 15 patients in each group underwent Rives Stopa Technique (sublay) and onlay polypropylene mesh placement after obtaining proper informed consent and satisfying the inclusion & exclusion criteria.

RESULT: We observed seroma formation and infection in 6.66 %, 6.66%, patients respectively on onlay mesh placement group and in 3.33% ,3.33% patients respectively in sublay mesh placement group. No recurrence was noted in any of the group during the follow up period of three months. Based on these results we observed superior and better results in sublay(Rives Stopa Technique) mesh placement in incisional hernia repair(surgery).

CONCLUSION: Seroma formation, SSI and recurrence is foundd to be more commonly associated with onlay mesh placement compared to sublay(Rives Stopa Technique) mesh placement . No recurrence and haematoma was encountered in any of the group in the current study during the follow up period. Finally to conclude "sublay mesh placement is superior to onlay mesh placement"

.
KEY WORDS: Incisional Hernia (IH), Mesh placement, Onlay, sublay (Rives Stopa Technique), Seroma, Recurrence

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

INTRODUCTION

Incisional hernia (IH) has been a complication following abdominal surgery for more than a hundred years. IH is the one of the true iatrogenic hernia. Ian Aird defines IH as a diffuse protrusion of peritoneum and abdominal cavity contents through a weak scar of an operation, or an accidental wound . IH occurs in 5-12 % of patients subjected to abdominal surgeries [1,2]. Many factors are associated with IH like age of the patient, gender, obesity, chronic cough, diabetes mellitus, urinary obstructions, any occupations which increases intra-abdominal pressure, type of suture material used and SSI[1].

IH usually starts as a result of failure of lines of closure of the anterior abdominal wall following laparotomy (open abdominal surgery) or laproscopic surgeries. If left untreated they gradually attain huge size and cause discomfort/difficulty to the patients or may lead to complications like strangulation, incarceration, obstruction, perforation or may cause skin changes or skin necrosis , all of which greatly increase the risk to patients life and morbidity.

With the advancement in anaesthesia techniques, preoperative antibiotics, sterilization, asepsis and better understanding of abdominal wall anatomy, the approach towards the hernia treatment dawned. Currently by the use of the above mentioned concepts, IH is repaired with least morbidity and recurrence. Every surgeon has got his own methods and techniques and may modify them accordingly.

Laparoscopic IH hernia repair has revolutionized the treatment of IH repair by reducing the morbidity and hospital stay to the patient. This study has been undertaken to compare and analyze the results of two methods of surgical management of IH that is open retro muscular mesh mesh placement (sublay) and open onlay mesh placement.

AIMS AND OBJECTIVES

- To assess the outcome of surgery in patients undergoing **onlay mesh placement**
- To assess the outcome of surgery in patients undergoing **sublay mesh placement**
- To compare these outcomes in terms of surgical site infection, seroma formation , hematoma formation ,difficulty in fascial closure ,recurrence and pain in patients undergoing **onlay** and **sublay mesh placement**

REVIEW OF LITERATURE

The term hernia is derived from the Greek word "Hernios" meaning a bud, a branch or an off shoot. The Himalayan increase in abdominal operations since last century brought an increased incidence of IH. A large number of efforts have been made for repair of IH since the last 100 years which leads to the development of newer techniques.

Gerdy et al. report on scar hernia reveals of the repair of large ventral herniae in 1836, as the first record of such a procedure[3] .He inverted the entire sac, including the skin and sutured the margins of the defect together. Ammonia was then poured into the inverted sac, in order to form adhesions.

Maydl[4] (1886) first used a technique which simply mimics the present day standards. He dissected out the various musculo fascial planes and repaired it separately. Witzel in 1890, Goepel in 1900, Barlet[5] in 1903, Mc Arthur[6] in 1901 described the repair of IH from continuous fascial plane sutures from the external oblique in autoplastic suture of hernia.
Koontz[7] and Throckmorton8 (1948) introduced tantalum gauze. This foreign material had the disadvantage of metal fatigue/damage with fragmentation, sinus formation, perforation of bowel with fistula formation.

Judd[9] in 1912 and Gibson[10] in 1916 both described repair technique based on extensive anatomic dissection of the scar and adjacent tissues. Gibson[10] in 1920 reported having repaired successfully (quoted by Ponka, 1980) 8 cases of huge IH using lateral muscle relaxing incision in anterior rectus sheath, parallel to the midline.

Techniques with extensive tissue dissection were described by Nuttal in 1932, Dixon (1929), Watson (1938), Wells (1956), Maingot (1958) and Madden (1964). These techniques frequently resulted in recurrence because the tissues were sutured. Fascia lata grafts used in the form of strips or sheets were first reported by Mc Arthur[6] in 1901, Kirschner in 1910, Gallie in 1921 and again in 1923, 1924, 1932 which popularised the use of fascia lata graft. Hamilton in 1968 published a large case series of hernia patients managed successfully with Fascia Lata graft.

Mair[11] in 1945 advocated the use of skin in sheets or strips. Hamilton in 1968 also used the same material. But the skin tents to get absorbed and was associated with very high recurrence rates. Graft harvesting was associated with complications like malignant changes and sinus formation. While the "patchers" were "patching" the "darners" were seeking ideal method of darning.

Darning technique involving aponeurosis of External oblique were made popular by Burton (1959). Gosset (1953) used skin ribbon sutures. Moloney(1948) used nylon and Maingot (1958) reported his work on IH repair using floss silk. The popularity of darning started with the development of newer materials like stainless steel and nylon; when Abel (1960) used stainless steel wire for the lattice work after constructing the new linea alba in midline IH . Hunter in 1971 explained an almost similar technique using nylon thread. This trend had an impact in the descriptions of Abrahamson (1987) of his "shoelace" darn technique in repair of IH.

The era of prosthetic mesh hernia repair started in 1958 when Usher. F. C[12] published his study with marlex mesh (polyethylene). Later nylon mesh (polyamide) and recently Polytetra fluoro ethylene (PTFE) were used. These three materials had revolutionized the management of IH, making the earlier methods obsolete.

To prevent development of seroma formation following meshplasty with prosthetic material, Usher in 1971, recommended the use of negative suction drains and the post operative application of an encircling adhesive based plaster girdle. Durden and Pemberton in 1974 adviced the use of closed suction drains following non-absorbable mesh placement into the wound. They also reported their experience with the use of Dacron mesh for hernia IH repair.

More recently use of expanded Polytetra fluoro ethylene mesh has been reported by Sher (1980), Jenkins (1983) and Baner (1987). This material cause minimal tissue reaction and are strong and does not get infected easily.

Jayanth Sharma et al[13] in their studies reported that IH occurring through the midline incision was the most common variety warranting prolene mesh repair . Lichtenstein[14] in 1991 reported in his studies that monofilament PTFE mesh stimulates a strong fibroblastic reaction and had better resistance to infection. Laparoscopic IH repair is becoming increasingly popular. An IPOM mesh is sutured or tacked in place with the mesh extending 5 cm beyond the edges of the hernia defect[15]. However they are more expensive, time consuming and demands technical expertise.

Studies conducted by K. Cassar and A. Munro[16] in 2002 for surgical management of IH states that anatomical repair for IH holds an unacceptably high recurrence rate of 31-49% . On the other hand the results of open and laparoscopic mesh placements are giving us extra hopes with minimal recurrence rates of 0-10% and 0-9% respectively. The laparoscopic methods result in minimal post operative pain (VAS) and reduced hospital stay with similar recurrence rates.

ANTERIOR ABDOMINAL WALL

Surface Anatomy:

Abdomen is the lower half of the trunk and it lies below the diaphragms. Boundaries of the abdomen are:-

SUPERIORLY – lower margins of thorax

INFERIORLY – symphysis pubis, iliac crest and inguinal ligament.

PART OF THE ABDOMEN ABOVE UMBILICUS - upper abdomen

PART OF THE ABDOMEN BELOW UMBILICUS - lower abdomen.

layers Abdominal wall :

1. Skin
2. Subcutaneous tissues
3. Superficial fascia (Scarpa‟s fascia)
4. Muscles (fig. 2 and 3)
5. Fascia transversalis
6. Extra peritoneal connective tissue
7. Peritoneal layer

In the midline- linea Alba, it extends from xiphisternum to pubic symphysis.

1. Skin:

Texture of the skin is thin in front and thick in back. Langer's lines are linear clefts in the skin that indicate the direction of orientation of the underlying collagen fibers. These lines are important as incision parallel to the long axis of these lines heals with a better scar than the incision perpendicular to it.

2. Subcutaneous tissue:

Subcutaneous tissue contains fat contained in loculi, its fibrous wall connect the overlying dermis to the underlying fascia. The fibrous septations condensed below the fat to form a thin and strong membrane known as Fascia of Scarpa.

The layer affords minimal strength in wound closure, but its approximation helps in the formation of an cosmetically better scar.

BLOOD SUPPLY:

1. The internal mammary artery supply through the upper rectus abdominus muscle to the upper central abdominal structures.

2. The segmental thoracic and lumbar intercostal arteries traverse between the external and internal oblique muscles with direct lateral skin perforators to supply the overlying skin.

3. The external iliac artery giving off the deep inferior epigastric artery to the lower rectus abdominis muscle and skin, and the deep circumflex iliac artery supplying the inner aspect of the ileum and terminating in the skin over the iliac crest.

4. The femoral artery giving off the superficial inferior epigastric artery to the lower abdomen and the superficial circumflex iliac artery to the anterior iliac spine area.

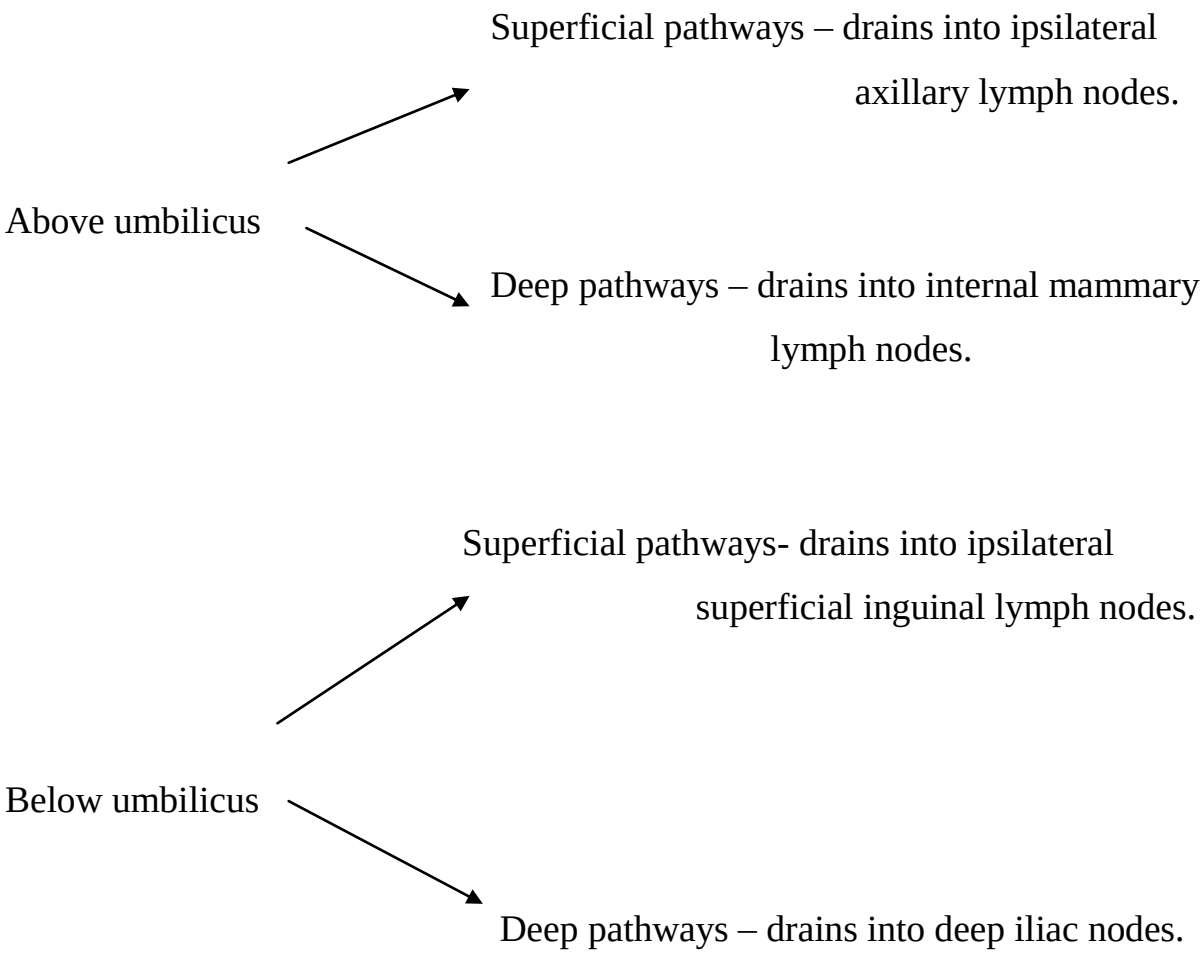
The venous return of the anterior abdominal wall does not follow the artery. The blood is collected into a network of veins that radiate out from the umbilicus to drain into the axillary vein through the lateral thoracic vein and below into the femoral vein through the superficial epigastric and great saphenous vein. A few paraumbilical veins via the umbilicus and along the ligament teres to the portal vein.

NERVE SUPPLY:

- lower 5 intercostal nerves
- iliohypogastric nerves and
- subcostal

They pierce the rectus sheath in the median plane; divide into medial and lateral branches to supply the skin of the front of the abdomen.

LYMPHATICS: Water shed line at the level of umbilicus- above drains into axillary group of lymph nodes and below into the superficial inguinal lymph nodes.



4. Muscles of the Anterior Abdominal Wall:

- External oblique
- Internal oblique
- Transverse abdominis
- Rectus abdominis
- Pyramidalis
- Cremaster.

External oblique

Origin:

Eight slips from lower eight ribs.

DIRECTION OF FIBRES: - downwards, forward and medially.

Insertion:

Upper fibres:-Xiphoid process, Linea alba, Pubic symphysis
Pectineal line of pubis and Pubic crest.

Lower fibres:-Anterior 2/3 rd of the outer lip of the iliac crest.

Internal oblique

Origin:

Lateral 2/3rd of the inguinal ligament, anterior 2/3rd of the iliac crest and thoracolumbar fascia.

DIRECTION OF FIBRES:-Upwards, forwards and medially.

Insertion:

Upper fibres: - lower 3 or 4 ribs.

Lower fibres:-Inserted to aponeurosis which is inserted into 7th, 8th and 9th costal cartilages, Xiphoid process, Linea alba, Pubic crest and Pectineal line of the pubis

Transverse abdominis:

This is the smallest of the three flat muscles of the abdomen.

Origin:

Lateral two third of inguinal ligament, Anterior two third of inner lip of iliac crest, Thoracolumbar fascia, Inner surface of lower six costal cartilages

DIRECTION OF FIBRES: - Horizontally forwards.

Insertion: - Broad aponeurosis inserted into xiphoid process, linea Alba, pubic crest and pectineal line of pubis.

Rectus abdominis:

It arises from two heads

Origin: - lateral head from lateral part of the pubic crest

-medial head from anterior pubic ligament.

DIRECTION OF FIBRES: - vertically upwards.

Insertion: -anterior aspect of the fifth, sixth and seventh costal cartilage and xiphoid process.

3-5 tendinous intersection cross the rectus muscle. They are attached to the anterior part of rectus sheath and help to prevent the retraction of the muscle in transverse incision.

Cremaster:

It is derived from the lowest fleshy fibres of internal oblique arising from the inguinal Ligament.

Pyramidalis:

It is a triangular muscle anterior to the rectus muscles.

Origin: - Front of the pubis

Insertion: - Linea alba approximately halfway between the symphysis pubis and the umbilicus.

FUNCTION:-Tensor of the linea alba.

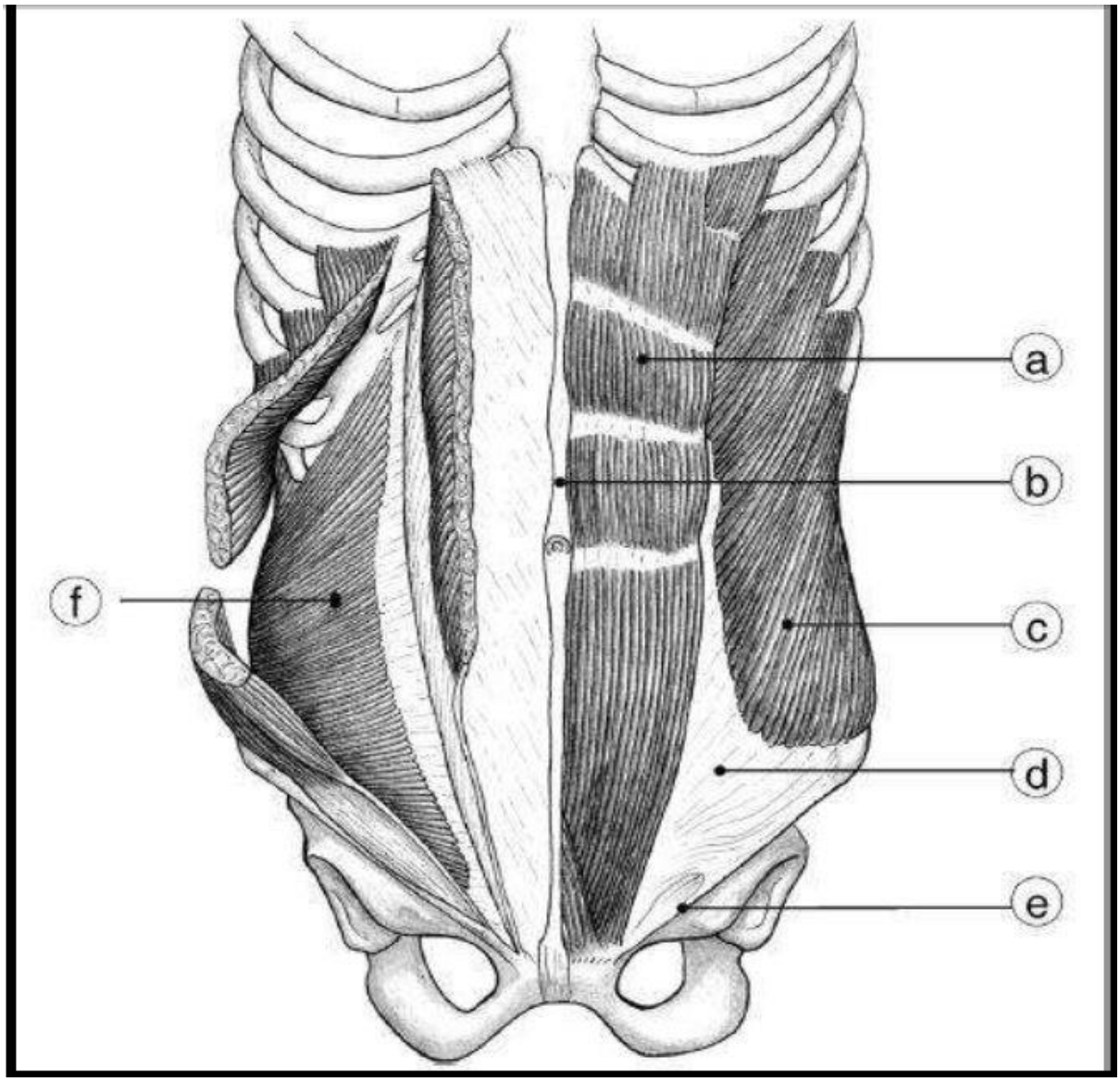


Figure 1:

Anterior Abdominal Wall

a– rectus abdominis, b– Linea Alba, c – External Oblique, d- External Oblique Aponeurosis, e - Inguinal Ligament, f– Internal Oblique.

RECTUS SHEATH

Above the semicircular line of douglas the posterior rectus sheath is composed of fascia from the Posterior lamella of the internal oblique muscle transversus abdominis muscle and transversalis fascia. Anteriorly, the rectus sheath is composed of external oblique aponeurosis and anterior lamella of the internal oblique aponeurosis.

Below the arcuate line, the point at which the inferior Epigastric vessels pierces the rectus sheath, the posterior rectus sheath is absent because the fascia of all the flat muscles passes anterior to the rectus muscle. The rectus muscle, below the arcuate line(semicircular line of douglas) , is covered by a thin layer of transversalis fascia posteriorly.

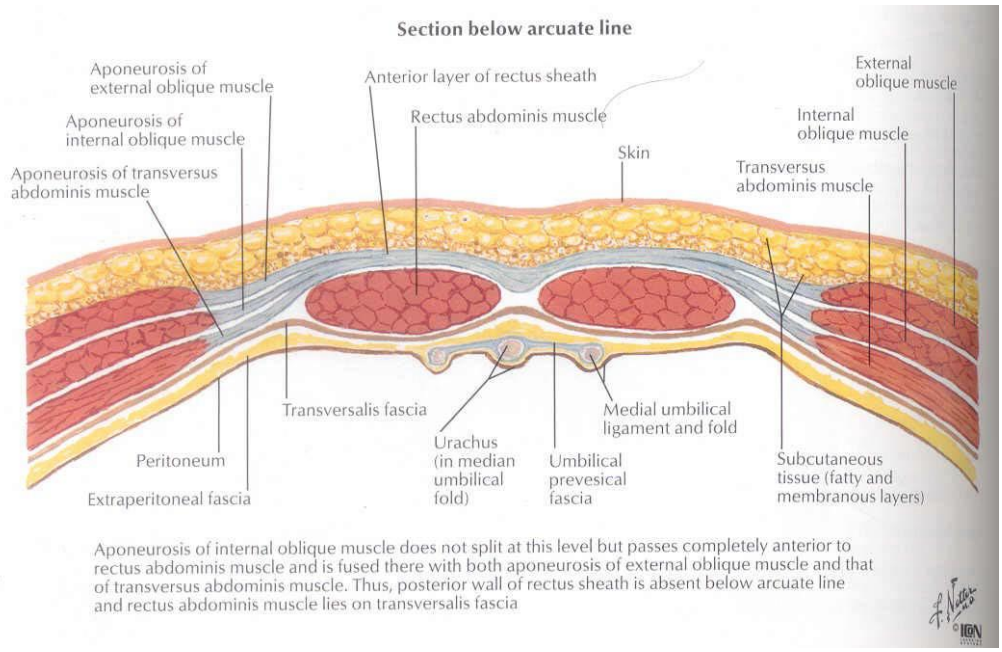


Figure 2

Anterior abdominal wall (section below arcuate line)

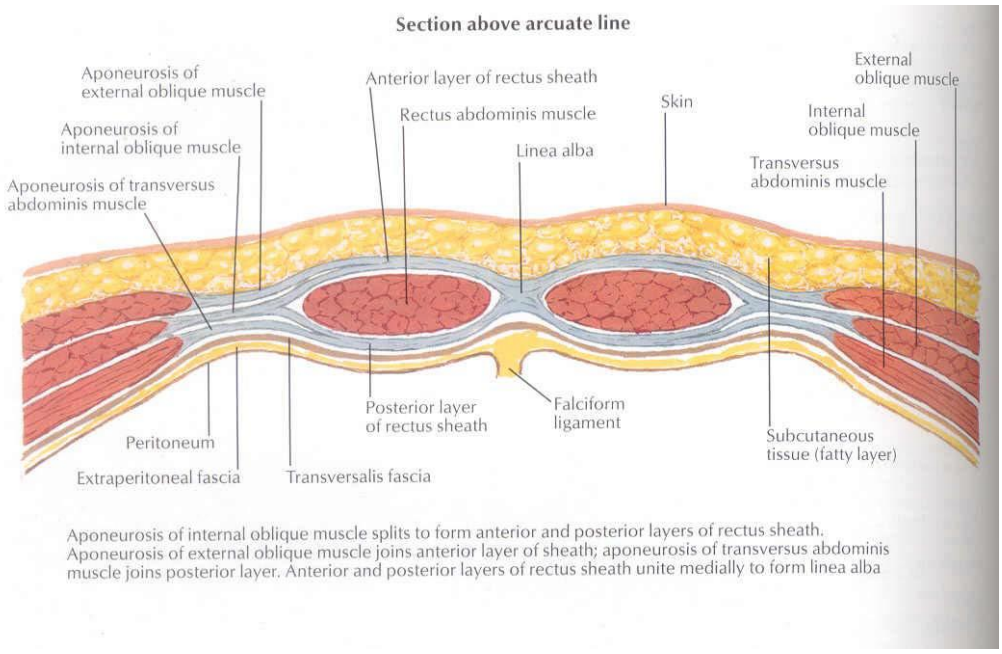


Figure 3

Anterior abdominal wall (section above arcuate line)

5.Fascia transversalis:

It is the fascia that lines the under surface of transverse abdominis muscle. The integrity of the transversalis fascia is very important for the integrity of the anterior abdominal wall. If fascia transversalis is intact, no hernia exists. Hence hernia can also be defined as a defect in the endo-abdominal fascia or transversalis fascia. This definition applies to umbilical hernia, inguinal hernia, femoral hernia, and incisionl hernia. Transversalis fascia is separated from peritoneum by extra peritoneal connective tissue.

PRE PERITONEAL CONNECTIVE TISSUE

This layer loosely attaches the abdominal wall with the peritoneal layer , this layer can therefore be easily removed/stripped.

PARIETAL PERITONEUM

The parietal peritoneum provides little strength in wound closure but it affords remarkable protection from infection.

ANATOMY OF ABDOMINAL INCISIONS AND CLOSURES

The choice of incision and correct surgical methods of opening and closing the abdomen are of great importance in development of IH. Any deviation from the correct method may result in serious complications.

The principles governing abdominal incisions are:

- Incisions must provide direct access to the anatomy to be investigated.
- Provide sufficient room for the required procedure to be performed.
- The incisions could be extended in any direction according to the scope of the operation.
- The closure of the wound must be so meticulous that it leaves the abdominal wall strong after the operation as before.
- Avoid cutting the muscles, instead it can be split or retracted.
- Incisions must be always be parallel to blood and nerve supply to avoid post operative complication of chronic pain, seroma, hematoma and incisional hernia.
- Transverse incisions and Oblique are mush stronger and less liable for disruption and IH.
- Re-entry into the abdomen should be done through the previous incision, So that hernia can be repaired in the same sitting.

The principles governing abdominal closure are:

- The sutures should be tightened lightly to avoid strangulation & necrosis of the muscle.

- Place the drain through a separate incision to avoid infecting the main wound which weakens the scar and later lead to IH.
- When wound tension is anticipated, deep tension sutures can be used and if they have been employed, they are left in situ for 14 days.
- Fascial layers must be sutured using Non-absorbable suture materials

DIFFERENT ABDOMUNAL INCISIONS :

➢ DIVIDING NO MUSCLES:-

- Median
- Paramedian
- Pararectal
- Pfannensteil's

➢ SPLITTING MUSCLES:-

- Paramedian muscle splitting
- McBurney
- Lanz
- Hernia incision.

➢ DIVIDING MUSCLES:-

- Subcostal (Kocher)
- Rutherford Morrison
- Transverse incision
- Oblique lumbar (Morrison)

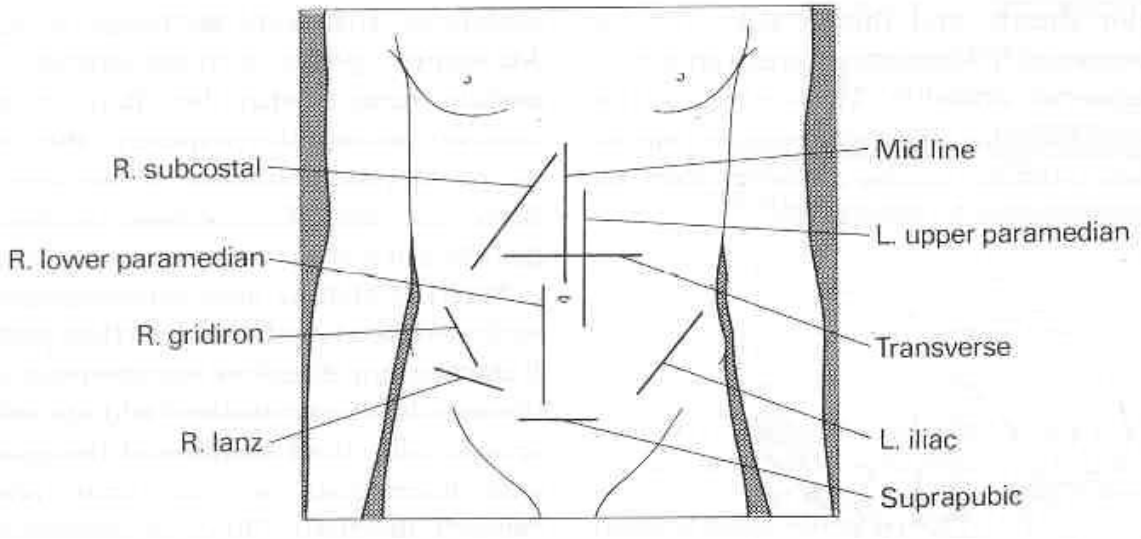


Figure 4

Commonly used abdominal incisions

COMMONLY USED INCISIONS:

Midline incisions:-

It is a midline incision extending, below or above the umbilicus. Commonly used for exploratory laprotomy and other intra abdominal operations. Muscle fibres are not divided. None of the nerve fibres are damaged. It is quick to open and close. It has the advantage of extending the incision when needed and can be used for re-exploration

.

Mc Burney's incision:-

Most common incision used for appendicectomy . It is an excellent example of using the muscle tension to achieve wound closure. This incision gives the liberty to extend the incision above and below when warranted. This incision is prone to cause Ilioinguinal nerve injury leading to IH.

Kochers incision:

It is the right or left subcostal incision used for following surgeries of gall bladder, liver, spleen and biliary tract. The main drawback is longer duration of procedure. The incision joins the middle about three to five centimetres below the xiphisternum. It runs 2 cm below and parallel to costal margin. It's a muscle dividing incision.

.

Paramedien incision:-

This incision is made on either side of the midline and runs parallel to it.

It can be extended both supra umbilical and infra umbilical depending upon the need. Anterior rectus, rectus muscle and posterior rectus can be opened vertically. It provides a strong scar but can be time consuming and can lead to hematoma.

MOST DESTRUCTIVE INCISIONS :

Pararectus incision:-

Incision is given lateral to the rectus muscle thus damaging the intercostal nerves and blood vessels.

Long oblique incision:-

This is the incision preferred for kidney surgeries. Incision begins at the renal angle and passes forward parallel to the 12th rib up to the lateral border of rectus abdominis . This incision causes injury to lateral cutaneous branch of 12^{th} thoracic nerve, ilioinguinal and iliohypogastric nerves.

AETIOLOGICAL FACTORS

Many factors, either alone or in combinations causes failure of wound to heal satisfactorily and lead to the development of IH.

PREOPERATIVE FACTORS:-

Obesity, Malnutrition, Advanced age, Malignant disorders, Jaundice, Diabetes mellitus, Renal disorder, Smoking, Alcoholism, ACTH and steroid therapy , Hypothyroidism.

PEROPERATIVE FACTORS:

- Type of operation
- Type of incision
- Suture material used
- Suture techniques
- Use of drainage tubes

POSTOPERATIVE FACTORS:

- Wound infection
- Postoperative pulmonary complications and increased intra abdominal pressure
- Collagen abnormalities
- Ageing

PRE-OPERATIVE CAUSES

1. Obesity:

It is associated with high percentage of IH hernia as well as recurrence (3 times) due to:-

- Increased intra abdominal pressure
- Stretching of abdominal wall
- Fat is hard to suture and tends to bleed
- Easily breaks down, inhibits wound healing, and raises infection rate.

2. Diabetes Mellitus:

- Decreased inflammatory response
- Increased wound infection rate

3. Smoking:-

- Inactivate anti proteases, so protease and elastase destroy collagen and elastin of rectus sheath and transversalis fascia leading to hernia formation, Postoperative atelectasis , pulmonary infection, chronic Cough and Hernia.

4. Steroid Therapy:-

Inhibit fibroblasts, capillary proliferation and decreases the inflammatory response resulting in impaired formation of granulation tissue leading to incisional hernia.

5. Malnutrition:-

- Hypoproteinemia and anemia leads to poor wound healing due to inadequate Delivery of blood and oxygen to tissues.

- Ascorbic acid deficiency -Inhibition of collagen synthesis leading to poor scar formation and IH.

6. Multiple pregnancies:-

There is increased incidence of IH in multiparous women compared to others.

PER-OPERATIVE CAUSES

1. Nature of Surgery:-

Emergency laparotomies for peritonitis, appendicitis, Diverticulitis, acute pancreatitis and intestinal obstruction are associated with increased incidence of incisional hernias compared to elective surgeries.

2. Type of Incision:-

- Mid line incision – 70%
- Transverse incision – 12% (If they cross linea alba)
- Oblique incision – 12% (Cholecystectomy, nephrectomy &appendicectomy)

Vertical incision:-

Para Median / Lateral paramedian incision has decreased the number of incisional hernia because of wide shutter mechanism. Lower midline incision is associated with more IH than upper midline incision because of the absence of posterior rectus sheath and greater effect of gravity on the lower abdomen.

Pararectus incision:-

This incision divides the inter-costal nerves and inter-costal vessels leading to weakness and increased incidence of hernia formation.

Transverse incision:-

Wound closure places suture materials around fascial fibers. On contraction the fibers are opposed and the suture material would realize minimal laterally directed tension.

Oblique incision:-

Intercostal nerves are damaged as in case of sub costal incision and for renal exploration leading muscles atrophy and predispose to hernia formation.

3. Suture Materials:-

Mechanism of wound healing is important, to know the importance of suture materials and its prevention of IH. There is no tensile strength in the wound in 1st week. Rapid increase in strength of the wounds in takes place 70 days after surgery. Maximum strength and durability of the scar is achieved by one year. The original strength before surgery can never be attained.

So during early phase of wound healing suture material does, in fact play an important role in maintaining the integrity of the wound closures and there is no or minimal role for absorbable suture materials (catgut, polyglactic acid etc)for abdominal wall closure.

Absorbable suture materials lose 80% of their strength within 14 days, IH has been shown to be more common. The sutures are entirely responsible for the integrity of the wound during early phase of wound healing. Hence ideal suture material for abdominal closure is monofilament stainless steel wire used in mass closure. Polypropylene and polyamide sutures can be used but are not convenient to knot.

Ideal suture material:

- Non absorbable
- Monofilament with retention of high tensile strength.
- Inert and doesn't act as a nidus for infection.

4. Technique of wound closure

a)

Mass closure	**Layered closure**
Wide bite a minimum 1cm from the wound edges and placed at an interval of 1cm is ideal	Too many sutures lead to strangulation & necrosis compared to mass closure[17]

b) Continuous Vs interrupted:-

Continuous suture disperses suture tension along the length of incision. In Interrupted sutures the tension is different at each suture that may led to fascial necrosis if tied too tight and poor approximation if tied too loosely.

c)Length of Suture material:-

According to Jeinke's formula for ideal closure of the abdominal wound without tension and risk of wound dehiscence or incisional hernia, the length of suture material should be at least four times the length of wound (4:1).

5. Hematoma:-

It acts as a nidus of infection that in turn increases the incidence of IH. Dead space drainage and obliteration of dead space prevents any collection and decreases wound infection.

6. Wound tension:-

Wound tension is one of the factor which decides fate of wound healing. Excessive wound tension leads to ischemia and necrosis which leads to hernia formation. The lateral pull of the abdominal wall muscles against the suture creates an area of pressure necrosis where the suture meets the tissue. This was amply demonstrated as a cause of wound dehiscence by Bartett[18] (1985).

7. Drainage tube:-

Abdominal drain through the main wound increases contamination and infection. So separate port must be used for the drain.

POSTOPERATIVE CAUSES

1. Wound infection:-

It is the commonest etiological factor suggested by many authors. It acts by release of collagenases, fibrinolysins, hemolytic and coagulase enzymes. Bucknall and colleagues in their studies states that the presence of wound infection was associated with fivefold increase in the rate of developing hernia (23%) compared with uninfected wound (4.5%).

2. Postoperative pulmonary complications:-

Conditions which increase intra abdominal pressure in the immediate postoperative period like intractable cough, lung consolidation, pulmonary embolism, obstructive lung diseases and restrictive lung diseases.

3. Collagen abnormalities:-

Diseases like Ehler Danlos disease, Marfan's syndromes are likely to suffer from multiple hernias and also at multiple sites.

4. Ageing:-

Ageing and weakness of tissues and the increased intra abdominal pressure associated with chronic cough and constipation are the proposed etiological factors for the onset of IH in later age group.

5. Wound dehiscence (burst abdomen):-

Dehiscence of all layers of abdominal wall with protrusion of abdominal viscera is termed as burst abdomen. It occurs in approx. 1% of laparotomy wounds and associated mortality- 20%. Burst abdomen occurs because of slippage of knots or due to insufficient number of sutures. Its incidence after primary wound healing is approximately 1% rising up to 10% for infected wounds and 30% after wound dehiscence and re-laprotomy.

Jack Abrahamson described two types of postoperative herniae

A) EARLY INCISIONAL HERNIA

B) LATE INCISIONAL HERNIA

EARLY INCISIONAL HERNIA

Early IH appears soon after the abdominal closure; often the entire length of the incision stretches rapidly and contents herniates . This early failure is mostly due to mistake on the part of surgeons or patient factors.

LATE HERNIAE

The late hernias develops in a perfectly healed wound that has served Satisfactorily for 5-15 years after surgery.

HYPOTHESIS OF INCISIONAL HERNIA FORMATION

URSHEL AND CO

Fascia under stress has increased DNA and protein by fibroblast and these continue for a long time.

Phases of wound healing

1. **Substrate phase**

   1-4 days – Exudative / Inflammatory

2. **Fibroblastic phase**

   5-20 days – Proliferative phase, connective phase, incremental phase

3. **Differentiation phase**

   21st day up to years – remodeling, resorptive or plateau phase.

Any interruption of this process at any time remote from the apparent Healing of wound may lead to fascial weakness.

Early fascial separation may be predictive of incisional hernia. Metal clips were placed on either side of fascia and abdominal radiography done at one month showed that patients who developed IH post surgery , had demonstrable separation more than 12 mm compared to other.

CLINICAL MANIFESTATIONS

Among ventral hernias the IH is the one for which the patient most frequently visits the surgeon. 60% of patients with IH are asymptomatic. The usual complaints are , swelling in the vicinity of a healed scar, pain and discomfort, dragging sensation aggravated by cough and straining , areas of pressure ischemic necrosis and ulceration. If the hernia strangulates then the features of intestinal obstruction like pain, abdominal distension, vomiting and constipation sets in. Intertrigo can be seen in the skin crease developed between the herniae and the abdominal wall. Rupture of large IH is encountered occasionally.

Rupture of large incisional hernias is uncommon but is encountered occasionally (Hamilton, 1996). In large lower abdominal midline dependent incisional herniae , areas of skin may undergo pressure necrosis and may ulcerate to rupture and even evisceration, may occur.

Past History

Initial operative procedure, complications following initial operations, time of onset of IH, number of laparotomies and organ which was operated should be sought for incidences of incisional hernia in different operations. In Ponka's series of 794 cases of laparotomies, surgeries on female pelvic organs are the most frequent antecedent procedures.

Physical examination

Age - An increase of incisional hernia is noted in patients over age 60years. Incisional hernia is more common in 5th, 6th and 7th decades.

Sex – More in females due to more surgeries on the female reproductive organs.

Obesity – Incidence of IH and recurrence rate following repair of IH are much higher in obese individuals.

Local examination

The size of the herniae itself can be assessed with the patient erect and coughing, but more important is the size of the defect, which should be examined with the patient in supine position. The examiner's hand, with fingers straightened, is inserted into the defect, and the patient is requested to raise his head and shoulders forwards without the aid of his hands. Per rectal and per vaginal examination is a must to rule out coexisting abdominal pathology.

Diagnosis

The scar of the previous surgery is always noted over the swelling. In a large incisional hernia the diagnosis is obvious. However, in certain cases, ultrasonography, CT scan or both have been utilized to distinguish between hernia defects from other abdominal wall pathologies that may present as mass lesion or be the source of pain syndrome.

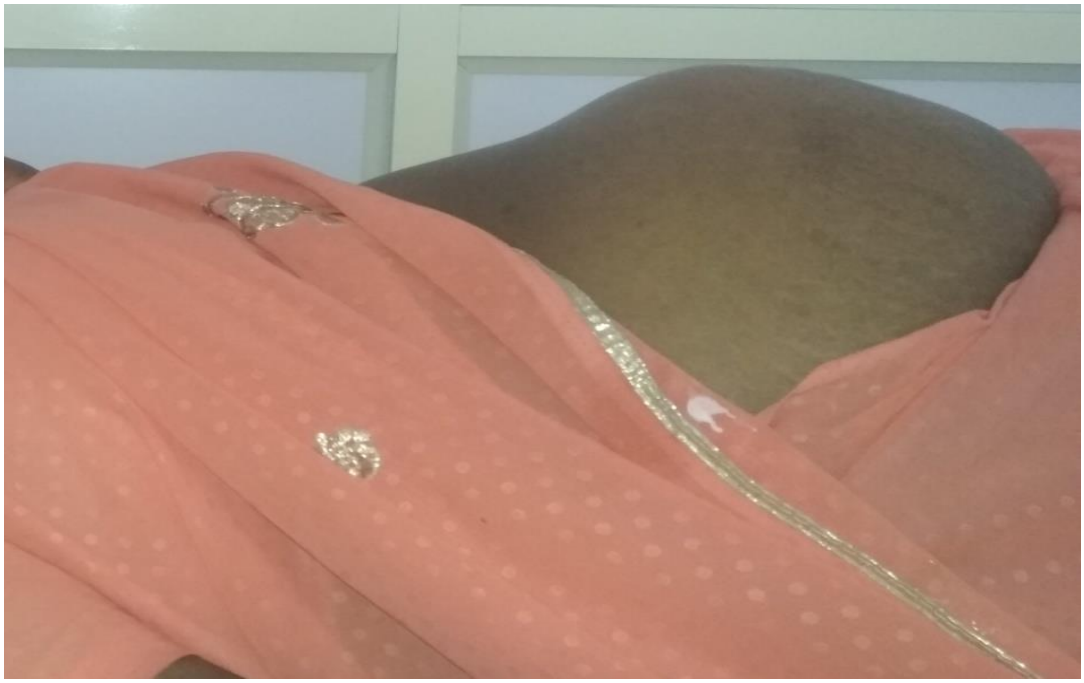


Figure 5

Incisional hernia (preoperative photo)

INCIDENCE

The incidence of IH varies. In 1887 John Himans of Bostan (quoted by Ponka) reported an incidence of 10 percentage of IH in 184 cases of laparotomies. Most studies have noted incidence at one year. In 1993 Cave (quoted by Zimmerman[19] in 1967) demonstrated an incidence of 6% of IH in laparotomy wounds.

Rodney Maingot states that IH occur in 1-14 % of subjects undergoing laprotomies . Akman (1962) reported 67.8% of hernias were apparent by one year and 97.7% within 5years. A further 1.4% occurred between 5th and 13th year.

Goligher[20] and colleagues in 1975 at Leeds infirmary hospital did not encounter even a single IH in 108 abdominal surgeries where mass closure by interrupted wire suture was performed. Donaldson and colleagues[21] (1982) at St.Janne's hospital, using the lateral paramedian incision noted only a single IH in 231 abdominal surgeries.

Bucknall[1] and colleagues (1982) studied 1129 laparotomy wounds in patients and followed up the cases for 12 months after the surgery. They detected 84 cases of IH (7.4%) . Pollock[22] in 1981 studied 961 subjects, 6 months after the procedure and detected 96 cases of IH (10%). Ellis et al[23] studied 383 patients known not to have had incisional hernia at one year after operation of which 5.8% were found to have developed incisional hernia between 2 ½ - 5 ½ years of followup.

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PREVENTION

Armed with the knowledge of aetiological factors, various authors proposed various preventive methods, which may help in preventing incisional hernia.

A.INCISION:-

Liberal use of paramedian incision whenever possible can prevent incision related complications to some extent. Donaldson[21] and colleagues in 1982 found 0.37% IH. Guillow et al (1980) had zero percentage of incidence. Cox et al in 1986 had two IH in 431 patients.

B.USE OF CORRECT SUTURE MATERIAL:-

Use non absorbable suture materials like (Nylon, Prolene) for closing fascia, sheath and aponeurosis . |Double strands or loops are better than single strand.

C.CLOSURE OF LAPAROTOMY WOUND:-

Mass closure of laprotomy wound is better than layered closure[17]. Peritoneal layer can be left behind unsutured[24]. Use monofilament (prolene and ethilone) for skin closure to avoid stitch abscess.

D. METICULOUS OPERATING TECHNIQUE:

- Proper skin preparation and draping
- Smooth handling of the tissues
- Perfect haemostasis to avoid haematoma
- Avoid dead space

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E. PROPHYLACTIC ANTIBIOTICS:

Prophylactic antibiotics are used to prevent wound infection both in clean, clean contaminated, contaminated and dirty wounds. Polk et al[25] advised prophylactic antibiotic, both in clean, clean contaminated, contaminated and dirty wounds.

Antibiotics reach therapeutic concentration levels along the line of incision to prevent surgical site infection. Rios et al[26] in his study states that antibiotic prophylaxis is essential in mesh repair for preventing local complications.

F. USE OF MESH:

When it is not possible to approximate the rectus sheath without undue tension, PTFE[22], Marlex mesh[12] or Darn repair[27] should be undertaken using inert monofilament nonabsorbable sutures[28].

G. WOUND SEPSIS:

Clean the wound margins with normal saline, povidone iodine, metrogyl or gentamicine where SSI is expected . Wound can be left open if sepsis is considerably feared. Mesh soaked in antibiotic solution(povidone iodine) also helps to decrease SSI .

H. DRAINAGE TUBE:

If surgical site infection is inevitable, negative suction drain can be placed through a stab incision separate from the main wound.

I. OBESITY:

Overweight should be reduced as in all elective surgeries whenever possible.

J. ANAESTHESIA:

Though wound disruption occurs with equal frequency after local, SA, GA, an efficiently administered GA with adequate muscle relaxation and smooth extubation of patient, avoiding struggle is advantageous in hernia repair. Postoperative nausea and retching must be avoided with the use of adequate antiemitics.

PREOPERATIVE MANAGEMENT

Repair of large IH is a major task which requires careful preoperative evaluation and preparation.

1. The repair should be extended for at least 1 year after the surgery that caused hernia. This is the time taken for maturation of collagen and for the tissues to reach their dry state after all the infections have subsided.
2. Adequate skin hygiene like twice daily showers to reduce skin flora , antibiotic scrub on the day and prior to surgery , treatment of skin infection, any mycotic infection and intertrigo if present .
3. Weight reduction in obese patients to cut down the recurrence rate.
4. Smoking cessation at least 2wks prior to the surgery and to start spirometric exercises a week before the surgery.
5. Optimize the patient before surgery by treating associated co- morbid conditions like DM,HTN,IHD,COPD…..etc.
6. Nutritional deficiencies like Hypoalbuminemia and vitamin deficiencies should be treated with oral or parenteral supplements.
7. DVT prophylaxis
8. Prophylactic antibiotics prior to surgery.

TREATMENT

General Considerations:

Permanent treatment for incisional hernia is surgery. The major considerations in the IH repair include the following.

1. **CHOICE OF INCISION:**

Transverse incision should always be preferred. Previous scar is removed with an elliptical incision. The procedure requires adequate amount of undermining of subcutaneous tissue. Excess undermining may cause skin necrosis.

2. **ISOLATION OF HERNIA SAC:**

IH surgery is a clean surgery which includes dissection of abdominal wall, identification of layers of abdominal wall, isolation of hernia sac and releasing the adhesions.

3. **CLOSURE OF THE SAC:**

Sac should be opened and contents reduced. If any extra omentum that can be excised or pushed inside the peritoneum, which gives an additional support . Adequate muscle relaxation is required during the surgery (anesthetist plays an important role). Good haemostasis must be achieved to prevent hematoma and subsequent SSI which leads to recurrence.

4. **FASCIAL Vs MESH CLOSURE:**

In cases of recurrent hernia or lax abdominal wall, abdominal wall muscles will be thinned out and fascia will not be adequate for fascial closure. In such circumstances mesh repair is warranted.

5. **DRAINS:**

Negative suction Drains are placed in all hernias, except in small IH. Negative suction Drains are kept in place for 4-5 days.

6. **ANTIBIOTICS:**

Prophylactic antibiotics are given prior to surgery. According to Robert. J. Baker[22], antibiotics prophylaxis is not required with an effective suction drainage is in place. Diabetic patients require antibiotic coverage for 5 days.

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Indications for Surgery:-

a) Cosmetic purpose
b) Pain and discomfort
c) Impending strangulation.
d) History of SAIO
e) Irreducibility

Relative Contraindications:-

a) Extreme obesity.
b) Continuing deep sepsis
c) Intertrigo.

OPERATIVE METHODS OF REPAIR

Three methods of repair of these distressing hernias are:-

1. Anatomical repair
2. Shoelace darn repair
3. Synthetic non- absorbable mesh repair

The method chosen depends largely on the diameter of the hernial defect. A small defect (< 2 cm) is suitable for repair by primary suturing. Hernias with a larger defect (>2 cm) can also be repaired by the shoelace darn technique. The third method for repair of these hernias involves the use of synthetic non absorbable materials such as Polypropylene, polyester, or sheets of ePTFE placed over the defect and sutured to the abdominal wall.

ANATOMICAL REPAIR

The surgery is best done with the patient under GA with good muscle relaxation. The previous scar is excised out in an elliptical fashion and is carefully dissected from the hernial sac. The tissue on each side of the incision then is further dissected to expose the sac completely down to the musculoaponeurotic plane of the hernial defect. The sac is opened, and the contents are dissected off its inner surface .Old suture materials are excised up to the edge of the hernial defect to expose the normal tissues of the linea alba.

A heavy monofilament polypropylene (size 1) thread is commonly used. A continuous heavy monofilament polypropylene mass closure is used, taking large bites. The excess tissue is excised, and the wound is closed over the repair with automatic staples or with fine monofilament sutures.

MODIFIED MAYO TECHNIQUE

In which fascia edges were overlapped, typically provided a satisfactory outcome.

SHOELACE DARN REPAIR:-

In which relaxing incisions are made in the anterior rectus sheath. Allowing the anterior sheath to be approximated in the midline and it is especially useful for large upper midline hernias. This method is based on the fact that strong posterior rectus sheath protects the potential for hernia formation in the area of relaxing incision.

Next step is to repair the strong new midline which will anchor the flat muscles by remodelling new linea alba, which can also be done by suturing together a strip of fascia from the medial edge of each anterior rectus sheath. The next step is to restore the rectus muscle back to their former length by drawing closer together the lateral cut edges of the anterior rectus sheath where medial strips were split off. This step is accomplished with a continuous suture of heavy monofilament that passes to and fro between the cut edge and that also substitutes functionally and anatomically for missing anterior rectus sheaths.

PROSTHETIC MESH REPAIR

The use of non absorbable synthetic mesh prosthesis placed in abdominal wall defects has revolutionized the repair of IH and rendered obsolete most of the older types of surgeries.

TYPES OF OPERATIONS

1. Intraperitoneal mesh

A piece of mesh cut to the shape of defect, but slightly larger, may be sutured in place, deep to the peritoneum.

2. Inlay mesh

A piece of mesh cut to the size and shape of the defect may be sutured as an inlay graft to the edges of the defect.

3. Onlay mesh

It's the placement of mesh anterior to the anterior rectus sheath.

4. Rives-Stoppa technique

An excellent method which has been popular in France is the Rives-Stoppa technique of placing the sheet of prosthetic mesh in the place between the posterior rectus sheath and the rectus muscles. This has distinct advantages over the intra peritoneal, inlay or overlay methods.

5) Laparoscopic

- **TAPP**
- **TEP**
- **IPOM**

BIOMATERIALS

A biomaterial is defined as any synthetic or non pedicled natural substance that can be used for tissue replacement. Varying substances have been used for this purpose with varying degrees of success and recurrences.

AUTOGRAFTS:

a) Skin graft
b) Fascia late graft
c) Tendon grafts.

Loeve first used cutis graft in 1913. Rehn in 1914 and canadey[30] in 1942 used cutis grafts in repair of large IH. This method is now considered obsolete due to complication like SCC, sinus and fistulus tracts and SSI.

Fascia Lata Graft:

1901 Mc Arthur[6] used pedicled strips of external oblique aponeurosis for herniorraphy. Gallie and Leo Measurier[31] used fascia lata using a loose weave of fascial strips. These free fascial strips were infiltrated by fibroblast forming a new structural framework.

HETEROGRAFT:

• **Porcine dermal heterograft**:- Porcine stratum corneum was used with proteolytic enzyme and glutaraldehyde. This method is considered obsolete due to complications like seroma and SSI.

• **Bovine fascia heterograft**:- Bovine fascia lata grafts have been used to close defects in abdominal wall . It is strong and durable. But has very high recurrence due to sloughing of fascia lata. Koontz[7] utilized strips of ox fascia lata graft for repair of hernial defects.

METALLIC MATERIALS

a) **Stainless Steel** was used in the form of filigree, mesh or cloth. Can be used as in onlay , inlay and sublay mesh repair. Its inert than tantalum.

b) **Tantalum** exhibits good tensile strength and is quite malleable. Throckmorton[8] and Koontz[7] popularized this metal for herniorraphy.

c) **Silver:** Mc Govin[32] in 1932 first used it. Cole in 1936 also used it in herniorraphy with excellent results.

SYNTHETIC PLASTIC MATERIALS

a. **Absorbable Synthetic Material**: -

Polydiaxonon, (Dexan, vicryl), polygalacten are some of the absorbable synthetic material used for hernia repair. These sutures provide support to wound only for six weeks, their use in hernia repair is hazardous. Incidence of IH is 4.2% on closing the linea alba using these material[33].

b. **Non Absorbable Synthetic Material**: -

various types of non-absorbable synthetic material available are

- Polyethylene (marlex mesh)
- Polyamide (nylon mesh)
- Polyester
- Synthetic acrylic (orlon mesh)
- Polyvinyl sponge (ivolon)
- PTFE (Teflon mesh)
- Dacron (mersilene mesh)
- Dacron reinforced silicon (sialastic)
- expanded PTFE (Goretex)

No synthetic material is ideal with non-antigenic properties and can form a structural framework that can gradually be replaced by fibroblast. However,

polypropylene (prolene), polyethylenie (marlex), mersilene (Dacron) have been widely used and have proved highly useful in repair of large hernias. Only problem with this synthetic material is the risk of seroma formation, sinus formation and SSI.

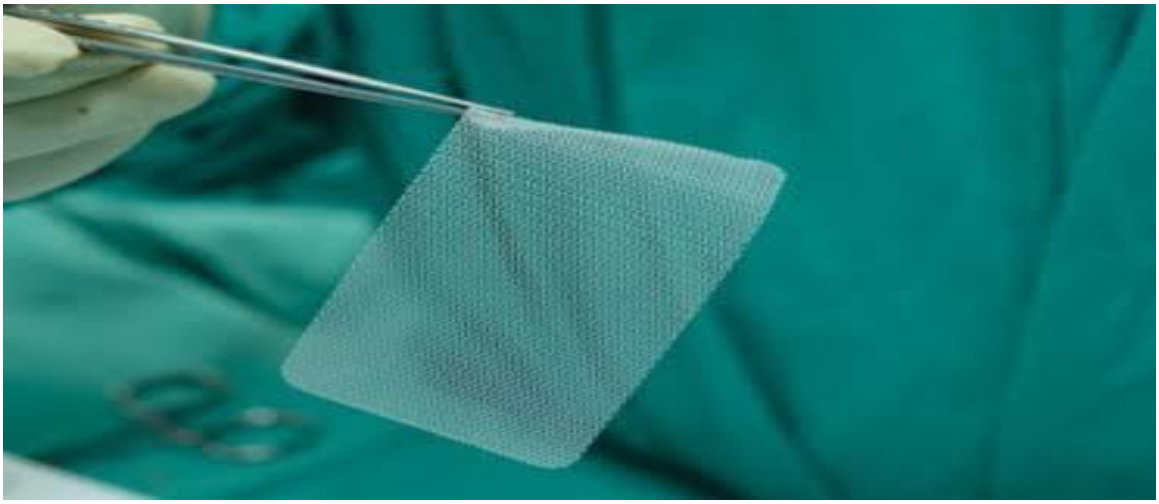

Figure 6

Prolene mesh

Figure 7

Prolene mesh

c. **Carbon implants and composites**: Flexible filamentous carbon attracts Fibroblastic growth and forms dense connective tissue with collagen bundles oriented along the lines of stress. Carbon implants are gradually fractionated and removed by phagocyte action[34].

INDICATIONS FOR USE OF PROSTHETIC MESH IN INCISIONAL HERNIA:-

a) Repair of recurrent IH.
b) Massive hernia with large tissue defect where tissue approximation without tension is not possible.
c) Loss of essential fascial segments due to severe trauma.

DESIRABLE QUALITIES OF A PROSTHETIC MESH:-

a) Tissue Reaction –Biologically and Clinically Inert.
b) Durability
c) Strength
d) Flexibility
e) Easy Handling
f) Tolerance to withstand infection.
g) Non Fragmentation
h) Non Wandering
i) Porosity To Permits Growth Of Fibrous Tissues
j) It must be radio translucent.

GENERAL PRINCIPLES:-

a) Timing –repair should be deferred in the presence of infection.
b) Avoidance of undue tension
c) Synthetic non-absorbable monofilament suture must be used for fixation

d) Adequate haemostatic should be achieved.
e) Negative suction drain
f) Antibiotic prophylaxis

LAPAROSCOPIC HERNIA REPAIR:

It is the latest advancement in the repair of the IH. Laparoscopic repair of abdominal IH with dual mesh plug follows the principles of hernia repair without any extensive dissection.

Procedure:-

- Insertion of ports and visualization of hernia defect.
- Adhesiolysis and reduction of contents.
- Mesh preparation, marking and placement according to the hernia defect.

Four corners of the mesh are tied with non absorbable suture leaving six inch tails, knots are placed on the mesh in such a way that it is in contact with the peritoneal surface. The mesh introduced in to the abdominal cavity through a 10 mm port. The 4 stitches anchor the mesh to the abdominal wall. The abdomen cavity is deflated and the fascial defects are closed.

Advantages:

- Tension free repair
- Cosmetic effect
- Short duration of hospital stay
- Less pain.

TECHNIQUE OF ONLAY REPAIR:-

The first step in incisional hernia repair is to re-open the old incision. The hernia sac is mobilized, contents are reduced and excision of any redundant

peritoneum. Thinned out scar and fascia should be freshened back to healthy fascial margins.

Tissue should be dissected away from the wound margins in the supra-fascial plane for a distance of 8-10 cm from the hernial defect. If the margins of the herniae can be approximated without any undue tension then the technique of onlay mesh repair is preferred. If the margins cannot be approximated then the technique of replacement of deficient tissue using a double layer graft repair are selected.

PRINCIPLES OF REPAIR:

No Tension:

Tension in a hernia repair is the principle factor in failure of wound healing due to the formation of thin scar that does not adequately resist increased intra abdominal pressure.

Bowel should not be exposed to the synthetic mesh:

Synthetic mesh incites an intense inflammatory reaction that mature as dense sheet of scar and if bowel is exposed to prosthesis it becomes densely adherent and predisposes to obstruction.

Antibiotic prophylaxis and preoperative preparation:

The presence of any prosthesis within a wound disables normal host defence mechanisms that protect against the low level of bacterial contamination that occurs with every surgical wound – to combat this problem, inj. Cefotaxime 1gm is administered intravenously about 30 min before the skin incision.

Incision

Elliptical incision given over the excising the previous scar.

Excision of sac:

Skin and subcutaneous flaps raised and the hernial sac dissected all around. The hernial sac opened and the dissected all around. Excess sac was excised and peritoneum closed in the midline with absorbable suture materials.

Dissection of flaps:

Skin and the subcutaneous tissues overlying the hernia sac are dissected in the plane outside the sac and deep to the subcutaneous fat until the musculofascial border of the hernia were reached. The dissection is then continued on the surface of the fascia elevating the overlying skin and fat to a length of 5-8 cm from the margins of the hernia orifice. Midline defect in rectus sheath closed with 1- prolene suture material in continuous manner without tension.

Placing of prosthesis

Polypropylene, monofilament knitted mesh about 15 x 15 cm used for repair is kept over the sheath without tension and excessive folding.

Fixation of mesh

Mesh is placed over the rectus sheath, it is fixed using 2-0 prolene around 1cm form its edge with the rectus sheath. Two closed suction drains are placed over the mesh and fixed to the skin.

Figure 8

Onlay mesh placement

Figure 9

Onlay mesh placement

RIVES-STOPPA TECHNIQUE (SUBLAY):- Another promising technique for IH repair. In this technique the PTFE mesh is placed b/w the rectus muscle and posterior rectus sheath. Above the umbilicus, dissection is performed anterior to the posterior rectus sheath and posterior to the rectus muscle. Below the umbilicus, absence of a posterior rectus sheath necessitates dissection in the Pre-peritoneal plane. PTFE mesh is placed in the space created, and fixed with full or partial thickness suture.

Bauk JJ, Harrin MT et al[31]

Department of surgery, Mt Sinai School of Medicine, Mt Sinai Hospital,New York.

Study : 57 patients for 6 year period of whom 15 were recurrent.

Follow up : 34.9 months

Results : No recurrences, GI complications, fistula or death. 2 patients had wound infections

Conclusion : It gives excellent long term results and minimum morbidity.

Figure 10

Creating retro-rectus plane

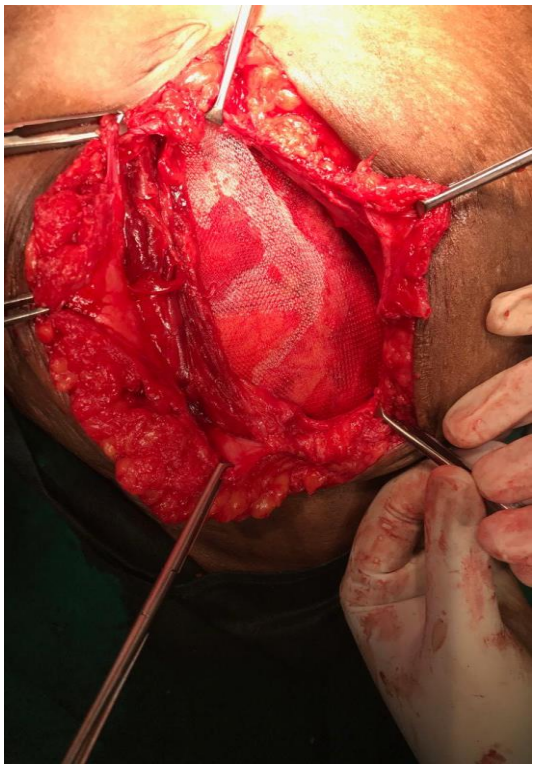

Figure 11

Sublay mesh placement

POST OPERATIVE CARE

- Ryles tube aspiration continuous and 2nd hourly to keep the stomach decompressed. .
- Surgical site was dressed and abdominal binder applied.
- I/V fluids are continued till bowel motility starts.
- Early ambulation.
- Negative Suction drain care.
- Antibiotic coverage till drain removal.
- Stool softeners and laxatives to avoid constipation and straining.
- Advised to avoid child bearing for 1 year and weight lifting for 6 months.

POST OPERATIVE COMPLICATIONS

GASTROINTESTINAL: Paralytic ileus secondary to excessive bowel handling which leads to increased intra abdominal pressure and poor wound healing.

PULMONARY: Respiratory conditions causes coughing or sneezing, which increases the intra abdominal pressure and lead to recurrence. Such conditions should be taken care of properly.

URINARY: Most common urinary complication is acute retention of urine which increases the intra abdominal pressure. Catheterization of the bladder with an indwelling Foley's catheter solves these complications.

DEEP VEIN THROMBOSIS: When the contents of the hernia sac is reduced back into the abdominal cavity, it increases the intra abdominal pressure causing venous hypertension in the lower extremities. This can predispose to DVT and can be prevented by prophylactic low dose heparin. Patients should be mobilized as early as possible in the post operative period.

LOCAL COMPLICATIONS:

SEROMA:

It is the recurring accumulation of serum in abdominal wall. It is the most common complication associated with IH repair. It warrants repeated needle aspirations and compression dressings, but it rarely requires continuous wound drainage.

HAEMATOMA:

Small hematomas are left undisturbed. It's always a site for SSI and should be drained when and where required.

WOUND INFECTIONS:

Superficial incisional:- Involves skin and subcutaneous tissue of the incision .

Deep incisional:- Includes tissue down to and including fascia and muscle.

Organ space:- Involves any body cavity that was opened during the surgery.

MATERIALS AND METHODS

SOURCE OF DATA:

All patients with incisional hernias admitted to Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar, in during the study period from Dec 2018 to June 2020.

In onlay mesh repair mesh was placed anteriorly to the rectus sheath defect with an overlap of 5 cm of the abdominal wall defect in each direction.

In sublay mesh placement, a space was created between the posterior rectus sheaths and the rectus muscle after peritoneum is closed with a continuous running absorbable suture material.

Polypropylene meshes of various sizes were used for the study.

Figure 12

Prolene mesh

DURATION OF STUDY: 18 months

STUDY DESIGN: COMPARATIVE STUDY

SAMPLE SIZE: 30

Sample size of standard deviation based on difference in duration of surgery in onlay and sublay mesh repair. Reported a variance estimate of 16.4 min to detect a difference of 30% deduction in duration of surgery with 95% confidence interval; with 80% power. The estimated sample size in each group is 12 (follow up study). Expecting a drop out ratio of 20% during follow up, the final sample size per group will be 12 +2.4 =15 (aprox).

Formulae

$$n = \frac{2s_p^2\left[z_{1-\alpha/_2} + z_{1-\beta}\right]^2}{u_d^2}$$

$$s_p^2 = \frac{s_1^2 + s_2^2}{2}$$

Where

s_1^2 : *standard deviation in the first group*

s_2^2 : *standard deviation of second group*

u_d^2 *: mean difference between the samples*

α *: significance level*

$1-\beta$ *: Power*

INCLUSION CRITERIA:-

All the patients above 18 years with anterior abdominal wall Incisional hernia

EXCLUSION CRITERIA:-

1. Patients with obstructed and strangulated hernia
2. Patients with divarcation of recti
3. Recurrent incisional hernia

METHOD OF COLLECTION OF DATA

The study includes patients with incisional hernias satisfying inclusion criteria who were admitted to the surgical wards of RLJH and RC.

A complete detailed history, as per standard proforma was obtained and documented. All patients underwent clinical examination with relevant investigations after obtaining an informed consent. Patients were divided into two groups using even-odd method to include similar types of cases in both groups. The subjects in "even group" underwent onlay repair where those in "odd group" underwent sublay repair. Intraoperatively the difficulty in fascial closure, time taken to complete the procedure were noted.

Patients were followed up throughout the course of their hospital stay for complications like post operative pain,seroma formation, hematoma formation and surgical site infection and reviewed over a period 1, 2 and 3 months for recurrence

STATISTICAL METHODS:

Difficulty in fascial closure, time taken to complete the procedure, Pain (VAS), surgical site infections were considered as primary outcome variables. Procedure (Onlay vs Sublay) was considered as primary explanatory variable. age, gender were other explanatory variables.

All Quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro- Wilk test was also conducted to assess normal distribution. Shapiro Wilk test p value of >0.05 was considered as normal distribution.

For normally distributed Quantitative parameters the mean values were compared between study groups using Independent sample t-test (2 groups). For non-normally distributed Quantitative parameters, Medians and Interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups).

Categorical outcomes were compared between study groups using Chi square test /Fisher's Exact test .P value < 0.05 was considered statisticaly significant.

RESULT

A total of thirty (Fifteen subjects were included in each group) subjects for final analysis:-

Table 1: Descriptive analysis of procedure in the study population (N=30)

Procedures	Frequency	Percentages
ONLAY	15	50.00%
SUBLAY	15	50.00%

Among the study population, 15(50%) participants underwent Onlay Procedure and 15(50%) underwent Sublay Procedure. (Table 1 & Figure 1)

Graph 1: Bar chart of procedures in the study population (N=30)

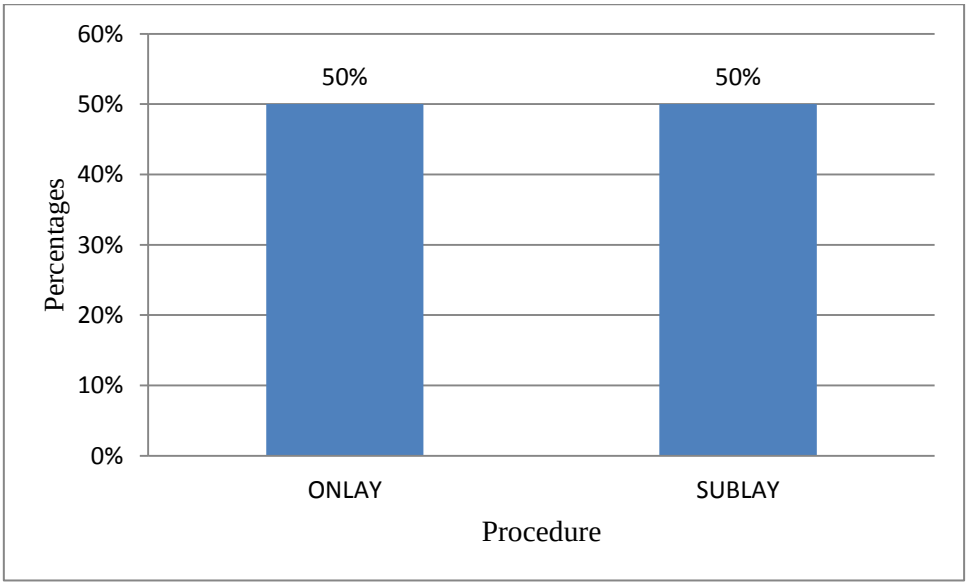

Table 2: Comparison of means of age across procedures (N=30)

Parameter	Procedure (Mean± SD)		P value
	Onlay (N=15)	Sublay (N=15)	
Age	54.8 ± 14.73	45.87 ± 11.92	0.079

There was no statistically significant difference in Mean Age between Procedures (P value 0.079). (Table 2)

Table 3: gender wise distribution across procedures (N=30)

Gender	Procedure		Chi square	P value
	Onlay (N=15)	Sublay (N=15)		
Male	3 (20%)	7 (46.67%)	2.400	0.121
Female	12 (80%)	8 (53.33%)		

There was no statistically significant difference in gender distribution of patients across procedures (P value 0.121). (Table 3 & Figure 2)

Graph 2: Stacked bar chart of comparison of gender across procedures (N=30)

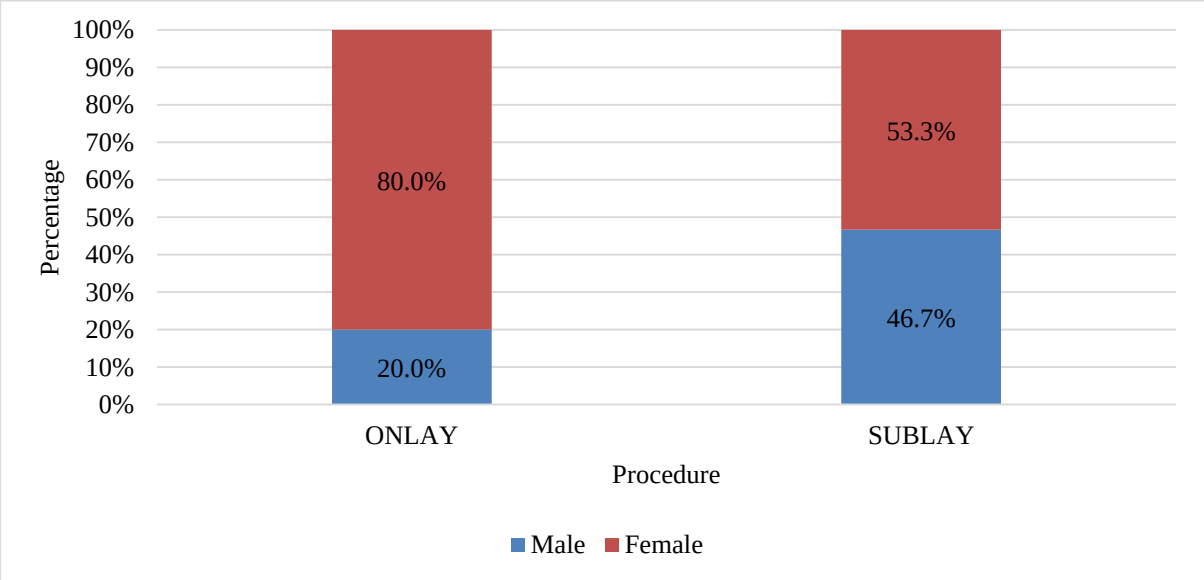

Table 4: Comparison of difficulty in fascial closure across procedures (N=30)

Difficulty in Fascial Closure	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	1 (6.67%)	5 (33.33%)	0.169
No	14 (93.33%)	10 (66.67%)	

There was no statistically significant difference in difficulty in fascial closure across Procedures (P value 0.169). (Table 4 & Figure 3)

Graph 3: Stacked bar chart of comparison of difficulty in fascial closure between procedure (N=30)

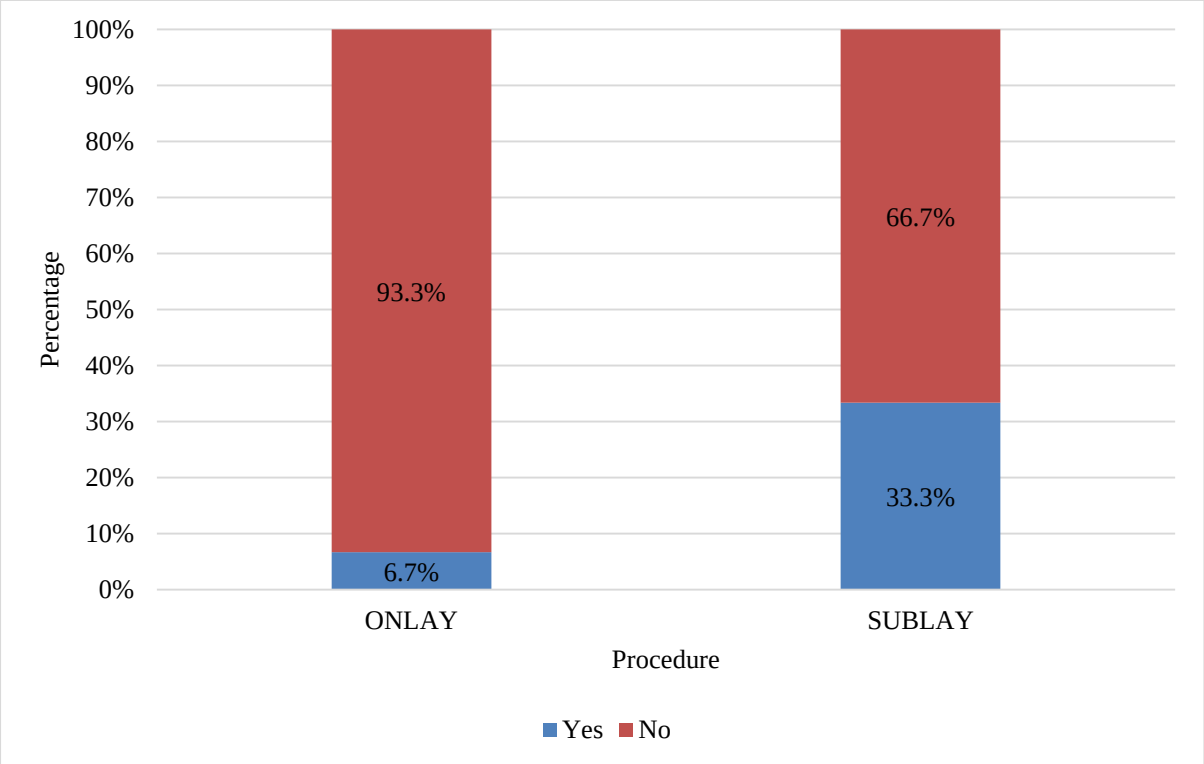

Table 5: Comparison of Pain (VAS) between procedure (N=30)

Parameter	Procedure Median (IQR)		Mann Whitney U test (P value)
	Onlay (N=15)	Sublay (N=15)	
Pain (VAS)	4 (4,5)	5 (4,5.5)	0.103

There was no statistically significant difference in Pain (VAS) across procedures (P value 0.103). (Table 5 & Figure 4)

Graph 4: Line chart of comparison of difficulty in facial closure across procedures (N=30)

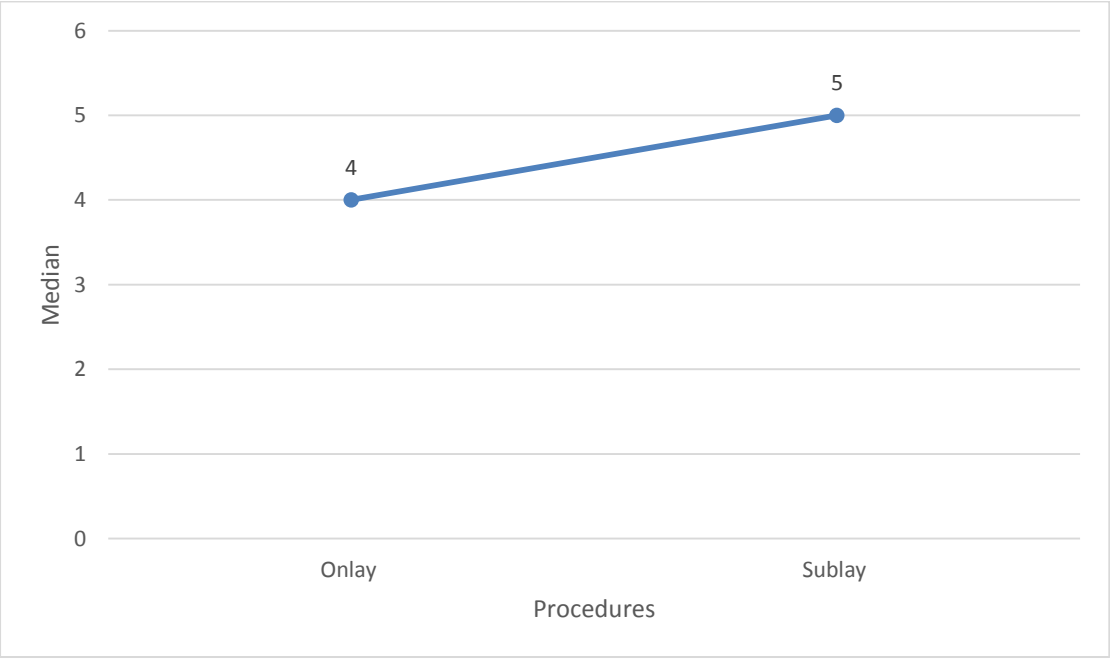

Table 6: Comparison of SSI across procedures (N=30)

Surgical site infections	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	2 (13.33%)	1 (6.67%)	1.00
No	13 (86.67%)	14 (93.33%)	

There was no statistically significant difference in Surgical site infections between Procedures (P value 1.00). (Table 6 & Figure 5)

Graph 5: Stacked bar chart of Surgical site infections across procedures (N=30)

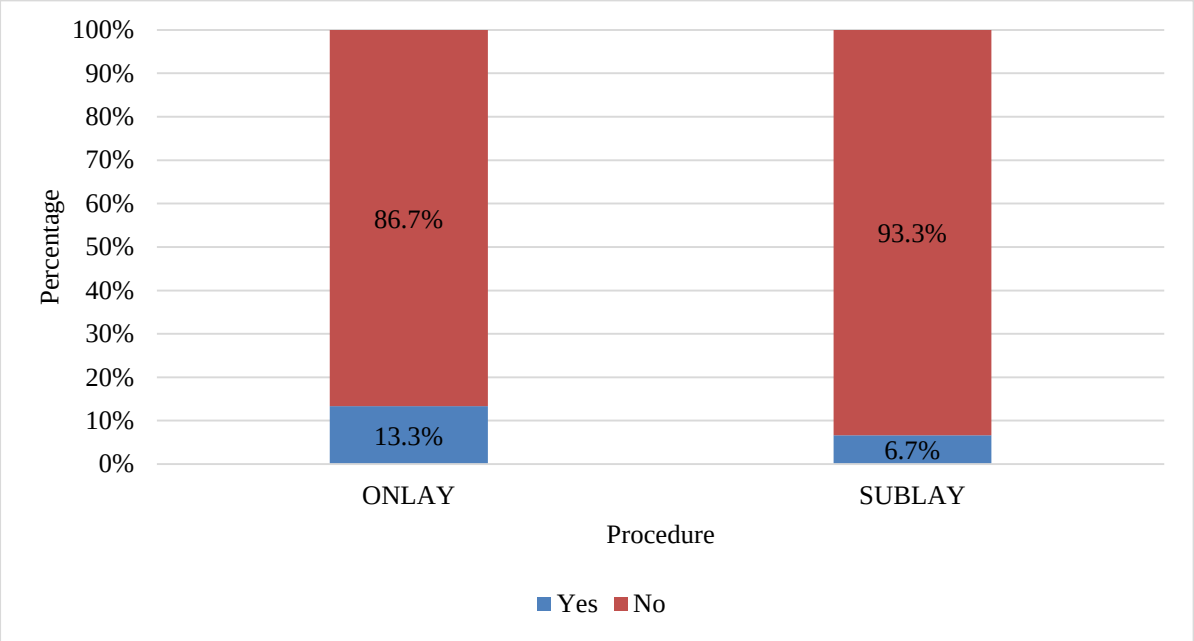

Table 7: Comparison of seroma across procedurse (N=30)

Seroma	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	2 (13.33%)	1 (6.67%)	1.000
No	13 (86.67%)	14 (93.33%)	

There was no statistically significant difference in Seroma between procedures (P value 1.00). (Table 7 & Figure 6)

Graph 6: Stacked bar chart of Seroma across procedures (N=30)

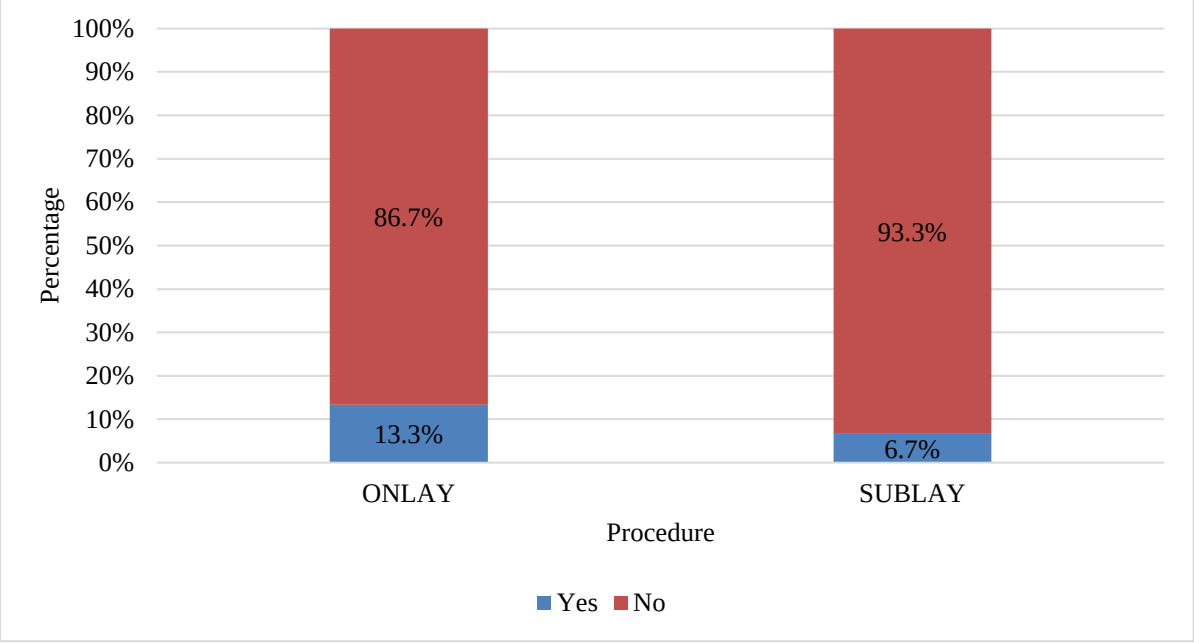

Table 8: Comparison of haematoma formation across procedures (N=30)

Haematoma	Procedure	
	Onlay (N=15)	Sublay (N=15)
No	15 (50%)	15 (50%)

Table 9: Comparison of Recurrence between procedure (N=30)

Recurrence	Procedure	
	Onlay (N=15)	Sublay (N=15)
No	15 (50%)	15 (50%)

None of the patients developed recurrence or hematoma on a follow up of three months (Table 8 and Table 9)

DISCUSSION

Incisional hernia (IH) has been a complication following abdominal surgery for more than a hundred years. Ian Aird defines IH as a "diffuse protrusion of peritoneum and abdominal cavity contents through a weak / poor scar of an operation, or an accidental wound ". IH occurs in 5-12 % of patients subjected to abdominal surgeries. Many factors are associated with IH like age of the patient , gender , obesity(BMI>30) , chronic cough , diabetes mellitus, urinary obstructions , any occupations which increases intra-abdominal pressure, type of suture material used and SSI(surgical site infection).

ONLAY MESH REPAIR:

Onlay mesh repair was done in preference to other procedures because of the following reasons:-

1. Onlay is technically simple and easy procedure compared to others.
2. No need to dissect in complex areas like behind the rectus, which leads to hematoma formation.
3. Complications like obstruction due to adhesion formation and fistula formation are rare compared to other procedures.

RETROMUSCULAR (sublay) MESH REPAIR

It is an excellent technique (Rives-Stoppa technique) by placing the sheet of prosthetic mesh in the plane between the posterior rectus sheath and the rectus muscles. This has distinct advantages over the intraperitoneal, inlay or onlay technique. Though it is technically challenging with the higher rate of blood loss it has the distinct advantage of reducing the rate of infection and recurrence.

Mesh repair has become the standard for the repair of all incisional Hernias. Among the various techniques described in the mesh placement; onlay repair, though technically easier and associated with the negligible blood loss, is complicated by a higher rate of infection and seroma formation.

It is estimated that 2 to 10% of all abdominal operations result in an IH. Small hernias less than one inch in diameter can be successfully closed with anatomical repair. However, larger ones have a recurrence rate of up to 30-40% when a anatomical repair alone is performed . Nowadays tension free repair using prosthetic mesh has decreased recurrence to negligible.

In this study we have compared the two different type of mesh repair ie.onlay and sublay .Controversy exists among the surgeons regarding the use of types of either mesh repair, due to difference in ease in performing the surgery, difficulty in facial closure, complications like seroma , hematoma , SSI, occurring in the post operative period and the recurrence.

In our study attempt has been made to compare both these types of mesh repair and their outcome.

AGE OF PRESENTATION

Incisional hernias are more common in patients aged between 40-60 years (60 %) in our study. Youngest patient in our study was 25 years old. It was found that incisional hernias could be rare after 80 years as no patient was more than 80 years in our study.

GENDER DISTRIBUTION

Incisional hernias are more common among females.20 (66.6 %) patients were females and 10 (33.3%) patients were male ($p<0.121$) . In literature the ratio is 3:1. In our study it was 2:1. There is no significant difference in age distribution in males and females, as disease is more common between 40 to 60 years in both. Ellis H. et al.[23] have observed 64.6% of female preponderance in his study of 342 patients. In our study females comprised 66.6%, in a study by Godara et al[31] 42.5% of all subjects were females.

TABLE 10:- Percentage females in different study series

Study Group	Percentage females (%)
Ellis H. et al[23]	64.6
Godara et al[35]	42.5
Present study	66.6

ASSOCIATED FACTORS IN INCISIONAL HERNIA

Among incisional hernias Gynaecological surgeries are the most common associated surgery. Tubectomy was the most common predisposing surgery, constituting 50% followed by LSCS (45.8%), Hysterectomy (4-2%). Godara et al series[35] also mentions Gynaecological surgeries as the most common associated preceding surgery.

DIFFICULTY IN FASCIAL CLOSURE

Difficulty in fascial closure was seen in 1 (6.67%) case of onlay and 5 (33.33%) cases of sublay mesh placement (P <0.169). This was studied depending upon the duration of surgery.

Mean duration of procedure in our series, in onlay mesh repair was 48.6 minutes and those who underwent sublay mesh repair was 74.6 minutes (p<0.169). The difference could be accounted to more time required for dissection for creating pre peritoneal space. Securing adequate haemostasis is another reason for delay in completing the procedure. Ease of operation was largely subjective, and depended on surgeons' experience, exposure, quality of assistance and conductive facilities. Godara et al[35], reported a mean duration of 49.35 minutes for Onlay and a mean duration of 63.15 minutes for sublay Mesh repair (p<0.0001), while in John. J. Gleysteen et al[36] series the mean duration for onlay and Pre-peritoneal Mesh repair were 42 and 70.5 minutes respectively. Table 10 shows the comparison of duration of surgery in different series.

TABLE 11:- Comparison of duration of surgery in different series

Mean Duration (in minutes)	Godara et al[35] (100)	John. J. Gleysteen et al[36] (125)	Present study (*30)
ONLAY	49.35	42	48.6
SUBLAY	63.15	70.5	74.6

COMPLICATIONS

The most common complication observed was seroma and surgical site infection. Seroma was seen in 30 % (3 patients) patients. Of these 2 patients under went onlay repair and 1 patient sublay mesh repair (P<1.0). Seroma was less in the **sublay** group. This complication was managed with seroma drainage. Onlay technique had more of seroma formation , due to the fact that onlay techniques requires significant subcutaneous dissection to place the mesh, which can lead to devitalized tissue with seroma formation or infection. The superficial location of the mesh also puts it in danger of becoming infected if there is a superficial wound infection.

Wound infection rate is about 30 % (three patients) in our patients. Of these 2 patients had onlay mesh and 1 patient had sublay mesh placement (P<1.0). These patients were treated with appropriate antibiotics as per culture and sensitivity and regular dressing. No patient required removal of mesh because the infection was superficial and responded well to antibiotics.

The mean pain score assessed by VAS was 4 (4, 5) in onlay and 5 (4, 5.5) in sublay mesh placement (P<0.103). Pain was more in sublay group. This is due to the fact that sublay mesh placement requires extensive dissection to create plane between the rectus muscle and posterior rectus sheeth.

TABLE 12:- C**omparison of overall complications of surgery in different series**

Complications	Godara et al[35]	John. J. Gleysteen et al[36]	Present study
ONLAY	15%	19%	13.33%
SUBLAY	22.5%	12%	6.66%

RECURRENCE AND HAEMATOMA

No recurrence of hernia or hematoma was noticed in both sublay and onlay mesh placements during the limited observation follow up period, in the present series .John. J. Gleysteen et al[36] found a recurrence rate to be 20% in Onlay and 4% in sublay Mesh repairs . A retrospective study in Europe done by de Vries Relingh et al[37] (2004) noticed a recurrence rate of 23% in cases that underwent onlay mesh repair, and no recurrence in patients with sublay mesh repair. According to the Shackelford primary repair is often under tension in onlay meshplasty, which can contribute to recurrence.

TABLE 13:- **Comparison of recurrence rates in different studies**

Recurrence Rate	John. J. Gleysteen et al[36]	de Vries Relingh et al[37]	Present study
ONLAY	20%	23%	0
SUBLAY	4%	0%	0

All the complications were comparable between both types of mesh repairs based on P value .

Sublay mesh repair is considered superior because the mesh with significant overlap placed under the muscular abdominal wall works according to Pascal's principles of hydrostatics. The intra-abdominal cavity functions as a cylinder, and therefore the pressure is distributed uniformly to all aspects of the system. Consequently, the same forces that are attempting to push the mesh through hernia defects are also holding the mesh in place against the intact abdominal wall. In this manner, the prosthetic is held firmly in place by intra-abdominal

pressure. The mechanical strength of the prosthetic mesh prevents protrusion of the peritoneal cavity through the hernia because the hernia sac is indistensible against the mesh. Over time, the prosthetic mesh is incorporated into the fascia and unites the abdominal wall, now without an area of weakness.

CONCLUSION

Sublay mesh repair is a better technique with less incidence of postoperative compilations like seroma formation, surgical site infection and least recurrence rate, and minimal mesh related-complication..

- Seroma formation and infection are found to be more commonly associated with onlay mesh placement compared to sublay mesh placement.

- Although time taken for surgery in onlay mesh repair is significantly less compared to sublay mesh repair, a complication associated with it limits its wider usage. Ease of the procedure in performing onlay mesh repair over sublay repair gives it the points over pre-peritoneal but, associated complications limits its use.

- Pain was more in sublay group. This is due to the fact that sublay mesh placement requires extensive dissection to create plane between the rectus muscle and posterior rectus sheath.

- Current study does not have any recurrence or haematoma formation during the available follow up period.

Finally it can be concluded that "Sublay mesh repair is superior to Onlay mesh repair" for ventral incisional hernia repair

SUMMARY

Mesh repair has become the standard for the repair of all incisional herniae. Among the various techniques described for the mesh placement; onlay repair, though technically easier with the low incidence of blood loss, is complicated by a higher rate of infection and seroma formation.

In our study attempts to compare these two types of mesh repair (ONLAY AND SUBLAY MESH PLACEMENT) and their outcome after obtaining the approval of institutional and ethics committee.

In this study, 30 patients with incisional Hernia, admitted to **Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar,** during the study period of December 2018 to June 2020 were treated with onlay and sublay mesh placement .

Thirty patients presenting with IH were admitted and preoperatively assessed clinically and investigated by USG to confirm the diagnosis. Fifteen patients in each group underwent sublay and onlay mesh placements after obtaining informed consent and satisfying the above mentioned inclusion criteria.

Results were analysed according to the factors like difficulty in fascial closure, post operative pain, seroma and hematoma formation, infection and recurrence.

We observed seroma formation and infection in 6.66 %, 6.66%, patients respectively in onlay mesh placement group and 3.33% ,3.33% in patients respectively in sublay mesh repair group. No recurrence was noted in any of the group during the follow up period. Based upon these we observed superior

results in sublay mesh placement in incisional hernia repair as compared with onlay placement repair method.

BIBLIOGRAPHY

1) Bucknall TE, Cox PJ, Ellis H. Burst abdomen and incisional hernia: A prospective study of 1129 major laparotomies. British Medical Journal 1982;284:931-3

2) Mudge M, Hughes LE. Incisional hernia : A 10 year prospective study of incidence and attitudes.Br J Surg 1985; 72: 70-1

3) Devlin HB, Kingsmith HB. Abdominal wall and hernias. Chapter 10th in A new aids companion in surgical studies, 2nd edition. Keim GB Lunard, Edingburgh Churchill Livingstone; 1998:688-99

4) Ponka JL, Hernias of the abdominal wall. Phildelphia, PA :WB Saunders; 1981.

5) Devlin HB. Incisional hernia, management of abdominal hernia, 1st edition, Butterworth and Co limited, Cleveland : 1988:161-77

6) Mc Arthur LL. Autoplastic suture in hernia and other diastases- Preliminary report. JAMA 1901; 37: 1162

7) Koontz AR. Preliminary report on the use of tantalum mesh in the repair of ventral hernia. Ann of Surg 1948; 127: 1079

8) Throckmorton TD. Tantalum gauze in the repair of hernia and complicated by tissue deficiency. Surg 1948; 23:32

9) Judd ES. The prevention and treatment of ventral hernia. Surg Gynecol Obstet 1912; 14: 175

10) Gibson LC. Operation for cure of large ventral hernias. Ann Surg 1920; 72: 214-17

11) Mair GB. Preliminary report on the use of whole skin grafts as a substitute for fascial sutures in the treatment of hernia. Br J Surg 1945; 32: 381

12) Usher FC, Oschner J, Tuttle LLD Jr. Use of marlex mesh in the repair of incisional hernia. Am J Surg 1958; 24: 969

13) Jayant Sharma. Prolene meshplasty in hernia repair. Br J Surg 1997; oct:

289-92

14) Lichtenstein IL, Shulman AG, Amid PK. Twenty questions about hernioplasty. Am Surg 1991; 57: 730-3

15) Carbajo MA, Martpdel, Olmo JC, Blanco JL. Laparoscopic approach to incisional hernia . Surg Endoscopy 2003; 17(1): 118-22

16) Cassar K, Munro A. Surgical treatment of incisional hernia. Br J Surg 2002; 89(5): 534-45

17) Nayman J. Mass closure of abdominal wounds. Med J Australia 1976; 1: 183

18) Bartlett LC. Pressure necrosis is the primary cause of wound dehiscence. Can J Surg 1985; 28: 27

19) Zimmerman LM. The use of prosthetic materials in the repair of hernias. Surg Clinics of N. America 1968; 48: 143-53

20) Goligher JC, Irwin TT et al. A controlled trial of three methods of closure of laparotomy wounds. Br J Surg 1975; 62 : 823

21) Donaldson DR, Hegarty JH et al. The lateral paramedian incision- Experience with 850 cases. Br J Surg 1982; 69: 630-32

22) Abrahamson Jack. "Hernias" Chapter 14th in Michael J Zinner, Seymour Schwartz, Harold Ellis, Editors. Maingot's Abdominal Operations. Volume 1. 10th edition. Connecticut: Prentice hall international inc; 1997. 479pp

23) Ellis H, Gajraj H, George CD. Incisional hernias- when do they occur? Br J Surg 1983; 70: 290

24) Ellis H, Heddle R. Does the peritoneum need to be closed at laparotomy? . Br J Surg 1977; 64: 733

25) Polk HC, Lopex, Mayer JF. Post operative wound infection in surgery. Surgery 1969; 66: 97-103

26) Rios et al. Antibiotic prophylaxis in incisional hernia repair using a prosthesis. Hernia 2001 (sept); 5(3) : 148-52

27) Abrahamson J, Eldar S. Extraperitoneal repair of large post operative ventral abdominal hernias- Shoelace technique. Theor Surg 1987; 2:70

28) Abrahamson J, Eldar S. Anew method of repair of large post operative ventral hernias. Dig Surg 1884; 1: 117

29) Adloff M, Arnaud JP. Surgical management of large incisional hernia by an intraperitoneal mersilene mesh and an aponeurotic graft. Surg Gynaecol Obstet 1987; 165(3): 204-206

30) Canadey JE. Some of the uses of cutis graft in surgery. Am J Surg 1943; 59: 409

31) Gallie WE, Measurier AB. Living sutures in the treatment of hernia. Canadian Med Assoc Journal 1923; 13: 468

32) Mc Govin L. The double filigree operation for the radical cure of inguinal hernia. Br Med J 1909; 2: 357

33) Leaper DJ, Allan A et al. Abdominal wound closure- A controlled trial of nylon and polydiaxanone(PDS). Ann R Coll Surg(England) 1985; 67:273

34) Carbon fiber in hernia repair. Editorial Lancet 1990; Oct(20): 336

35) Godara et al Comparative evaluation of Sublay Vs Onlay Meshplasty in ventral hernia. *IJOS, 2006 vol8.*

36) John j . Gleysteen ,Mesh – Reinforced ventral hernia repair, Arch surg.2009; 144(8): 740-745

37) de Vries Reilingh TS, van Geldere D, Langenhorst BLAM, de Jong D, van der Wilt GT, van Goor H, et al. Repair of large midline incisional hernias with polypropylene mesh: comparison of three operative techniques. *Hernia.* 2004;8:56–9

38) Parekh JN, Shah DB, Thakore AB. Incisional hernia- A study of 76 cases. Indian Journal Of Surgery 1988; 50: 49-53

39) Bose SM, Lal Roshan, Kalra Manju, Wig JD, Khanna SK. Ventral hernia – A review of 175 cases. Indian Journal Of Surgery 1999; 61(3): 180-84

40) Santora A Thomas, Goel. Incisional hernia. Surgical Clinics Of North

America; 73(3): 557-68

41) Khaira HS, Lall P, Hunter B, Brown HJ. Repair of incisional hernias.J R Coll Surg Edinb 2001; 46: 39-43

42) Jacobus WA et al. Long term follow-up of a randomized controlled trial of suture versus mesh repair of incisional hernia. Annals of Surgery 2004; 240(4): 578-8

ANNEXURE - I

PROFORMA

Particulars of the patients:

- Name :
- Age:
- Gender:
- Occupation:
- Date of admission:
- Date of discharge:
- UHID NO :
- Religion :
- Socio economic status :

HISTORY

- Chief complaints:
- HOPI :
- Past History:
- Family History:
- Personal History
- Menstrual history
- Family history:
- General physical examination

LOCAL EXAMINATION(P/A)

INSPECTION :

PALPATION :

PERCUSSION:

AUSCULTATIION:

SYSTEMIC EXAMINATION

CVS :

RS :

CNS:

VITALS

- Pulse rate :
- Blood pressure :
- Respiratory Rate:
- Temperature :

INVESTIGATIONS

HAMETOLOGICAL:

CBC- BT - CT- Blood grouping-

Blood Urea – Serum Creatinine –

Serum sodium- Serum potassium-

HIV- RBS- ECG-

HBsAg- USG- CXR PA VIEW-

- DIAGNOSIS
- PREOPERATIVE ORDERS
- SURGERY PERFORMED
- POSTOPERATIVE ORDERS AND PROGRESS

OUTCOMES

- DIFFICULTY IN FASCIAL CLOSSURE
- POST OPERATIVE PAIN(VAS)
- SEROMA FORMATION
- HEMATOMA FORMATION
- SURGICAL SITE INFECTIONS
- RECURRENCE

ANNEXURE - II

PATIENT INFORMATION SHEET

A COMPARATIVE STUDY OF ONLAY AND SUBLAY MESH REPAIR IN THE MANAGEMENT OF INCISIONAL HERNIAE

Patient name: Address:

Age: Ward and UHID no:

Sex: Study no:

INCISIONAL HERNIA is defined as a diffuse extrusion of peritoneum and abdominal contents through a weak scar of an operation or accidental wound. This can result in bowel strangulation, enterocutaneous fistula and affects quality of life. The incidence of IH is even higher in patients with risk factors such as obesity and abdominal aneurysms.

INCISIONAL HERNIA are repaired by an open technique such as onlay mesh placement and sublay mesh placement. The sublay repair technique where the mesh is placed on the posterior rectus fascia and onlay repair technique is where the mesh is placed on the anterior rectus fascia. Recurrence rate is low with the use of this techniques, however the disadvantage of sublay is increased post operative pain and that of onlay is increased chance of seroma formation.

This is a comparative study between onlay and sublay mesh repair in the management of incisional hernias. Patient satisfying the inclusion criteria will be divided into two groups as per the even-odd method. Patients in group A will be managed with onlay mesh placement and group B with sublay mesh placement. Patients will be followed up throughout the course in hospital stay for complications like post operative pain , seroma formation, hematoma

formation and surgical site infection and reviewed over a period 1, 3 and 6 months for recurrence.

For further information contact
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Post graduate
Department of General Surgery
SDUMC , Kolar
Ph:-7510106246

ANNEXURE - III

INFORMED CONSENT FORM

TITLE: - A COMPARATIVE STUDY OF 0NLAY AND SUBLAY MESH REPAIR IN THE MANAGEMENT OF INCISIONAL HERNIAE.

I have been explained in my own understandable language, that I will be included in a comparative study of onlay repair versus sublay repair for incisional hernia, being conducted in RL Jalappa Hospital, Tamaka, Kolar.

I have or have been read to me and understand the purpose of study, type of study, risks and benefits associated with my involvement. I have been explained that my clinical findings, investigations, intra-operative findings, post-operative course, will be assessed and documented for study purpose. I will have the opportunity to ask questions regarding various aspects of the study.

I have been explained my participation in this study is entirely voluntary and I can withdraw from the study any time and this will not affect my relationship with my doctor or the treatment for my ailment.

I have been explained on my own understandable language about the follow up details and possible benefits adversities due to interventions. I have understood that all my details found during the study are kept confidential and while publishing or sharing of the findings, my details will be masked.

I the undersigned agree to voluntarily participate in the study and authorize the collection and disclosure of my personal information for my research.

Subject name and signature/thumb impression Date:

Name and signature/thumb impression of witness: Date:

Name and signature of person obtaining consent: Date:

ರೋಗಿ ಮಾಹಿತಿ ಹಾಳೆ

ಶೀರ್ಷಿಕೆ:- ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾಸ್ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಆನ್ಲೇ ಮತ್ತು ಸಬ್ ಲೇ ಮೆಶ್ ರಿಪೇರಿಯ ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನ

ರೋಗಿಯ ಹೆಸರು: ವಿಳಾಸ:

ವಯಸ್ಸು: ವಾರ್ಡ್ ಮತ್ತು ಯುಹೆಚ್ಐಡಿ ಸಂಖ್ಯೆ:

ಲಿಂಗ : ಅಧ್ಯಯನ ಸಂಖ್ಯೆ:

ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾವನ್ನು ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಅಥವಾ ಆಕಸ್ಮಿಕ ಗಾಯದ ದುರ್ಬಲ ಗಾಯದ ಮೂಲಕ ಪೆರಿಟೋನಿಯಂ ಮತ್ತು ಕಿಬ್ಬೊಟ್ಟೆಯ ಒಳಭಾಗಗಳನ್ನು ಒಂದು ವಿಸರಣ ಹೊರಹೋಗುವಿಕೆಯು ಎಂದು ವ್ಯಾಖ್ಯಾನಿಸಲಾಗಿದೆ. ಇದರಿಂದ ಕರುಳಿನಲ್ಲಿ ನವೆ ಹಿಸುಕುವುದು, ಎಂಟರೋಕ್ಯುಟೇನಸ್ ಫಿಸ್ತೂಲಾ ಮತ್ತು ಜೀವನದ ಗುಣಮಟ್ಟದ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರಬಹುದು. ಸ್ಥೂಲಕಾಯತೆ ಮತ್ತು ಕಿಬ್ಬೊಟ್ಟೆಯ ರಕ್ತನಾಳಗಳಂತಹ ಅಪಾಯಕಾರಿ ಅಂಶಗಳಲ್ಲಿ ರೋಗಿಗಳಲ್ಲಿ ಐಹೆಚ್ ಸಂಭವವು ಇನ್ನೂ ಹೆಚ್ಚಾಗಿದೆ.

ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾವನ್ನು ಆನ್ಲೇ ಮೆಶ್ ಪ್ಲೇಸ್ ಮೆಂಟ್ ಮತ್ತು ಸಬ್ ಲೇ ಮೆಶ್ ಪ್ಲೇಸ್ ಮೆಂಟ್ ನಂತಹ ಮುಕ್ತ ತಂತ್ರದಿಂದ ಸರಿಪಡಿಸಲಾಗುತ್ತದೆ ಹಿಂಭಾಗದ ರೆಕ್ಟಸ್ ತಂತುಕೋಶ ಮತ್ತು ಒನ್ಲೇ ರಿಪೇರಿ ತಂತ್ರದ ಮೇಲೆ ಜಾಲರಿಯನ್ನು ಇರಿಸಲಾಗಿರುವ ಸಬ್ಲೇ ರಿಪೇರಿ ತಂತ್ರವೆಂದರೆ ಮುಂಭಾಗದ ರೆಕ್ಟಸ್ ತಂತುಕೋಶದ ಮೇಲೆ ಜಾಲರಿಯನ್ನು ಇರಿಸಲಾಗುತ್ತದೆ. ಈ ತಂತ್ರಗಳ ಬಳಕೆಯೊಂದಿಗೆ ಮರುಕಳಿಸುವಿಕೆಯ ಪ್ರಮಾಣವು ಕಡಿಮೆಯಾಗಿದೆ, ಆದಾಗ್ಯೂ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರ ಉಪಲೇಯ ಅನಾನುಕೂಲವು ಹೆಚ್ಚಾಗುತ್ತದೆ ಮತ್ತು ಆರೋಮಾ ರಚನೆಯ ಸಾಧ್ಯತೆಯು ಹೆಚ್ಚಾಗುತ್ತದೆ.

ಇದು ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾಗಳ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಆನ್ಲೇ ಮತ್ತು ಸಬ್ ಲೇ ಮೆಶ್ ರಿಪೇರಿ ನಡುವಿನ ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನವಾಗಿದೆ. ಒಳಗೊಳ್ಳುವಿಕೆಯ ಮಾನದಂಡವನ್ನು ತೃಪ್ತಿಪಡಿಸುವ ರೋಗಿಯನ್ನು ಸಮ-ಬೆಸ ವಿಧಾನದ ಪ್ರಕಾರ ಎರಡು ಗುಂಪುಗಳಾಗಿ ವಿಂಗಡಿಸಲಾಗುತ್ತದೆ. ಎ ಗುಂಪಿನಲ್ಲಿರುವ ರೋಗಿಗಳನ್ನು ಆನ್ಲೇ ಮೆಶ್ ಪ್ಲೇಸ್ ಮೆಂಟ್ ಮತ್ತು ಗ್ರೂಪ್ ಬಿ ಸಬ್ ಲೇ ಮೆಶ್ ಪ್ಲೇಸ್ ಮೆಂಟ್ ನೊಂದಿಗೆ ನಿರ್ವಹಿಸಲಾಗುತ್ತದೆ. ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರನೋವು ಮತ್ತು ಸೆರೋಮಾ ರಚನೆ, ಹೆಮಟೋಮಾ ರಚನೆ ಮತ್ತು ಶಸ್ತ್ರಚಿಕಿತ್ಸಾ ಸ್ಥಳದ ಸೋಂಕು ಮುಂತಾದ ತೊಂದರೆಗಳಿಗಾಗಿ ರೋಗಿಗಳನ್ನು ಆಸ್ಪತ್ರೆಯ ವಾಸ್ತವ್ಯದ ಉದ್ದಕ್ಕೂ ಅನುಸರಿಸಲಾಗುತ್ತದೆ ಮತ್ತು 1, 3 ಮತ್ತು 6 ತಿಂಗಳುಗಳ ಕಾಲ ಪುನರಾವರ್ತಿತವಾಗಿ ಮರುಪರಿಶೀಲನೆ ಮಾಡಲಾಗುತ್ತದೆ.

ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗೆ ಸಂಪರ್ಕಿಸಿ
ಡಾ. ಸುನಿಲ್ ಮ್ಯಾಥ್ಯೂ
ಸ್ನಾತಕೋತ್ತರ ಪದವಿ
ಜನರಲ್ ಸರ್ಜರಿ ವಿಭಾಗ
ಎಸ್ ಡಿಯುಎಂಸಿ , ಕೋಲಾರ .

ರೋಗಿ ಸಮ್ಮತಿ ಪತ್ರ

ಶೀರ್ಷಿಕೆ:- ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾಸ್ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಆನ್ಲೇ ಮತ್ತು ಸಬ್ ಲೇ ಮೆಶ್ ರಿಪೇರಿಯ ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನ

ಕೋಲಾರದ ಆರ್.ಎಲ್.ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ನಡೆಯುತ್ತಿರುವ ಇನ್ಸಿಷನಲ್ ಹರ್ನಿಯಾದ ಬಗ್ಗೆ ನಾನು ಒಂದು ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನದಲ್ಲಿ ಸೇರಿಸಲಾಗುವುದು ಎಂದು ನನ್ನ ಸ್ವಂತ ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ.

ನಾನು ಸಮ್ಮತಿ ಪತ್ರ ಓದಿದ್ದೇನೆ ಮತ್ತು ಅಧ್ಯಯನದ ಉದ್ದೇಶ, ಅಧ್ಯಯನದ ಪ್ರಕಾರ, ಅಪಾಯಗಳು ಮತ್ತು ನನ್ನ ತೊಡಗಿಸಿಕೊಳ್ಳುವಿಕೆಗೆ ಸಂಬಂಧಿಸಿದ ಪ್ರಯೋಜನಗಳನ್ನು ಅರ್ಥಮಾಡಿ. ನನ್ನ ವೈದ್ಯಕೀಯ ಸಂಶೋಧನೆಗಳು, ತನಿಖೆಗಳು, ಒಳ-ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರದ ಸಂಶೋಧನೆಗಳು, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರದ ಕೋರ್ಸ್ ಗಳನ್ನು ಅಧ್ಯಯನ ಉದ್ದೇಶಕ್ಕಾಗಿ ಮೌಲ್ಯಮಾಪನ ಮಾಡಲಾಗುತ್ತದೆ ಮತ್ತು ದಾಖಲಿಸಲಾಗುತ್ತದೆ ಎಂದು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ. ಅಧ್ಯಯನದ ವಿವಿಧ ಆಯಾಮಗಳ ಬಗ್ಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳುವ ಅವಕಾಶ ನನಗೆ ದೊರೆಯುತ್ತದೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಪಾಲ್ಗೊಳ್ಳುವಿಕೆ ಸಂಪೂರ್ಣವಾಗಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ ಮತ್ತು ನಾನು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು ಮತ್ತು ಇದು ನನ್ನ ವೈದ್ಯರೊಂದಿಗಿನ ನನ್ನ ಸಂಬಂಧದ ಮೇಲೆ ಅಥವಾ ನನ್ನ ಕಾಯಿಲೆಯ ಚಿಕಿತ್ಸೆಮೇಲೆ ಪರಿಣಾಮ ಬೀರುವುದಿಲ್ಲ ಎಂದು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಹಸ್ತಕ್ಷೇಪಗಳಿಂದ ಉಂಟಾಗುವ ಅನುಸರಣೆ ವಿವರಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಯೋಜನಗಳ ಬಗ್ಗೆ ನನ್ನ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ. ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ದೊರೆತ ನನ್ನ ಎಲ್ಲಾ ವಿವರಗಳನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಮತ್ತು ಸಂಶೋಧನೆಗಳನ್ನು ಪ್ರಕಟಿಸುವಾಗ ಅಥವಾ ಹಂಚಿಕೊಳ್ಳುವಾಗ, ನನ್ನ ವಿವರಗಳನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ನಾನು ಅಧ್ಯಯನದಲ್ಲಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿ ಭಾಗವಹಿಸಲು ಮತ್ತು ನನ್ನ ಸಂಶೋಧನೆಗಾಗಿ ನನ್ನ ವೈಯಕ್ತಿಕ ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸಲು ಮತ್ತು ಬಹಿರಂಗಪಡಿಸಲು ಅನುಮತಿ ನೀಡಲು ನಾನು ಒಪ್ಪುತ್ತೇನೆ.

ಪ್ರಯೋಗಾರ್ಥಿ ಹೆಸರು ಮತ್ತು ಸಹಿ/ಹೆಬ್ಬೆಟ್ಟು ಗುರುತು ದಿನಾಂಕ:

ಸಾಕ್ಷಿಯ ಹೆಸರು ಮತ್ತು ಸಹಿ/ಹೆಬ್ಬೆಟ್ಟಿನ ಗುರುತು: ದಿನಾಂಕ:

ಸಮ್ಮತಿ ಯನ್ನು ಪಡೆಯುತ್ತಿರುವ ವ್ಯಕ್ತಿಯ ಹೆಸರು ಮತ್ತು ಸಹಿ: ದಿನಾಂಕ:

ANNEXURE IV

MASTER CHART