

**“A PROSPECTIVE STUDY IN MANAGEMENT OF INCISIONAL  
HERNIA”**

**Dissertation submitted to**

**THE TAMILNADU  
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**With fulfillment of the Regulations  
For the Award of the Degree of**

**M.S. GENERAL SURGERY  
(BRANCH - I)**



**DEPARTMENT OF GENERAL SURGERY  
MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI  
HOSPITAL  
MADURAI – 625020  
APRIL – 2015**

## **CERTIFICATE**

This is to certify that this dissertation titled “**A PROSPECTIVE STUDY IN MANAGEMENT OF INCISIONAL HERNIA**” at **Government Rajaji Hospital, Madurai** submitted by **DR. P.MUKESH KUMAR**, to the faculty of General Surgery, **The Tamilnadu Dr. M.G.R. Medical University, Chennai** in partial fulfillment of the requirement for the award of MS degree (Branch I) General Surgery, is a bonafide research work carried out by him under my direct supervision and guidance from September 2013 to August 2014.

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**I have great pleasure in forwarding it to The Tamilnadu Dr. M.G.R. Medical University, Chennai.**

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## **DECLARATION BY THE CANDIDATE**

I, **DR. P.MUKESH KUMAR**, solemnly declare that the dissertation titled “**A PROSPECTIVE STUDY IN MANAGEMENT OF INCISIONAL HERNIA**” is a bonafide and genuine research work carried out by me in the Department of General Surgery, Madurai Medical College, during the period of September 2013 to August 2014 , under the guidance and supervision of **DR. S. LAKSHMI, M.S., D.G.O.**, Professor of Surgery, and overall guidance by **DR. A. SANKARA MAHALINGAM, M.S.**, Professor and Head, Department of Surgery, Madurai Medical College, Madurai. This is submitted to **The Tamilnadu Dr. M.G.R. Medical University, Chennai**, in partial fulfillment of the regulations for the award of MS degree (Branch I) General Surgery course on April 2015.

**Place : Madurai**

**Date:**

**SIGNATURE**

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**P. MUKESH KUMAR**

## **LIST OF ABBREVIATIONS USED**

LSCS : Lower segment caesarean section

TAT : Trans-abdominal tubectomy

IUM : Infra umbilical midline

SUM : Supra umbilical midline

TIU : Transverse infra umbilical

DU : Duodenal ulcer perforation

IU : Ileal ulcer perforation

USG : Ultrasonogram

AAW : Anterior abdominal wall

SSI : Surgical site infection

CDC: Centre for disease control

SD : Standard deviation

PTFE: Poly tetra fluoro ethylene

## **ABSTRACT**

### **BACKGROUND AND OBJECTIVE:**

Incisional hernia is a common complication of abdominal surgery and an important source of morbidity. It is best repaired using mesh either by open or laparoscopic methods. This study analyses the need and efficacy of negative suction drain in open mesh repair of incisional hernia.

### **METHODS**

Between September 2013 and August 2014, 30 patients with incisional hernia who got admitted to Department of Surgery , Madurai Medical College, Government Rajaji hospital were subjected to Chevrel onlay open mesh repair. They were equally segregated into two study arms each containing fifteen subjects .In one arm, redivac suction drain was used and this was the drain arm. In the other arm, no drain was used during mesh repair and this was the no drain arm. Both the groups were compared regarding postoperative complications such as wound infection, wound seroma, secondary suturing and length of postoperative hospital stay. Data was collected and analysed by various statistical methods

## **RESULTS**

In the drain arm of 15 subjects, only two patients shown signs of superficial incisional SSI according to CDC criteria which accounts for 13.3% in drain arm. In the no drain arm of 15 subjects, thirteen patients had shown signs of superficial incisional SSI which accounted for 86.7%. In the drain arm, there were no cases of clinical seroma. In the no drain arm, almost all the patients had clinical seroma. In the drain arm, there was no reported case of any secondary suturing. In the no drain arm, about nine patients got secondary suturing done (60%). In the drain arm, the mean postoperative length of hospital stay was about 10.6 days. In the no drain arm, the mean postoperative length of hospital stay was about 19.6 days.

## **INTERPRETATION AND CONCLUSION**

Negative suction drain during open mesh repair of incisional hernia helps in reducing the number of wound infection, preventing the formation of seroma, reducing the number of secondary suturing and decreasing the length of hospital stay.

## **KEY WORDS:**

Incisional hernia; Wound drain; Mesh repair; Complications

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## **INTRODUCTION**

Incisional hernia is the protrusion of abdominal viscera through the site of previous operation or traumatic wound of the abdominal wall except hernial site.<sup>1</sup>

The incidence of incisional hernia has been atleast 10 per cent. Incidence of incisional hernia is next only to inguinal hernia and may be higher than reported, since most of these are asymptomatic. Abdominal incisions differ from most other incision in that abdominal wall itself is subject to variable pressure from within. Hence physiological incisions should be preferred which produces less anatomical distortions. Among abdominal incisions highest incidences of incisional hernia occurs in the lower abdominal incisions. Through this incision only, most of the gynaecological operations are being done. The posterior rectus sheath is deficient below the umbilicus and pressure in lower abdomen is more than upper abdomen and the stress and strain on the lower abdomen predispose for herniations. There are numerous aetiological factors for the development of incisional hernia but wound infections and increased intra abdominal pressure are the most important causes.

There are numerous methods of repair of abdominal incisional hernias, simple resuturing, Shoelace darn repair<sup>2</sup>, Cattell's and Maingot's keel repair<sup>3</sup> are in vogue. These repairs are associated with

recurrence rate of 15 to 20 per cent.

Nowadays Polymer chemistry has revolutionised the suture material with polypropylene, polymer, nylon, polyester, PTFE, polyglactyl and polydioxanone.

Prosthetic graft has revolutionised the surgical field. Modern era of prosthetic repair of hernia began when Usher reported his experience with prolene mesh in 1958. Since then prolene mesh is widely used to cover wide defects in incisional hernia.<sup>4,5</sup>

## **AIM AND OBJECTIVE**

To determine the effects on wound complications and length of hospital stay of inserting a wound drain during mesh repair compared with no wound drain.

## REVIEW OF LITERATURE

Incisional hernia is due to the failure of lines of closure of abdominal wall following surgical incision. The approximated tissues get separated and bowel bulges through the gap which is covered from within outside with peritoneum, scar tissue and skin.

Earliest account about incisional hernia goes in credit of Celsus in the first century AD<sup>2</sup> his hernioplasty consists of freshness of edges and utilizing them by sutures.<sup>6</sup> Gerdy had successfully repaired an incisional hernia in 1836.

Repair of this hernia is one of the few instances in surgery in which implants of foreign material were used to bridge the gaps before the use of natural tissues. In the beginning of twentieth century Witzel, Goepel, Bartlett and McGavin advocated the use of silver wire filigree. Thorckomorton and Koontz both in 1948 used Tantalum gauze<sup>7</sup>. Sheets of stainless steel and tantallum were also used. Within a short period those metal sheets got fragmented and the hernia recurred in many cases and moreover those fragments caused skin sinuses and even perforation of bowel.

Fascia lata grafts in the form of sheets were reported to be used by MacArthur in 1901<sup>8</sup>, Kirschner in 1910, Guttic in 1968. Mair made use

of skin in sheets or strips in 1945 but they had high recurrence rates because of absorption. Harvesting skin grafts was always a problem due to complications such as sinus formation, dermoid cyst and malignant change.<sup>9</sup>

After the invent of synthetic plastic material, in 1948 Tempason made use of pliable plastic sheets and in 1955 Schofield made use of polyvinyl alcohol sponge. The modern era of prosthetic mesh in hernia repair started when usher reported his experience with prolene mesh in 1958. Later came the introduction of polyamide mesh and more recently polytetrafluroethylene. The surgery for post-operative hernia is revolutionised by these latter three materials.

The Darn technique is one of the good methods for repair of incisional hernia but this could not get popularised because of lack of suture material until later when Abel demonstrated his initial experiences with closing incisions of abdominal wall and repairing hernias with monofilament stainless steel wire.

Maingot's keel repair is one of the widely accepted repair procedure for incisional hernia those days.

## **EMBRYOLOGY OF ANTERIOR ABDOMINAL WALL**

The abdominal wall begins to develop early in the embryo, but it achieves its definitive structure only when umbilical cord separates from the foetus at birth. Abdominal wall formation is paralleled with closure of the midgut and reduction in relative size of the body stalk. The primitive wall is somatopleure consisting of ectoderm and mesoderm without blood vessels, muscle and nerves. Mesoderm from the myotomes that developed on either side of the vertebral column invades the somatopleure of abdomen. This mesodermal mass hypomere migrates as a sheet ventrally and laterally and the leading edges get differentiated, while still widely separated from each other, into the right and left rectus abdominis muscle. The final approximation of these muscles in the anterior midline closes the body wall.

The mesoderm from the hypomere divides into three layers that could be recognized during seventh week of intrauterine life which is followed by the fusion of primordia of the rectus muscle anteriorly. The inner sheet develops into transversus abdominis muscle, the middle sheet differentiates into internal oblique muscle and external oblique muscle. Dorsally, the superior and inferior posterior serratus muscle is formed from the superficial layer of the hypomere.<sup>11</sup>

Apposition of the two rectus abdominis muscles in the midline proceeds from both cranial and caudal ends and it gets completed by the twelfth week, except at the umbilicus. The final closure of the umbilical ring occurs only during the separation of the cord at birth but the ring may remain open, in that case an umbilical hernia is present. Most of those hernias gradually close spontaneously.

### **ANATOMY OF ANTERIOR ABDOMINAL WALL**

The anterior abdominal wall is a complex musculoaponeurotic structure which gets attached to the ribs superiorly, the bones of the pelvis inferiorly and vertebral column posteriorly. It is developed embryonically in a segmental, metameric manner and this could be revealed from its blood supply and innervation.<sup>11</sup>

Abdominal viscera is protected by the abdominal wall and its musculature works indirectly to flex the vertebral column. The strength of the abdominal wall is important for the prevention of hernia. In addition the abdominal wall is the safe place for adipose tissue, which might reach considerable proportions and produce morbid obesity.

The anterior abdominal wall consists of nine layers from without in, they are (1) Skin (2) Subcutaneous (3) Scarpa's fascia and Camper's fascia (4) External oblique muscle (5) Internal oblique muscle (6)

Transversus abdominis muscle (7) Endoabdominal or transversalis fascia  
(8) Extraperitoneal adipose and areolar tissue and (9) Peritoneum.

1) **THE SKIN** of the abdomen is general body skin

**LANGER'S LINES:** Lines of tension of abdominal skin are nearly transverse and hence vertical scars tend to stretch but transverse incisions heal more readily and become less conspicuous with time.

2) **SUBCUTANEOUS TISSUE** consists of a layer of soft adipose tissue that generally increases with age. It consists of little fibrous connective tissue and affords little strength in closure of incisions. Superficial fascia divides into superficial fatty Camper's fascia and deep membranous Scarpa's fascia below umbilicus.

3) **CAMPER'S FASCIA** is a layer of fibrous connective tissue of moderate thickness. The layer consists of abundant adipose tissue. This layer could be most distinctly felt in lower part of abdomen. The layer provides little strength in wound closure but its apposition holds considerably in the creation of aesthetic hair line scar specially in skin crease cosmetic incisions on fair women. Scarpa's fascia is a membraneous layer of abdominal wall which extends into thigh and becomes fixed to deep fascia of thigh.

4) **THE RECTUS ABDOMINIS MUSCLE:** This is a long broad muscle located between sternum and pubis on both sides of the linea alba. Its origin is from the pubic crest and anterior pubic ligament by tendinous fibres. Its muscular insertion occurs over anterior surface of the costal cartilage, 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup> ribs and xiphoid process.

Three tendinous insertions cross the anterior surface of the muscle - one at the xiphoid, one at the umbilicus and one in between the two. An inconsistent one may be situated below the umbilicus. The intersections are attached to the anterior rectus sheath thus a long muscle is segmented into a number of shorter ones, increasing its strength and efficiency. During surgery the muscle in the upper part could be cut across without retraction. Such separation and resutures does not cause any weakness. This is due to its multiple nerve supply (lower six intercostals) coming transversely and posteriorly. The rectus abdominis is the flexor of the vertebral column. Along with the oblique muscles and the diaphragm it helps in protecting the abdominal viscera, maintaining intrabdominal pressure and so in defecation, urination, vomiting and parturition<sup>11</sup>

- 5) **THE EXTERNAL OBLIQUE:** This is the largest and thickest of the flat abdominal muscles. It originates from the last seven ribs, the thoracolumbar fascia, the external lip of iliac crest and the inguinal ligament that inserts into the pubic tubercles. The muscle belly becomes strong aponeurosis at about the midclavicular line and inserts medially into the linea alba. In general the fibres of external oblique pass from superior lateral to inferior medial in hands in pocket manner. Therefore the direction of force generated by contraction of muscle is superior lateral.
- 6) **THE INTERNAL OBLIQUE:** Muscle originates from last five ribs, thoracolumbar fascia, the intermediate lip of iliac crest and the lateral half of inguinal ligament. Its fibres run opposite the direction of external oblique. Internal oblique becomes flat aponeurosis medially which divides to enclose the rectus muscle. The fibres which arise from lateral half of inguinal ligament follow a downward course and insert into os pubis between the symphysis and the tubercle. Some of the lower fibres pass downwards into the scrotum being pulled by the testis as it travels through the abdominal wall. These fibres are called as cremasteric muscle of spermatic cord which pulls up the testis during coughing and sneezing to act as a ball valve to prevent the hernia occurrence.

7) **TRANSVERSUS ABDOMINIS:** The transversus abdominis is the smallest of the three flat muscles arises from lower five ribs, thoraco-lumbar fascia, internal lip of iliac crest and lateral third of inguinal ligament. The direction of its fibres is transverse and it becomes flat aponeurosis which passes behind the rectus sheath in its upper two thirds.

The fibres of the transverse abdominis originating from lateral third of inguinal ligament join with the fibres of internal oblique and forms conjoint tendon which near it's insertion into pubic bone form a shutter like mechanism by contracting the inguinal ligament and pulling it up.<sup>11</sup>

The neurovascular plane presents between the internal oblique and transversus abdominis muscles and it contains segmental arteries veins and nerves that supply the abdominal wall. The abdominal wall is supplied by the anterior primary rami of T<sub>7</sub> to T<sub>12</sub> and L<sub>1</sub> in a segmental sequential manner from above downwards. The anterior cutaneous rami pass through the rectus and supply skin anteriorly.

The two recti and pyramidalis are located anteriorly whereas laterally three musculo aponeurotic strata on both sides complete

the wall. The fibres of three lateral muscles travel in different directions thus ensuing an efficient and strong abdominal wall.

#### **8) PYRAMIDALIS MUSCLE**

It is a small triangular muscle arising from the front of pubis and ligaments of symphysis. It gets inserted into linea alba and serves as tensor. It gets its innervation from T12 and is absent in 11% of the cases.

### **IMPORTANCE OF RECTUS ABDOMINIS MUSCLE IN VENTRAL HERNIA**

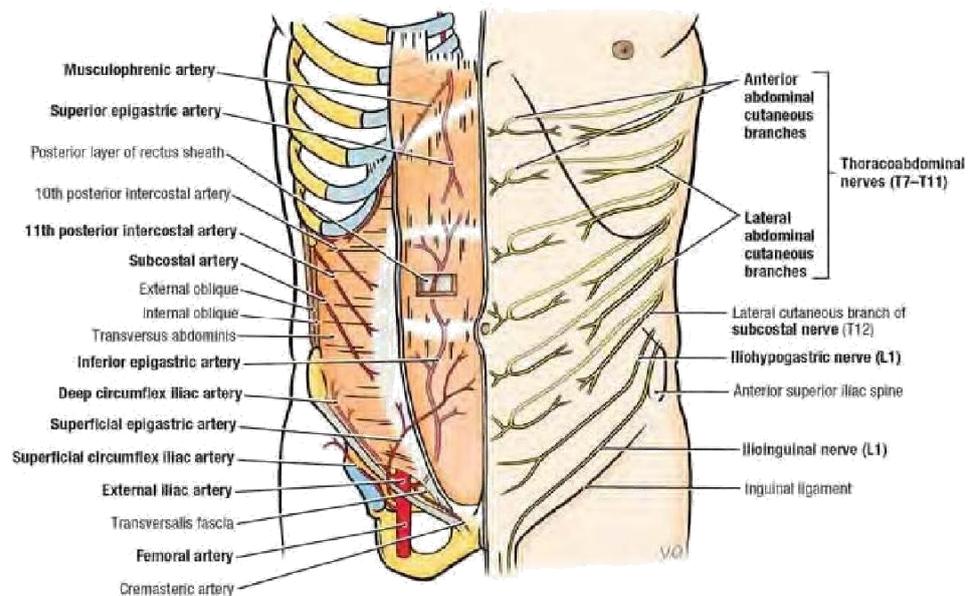
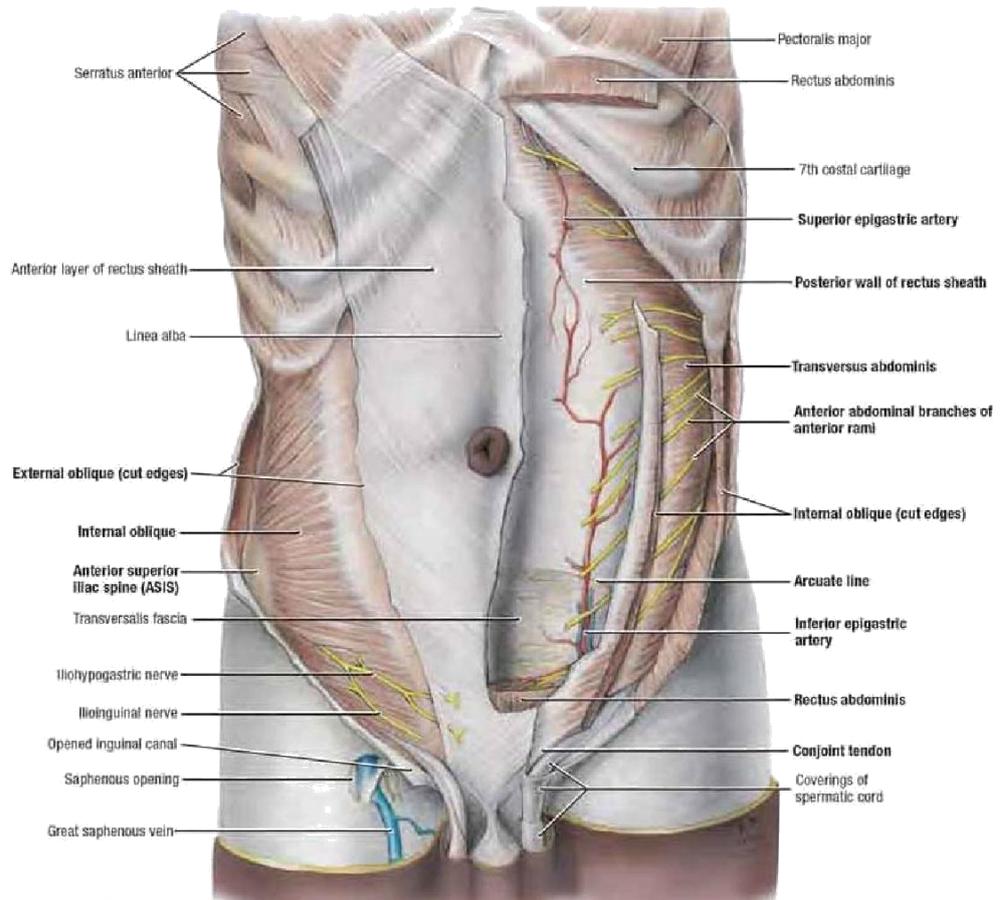
#### **A) AETIOLOGICAL FACTOR**

Trauma to or hematoma of this muscle predisposes to formation of post traumatic anterior hernia by creating a weakness in anterior abdominal wall.

#### **B) PREVENTIVE FACTOR**

In a paramedian incision after incising the anterior rectus sheath the rectus muscle is mobilized laterally to expose the posterior rectus sheath. This method provides an additional advantage by protecting the nerve supply which is along the lateral margin. This method prevents formation of incisional hernias. Paramedian incisions are supported with sounder reconstruction of abdominal wall, the rectus muscle working as a “trapdoor”.

**Figure 1: Anatomy of anterior abdominal wall**



### **C) AS AN AGENT FOR REPAIR**

This muscle or its sheath can be made use of to its best advantage therapeutically during the repair of large ventral hernia. A quadrangular flap of anterior rectus sheath can be raised from both sides and overlapped in median plane (McDonald) as there can be vertical double breasting as demonstrated by Mayo. The posterior rectus sheath, rectus muscle and the anterior rectus sheaths on both sides can be approximated in Cattles method. The two rectus muscles can be detached from the origins and transplanted to the opposite side of origin (Nutalls).

**TRANSVERSALIS FASCIA** is also called as endoabdominal fascia as it is investing the abdominal cavity. The strength of endoabdominal fascia is absolutely important for the integrity of abdominal wall.

**EXTRAPERITONEAL OR PREPERITONEAL FATTY LAYER** is relatively insignificant. It is located between endoabdominal fascia and peritoneum which is more in fatty people. In between the leaves of falciform ligament fat gets filled up above the umbilicus.

**THE PARIETAL PERITONEUM** is the inner most layer of the anterior abdominal wall. It is a thin layer of dense irregular connective

tissue and is covered within by a simple squamous mesothelium. The peritoneum is innervated by T<sub>7</sub> to L<sub>1</sub> does not provide enough strength in wound closure but it provides remarkable protection from infection if it remains unviolated.

## **ARTERIES AND VEINS**

The superficial arteries accompany the cutaneous nerves. Those accompanying intercostal nerves are branches of the posterior intercostal arteries. While those travelling with the anterior cutaneous nerves are derived from the superior and inferior epigastric arteries. The inferior epigastric artery taking origin from the external iliac just above the inguinal ligament courses medially and upwards. It forms the lateral boundary of Hassalbach's and triangle lies to the inner side of internal inguinal ring. In its course it pierces the transversalis fascia, passes in front of the linea semi lunaris to enter the rectus sheath behind the muscle. Ascending vertically it terminates into the muscular branches which anastomose with the branches of the superior epigastric artery in the substance of rectus muscle. The superior epigastric artery is one of the two terminal branches of the internal mammary artery and enter the rectus sheath from above. The branches of two epigastric arteries anastomosing with each other also anastomoses with the branches of intercostal arteries. Three additional branches of the femoral artery are

found in the superficial fascia of the groin, i.e. The superficial external pudental, the superficial epigastric and the superficial circumflex iliac arteries. The superficial veins on each side are divided into an upper and lower groups. The upper group returns the blood via the external thoracic and internal mammary veins into the superior vena cava the lower group returns the blood via the femoral vein to the inferior vena cava Both groups anastomose through the thoraco epigastric veins<sup>11</sup>.

## **NERVES**

Skin and muscles of anterior abdominal wall are supplied by lower six thoracic and first lumbar nerves. The lower six thoracic nerves give off anterior and lateral branches. The lateral branch of last thoracic nerve cross the iliac crest to supply the skin of the buttocks. First lumbar becomes the iliohypogastric nerve which pierces the external oblique aponeurosis about 2.5 cm above the superficial inguinal ring to innervate the intugment of the scrotum (or the labum majus) and medial aspect of the thigh. The ilioinguinal nerve is the collateral branch of the iliohypogastric (L1) like the collateral branch of the intercostal nerve, it has no lateral but only a terminal cutaneous distribution. In the anterior abdominal wall it lies in the neurovascular plane between the internal oblique and transverus abdominis muscles, pierces the internal oblique,

supplies its lower fibres and passes down beneath the external oblique, to emerge in the front of the cord through superficial inguinal ring. Division of the nerve paralyses these muscle fibres, so relaxing the conjoint tendon and causes a direct inguinal hernia. The anterior cutaneous twigs of the last six thoracic nerves gain a superficial level by piercing the rectus sheath, a short distance from the midline. The lateral cutaneous nerve attain a superficial level by passing between the digitation of the external oblique muscle, each splits into a small posterior division and a larger anterior division which supplies the external oblique muscle. They then course forwards as the lateral margin of the rectus sheath. The intercostal nerves gain the abdominal wall by passing under the costal margin between the slips of the diaphragm. They run forwards between the internal oblique and the transversus abdominis, supply them and pierce the posterior rectus sheath, run deep to the rectus a little distance, supply it and terminate as anterior cutaneous nerve as described already.

## **THE LYMPHATIC DRAINAGE**

The lymphatic drainage of abdominal wall follows a simple pattern. Above the umbilicus, the lymphatics drain into ipsilateral axillary lymph nodes. Below the umbilicus they drain into ipsilateral superficial inguinal lymph nodes.

#### **4. ABDOMINAL INCISIONS**

The choice of incision and correct methods of making and closing such wounds are factors of great importance. The incisions must give ready and direct access to the anatomy to be investigated and must also provide sufficient room for the required procedure to be performed. Any mistake may result in serious complications. Therefore to prevent such complications, certain essentials should be achieved.

The principles governing abdominal incisions are:

- Incision must give ready and direct access to the part of be dealt with.
- The incision should be extensible in a direction that will allow for any probable enlargement of the scope of the operation.
- Security: The closure of the wound must be reliable and ideally, should leave the abdominal wall as strong after the operation as before.
- As far as possible, muscles must be retracted or split in the direction of their fibres rather than cut across.
- The incision must traverse the muscle rather than fascia, as the scar left in the peritoneum is best protected.

- Incisions placed across the blood and nerve supply are prone for postoperative complication of dehiscence.
- Oblique and transverse incisions are stronger and less liable for disruption and herniation.
- The opening made through the different layers of the abdominal wall must as far as possible, not be superimposed.
- Reentry into the abdomen should be performed through the previous incision, since hernia can be repaired at the same time.
- In children, skin incision should confine to Langer's lines, otherwise the scar becomes hypertrophic and unsightly with age.

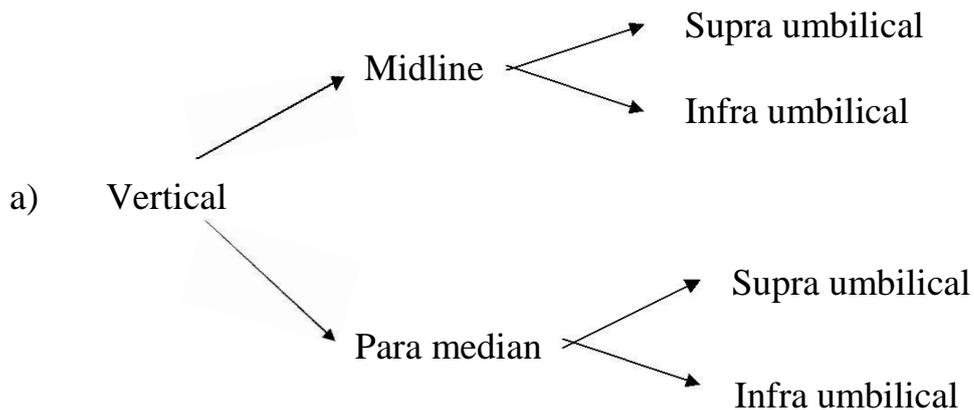
The principles governing abdominal closure are:

- The sutures should not be tightened too tightly to avoid interruption of the circulation resulting in areas of focal necrosis.
- The drainage tube should be inserted through a separate small incision otherwise it infects the main wound and weakens the scar.
- 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.
- Non-absorbable suture materials – should be used to suture the fascial layers.

In order to achieve security of abdominal wall the integrity, innervations and vasculature are maintained. So the muscles must be split in the direction of their fibres rather than cut across. The incisions should not divide the nerves. As obesity is the enemy of surgeons the degree of obesity also modify the incisions. However, it is the discretion of individual surgeons and the experience that they count.

## **TYPES OF INCISIONS**

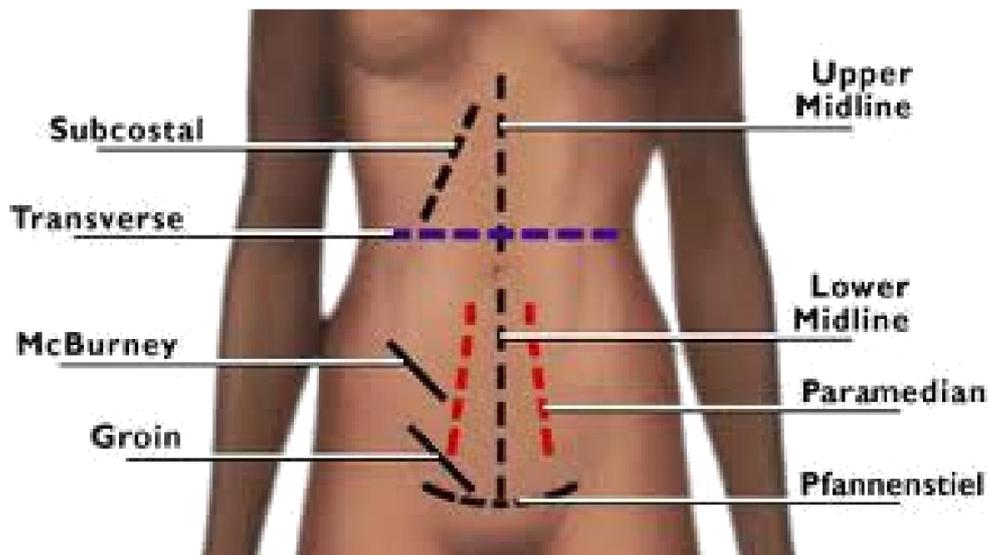
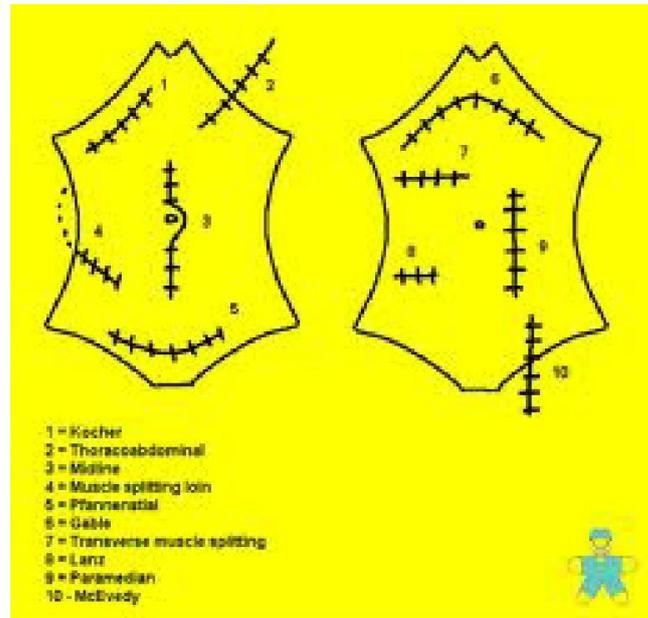
The incisions most often used for exploring the abdominal cavity may be classified as follows:



b) Transverse and oblique

- 1) McBurney gridiron
- 2) Kocher Subcostal incision
- 3) Pfannestiel infra umbilical incision.

- 4) Transverse or oblique lateral incision for exposure of colon



**Figure 2: Abdominal incisions**

- c) **Midline epigastric incisions:** Most operations on the stomach, duodenum, gall bladder, pancreas, spleen and hiatus hernia can be performed through upper midline incision.  
**Advantages:** It is almost bloodless, no muscle fibres are divided,

no nerves are injured, it affords good access to the upper abdominal viscera. Easy to open and close. It can be easily extended.

In this incision the skin, the subcutaneous tissue and the linea alba are divided to expose transversal fascia which covers the peritoneum. Transversalis fascia and peritoneum are divided in one layer. Closure done by suturing three layers the peritoneum with transversalis fascia, linea alba and the skin. Upper middle incisions are associated with 4.6% incisional hernia.

**(1) Midline subumbilical incisions:** Most of the gynaecological operations are done through this incision. Here the chances of developing incisional hernias, top the list. Incidences of incisional hernias are reported to be 33 to 47 per cent. It is because of the deficiency of posterior rectus sheath below the umbilicus and also linea alba is very much narrow. In the woman specially multiparous the abdominal wall is flabby. The higher incidences of incisional hernia are because of faulty closure also. Fascia is sutured instead of linea alba.

**(2) Upper paramedian incisions:** Paramedian incision is made vertical parallel to the midline and about 2.5 cms away from midline can be placed on both right and left side of midline. When the anterior sheath of rectus muscle has been exposed, it is incised for the whole length of

the rectus sheath is carefully dissected from the rectus muscle taking particular care not to cut the fibrous intersections of rectus sheath posterior rectus sheath and peritoneum are opened. The closure of the incisions also affords better security.<sup>13</sup>

(3) **Lower paramedian incision:** Same as upper paramedian except one should be careful of inferior epigastric vessels. The posterior layer of rectus sheath is absent below the semilunar fold of Douglas in the lower half of the incision.

(4) **Kocher's subcostal incision:** A right subcostal incision is used in gallbladder surgery and left particularly in elective splenectomy. The incision is taken 2.5 cms below and parallel to subcostal margin. Lateral abdominal muscles are cut. The ninth dorsal nerve should be preserved otherwise it weakens the abdominal muscles. The rectus muscle can be cut transversely without weakening. Incisional hernia are comparatively less.<sup>14</sup>

(5) **McBurney's Grid Iron Incision:** Incision of choice for appendicectomy. Here the muscles are split in the direction of their fibres. If further access is required it can be enlarged.

(6) **Rutherford Morrison's muscle cutting incision:** Same as Grid Iron incision and the muscles are cut laterally and the rectus sheath

medially provides good access to iliac fossa. This can be used for right and left sided colonic resection, caecostomy, sigmoid colostomy and operations on the ureters. Incidence of incisional herniae in appendicectomy operations is 13.4%.<sup>13</sup>

(7) **Pfannenstiel incision:** This is a gynaecological incision. The incision is usually about 12 cms. long is placed in the curving interspinous crease. Both anterior rectus sheath exposed and divided laterally. Rectus muscles are retracted and the peritoneum opened vertically in the midline. The advantage being it leaves almost an imperceptible scar. Incisional hernias are less as compared to lower midline incisions.<sup>14</sup>

(8) **Lanz's incision:** Instead of making an oblique incision as Grid Iron a transverse incision is made on the interspinous crease. This is preferred for most cosmetic reasons for appendicectomy on teenaged girls.

(9) **Thoracoabdominal incision:** Either left or right converts the pleural and peritoneal cavities into one common cavity and thereby give excellent exposure. The right incision specially used for hepatic resections. Left incision used for resection of lower end of oesophagus and proximal portion of stomach. The lower ribs can be excised in renal

operations. Here the incidences of incisional hernia are least.

## **CLOSURE OF ABDOMINAL INCISIONS**

The ideal method of closure is not discovered. Closures should be free from complications like burst abdomen, incisional hernia and persistent sinuses, should be comfortable to the patient and should have reasonably aesthetic scar. Selection of suture material is also very important.

## **CHOOSING A SUTURE**

The first decision is between absorbable and non-absorbable. Catgut loses its strength within one to four days. Usually the peritoneum will be sutured with catgut. Mass closure of the abdominal wall using either interrupted or continuous. Non-absorbable monofilament suture has been shown to be safe and strong as tried by Dudley, 1970 and Jenkins, 1976 and is mandatory in the presence of proteolytic enzymes such as happens in acute pancreatitis. Catgut when used to suture fascia and rectus sheath it disappears at a steady rate, it has lost most of its tensile strength before the tissue itself has recovered its integrity so that it is not satisfactory suture. Synthetic absorbable materials are currently being used for abdominal closure but their complete safety is questioned with incidences of delayed incisional hernias. Braided sutures harbour

bacteria.

Increased knowledge of polymer chemistry have revolutionised the sutures. Polyglycolide, polydioxanone, vicryl polyglactin, polyvinyl propylene and PTFE have better tensile strength, half life is more, non-toxic, non-carcinogenic, non-allergic, practically inert and non-disintegrated in presence of infection. Now prolene, PTFE are used more and more for abdominal closure.

When the surgeon is closing a case of peritonitis and is closing the wound under tension the peritoneum is sutured by horizontal mattress to avoid tension on the edges. Linea alba and rectus are preferably closed by using prolene in emergency, cases where there is peritoneal soiling to prevent the post-operative hernia developing.

Though stainless steel monofilament wire is known for its strength, it is not routinely used by the surgeons.

Most of the surgeons prefer layered closure. Of late it is proved that closing peritoneum is not a must because peritoneum heals by metamorphosis.<sup>15</sup>

Gilbert and Ellis in 1987 conducted a trial. In 77 patients undergoing laparotomy peritoneum was closed with No. 1 chromic catgut. In 75 patients peritoneum was left open. In both the cases anterior

sheath was closed with monofilament nylon using a mass closure technique. At follow up of between 1-2 years there had been no cases of burst abdomen. No incisional hernia developed in the cases wherein peritoneum was closed but in the second group one incisional hernia was reported. The differences were almost negligible. Maingot also prefers mass closure. For midline incisions all the layers of abdominal wall apart from subcutaneous fat and skin are incorporated, only in wide paramedian incisions mass closure is impossible.

The purpose of the sutures is to approximate the wound edges and to act as a splint while this dense fibrin scar deposits and matures.

Wide bites must be taken a minimum of 1 cm from the wound edge, and placed at intervals of 1 cm or less. The suture length should measure at least four times the wound length to ensure an adequate reserve of suture length in the wound when the suture is placed on tension, as may occur during abdominal distension.<sup>16, 17</sup>

Drains and colostomy should be brought out through separate stab incisions in order to prevent weakening of the mass laparotomy incision.

Now most of the surgeons prefer non-absorbable synthetic materials like polypropylene and polytetrafluoroethylene to suture rectus sheath.<sup>16</sup>

## 5. HEALING OF ABDOMINAL WOUNDS

*Surgeon creates the wound. God heals them.*

Precision allied to gentleness remains the marks of many a great surgeon because they promote the power to heal. Faced by a patient who has lost this power to heal, the most famous surgeons are reduced to impotence.

It is expected to achieve successful healing by first intention in all laparotomy wounds but in cases of pancreatic or recurrent intraabdominal abscesses or after military injuries, it may be allowed to heal by secondary intention or be closed by delayed primary or secondary suture.

**HEALING BY FIRST INTENTION:** This occurs in skin where the edges of a suitable incision are drawn together with sutures. This sequence of epithelial repair was first described by Gillman and Pera in 1956 along with sutures. There is some binding by fibres wound edges in early states. Basal cells free themselves from dermis within 24 hours and migrate to wound edge and down the suture tracks within 48 hours. This causes an acute inflammatory process. The epithelial migration governed by contractile fibres and desmosomes ceases, when the advancing edges meet and there is increase in the tensile strength with dermosomal reattachment and underlying dermal healing. Within 2 weeks new epidermis matures and epidermal growth along the sutured tracks and

islands of keratinising epithelium disappears with thinning of hypertrophied new epithelium. Surface keratinisation follows but skin appendages are not reformed.

**HEALING BY SECONDARY INTENTION:** Epithelial defects have a similar regenerative process as involved in sutured wounds a combination of cell migration and hyperplasia. Full thickness defects heal or repair not by regeneration. Either by secondary intention or by delayed secondary suturing or by skin grafting. It is a combination of epithelialisation and contraction. Epithelial cells detach from dermis divide and migrate over the defect. Fibroblasts with fibrils appear in the granulation tissue and pull the edges together through a mechanism involving actinomyosin. Wound contraction account for upto 80% of closure of full thickness defect. Following incised wound through the skin into the abdominal wall, healing relies upon laying of scar tissue protein collagen under optimal conditions.

**PREPARATION PHASE:** After bleeding has arrested and thrombus has; formed on vessel wall, it is strengthened by fibrin deposition and there is spillage of neutrophils, monocytes and capillary dilatation and release of chemotactic factors such as serotonin, prostaglandin, histamine and peptides. Neutrophils become plenty and their disintegration stimulates further inflammatory response. Macro-phages from monocytes

reach a peak within 24 hours and this removes dead tissue foreign body by phagocytosis and assists break down of complex aminoacids into ascertainable acids and sugars activates clotting cascade and complement system, releasing the platelet derived wound hormones, angiogenesis and fibroblast stimulating factors. First 2 days is called the lag phase, when the abdominal wound depends upon suture for support.

**PROLIFERATIVE PHASE:** Granulation tissue forms. A combination of macrophages, angiogenesis and fibroblasts, the wound nodule with adequate oxygen nutrients, collagen is laid down to bridge the gap. Capillary buds canalise themselves transforming into arterioles, capillaries and venules.

**MATURATION PHASE:** Collagen is laid down by fibroblasts. Proline, Hydroxyproline and glycine are predominant types of collagen. There are three types of collagen. Type 1 collagen is found in skin, tendon and ligaments. Granulation tissue gives rise predominantly to Type 1 collagen. Hydroxylation of immature procollagen requires oxygen, ferrous ions and ascorbic acid. Tropocollagen is produced by glycosylation of procollagen. Tropocollagen is extruded from the fibroblast, but disappears quickly as it matures by cross linkage to other collagen molecules resulting in stronger less soluble collagen. Thicker

collagen fibres soon abound and are laid down haphazardly in the ground substance.

The peritoneal layers heal in two stages. An initial case of debridement by macrophages is followed by the appearance of subperitoneal, perivascular cells which initiates healing and form new mesothelium.

Summary and adverse factors of wound healing:

### **General Factors**

- 1) Age
- 2) Malnutrition
- 3) Vitamin deficiency
- 4) Trace element deficiency
- 5) Anaemia
- 6) Malignant disease
- 7) Uraemia
- 8) Jaundice
- 9) Diabetes
- 10) Generalized infections
- 11) Cytotoxic drugs and steroids.

## **Local factors**

- 1) Tissue tension<sup>17</sup>
- 2) Haematoma formation
- 3) Necrotic tissue
- 4) Local infection
- 5) Foreign body present
- 6) A poor blood supply due to vascular disease or trauma
- 7) Faulty technique of wound closure
- 8) Recurrent trauma
- 9) Local irradiation

## **5. INCIDENCE OF INCISIONAL HERNIA**

With the evolution of modern survey and the rapid increase in the numbers of abdominal operations performed, post operative ventral hernias have risen in frequency and importance from a inconsequential position to the front rank of hernial distribution.

If we carefully review the post operative patients by simply asking them to raise their legs we can see a bulge over the healed abdominal wound. Patients go happily with gay but unfortunately notices an ugly, unsightly swelling on the abdomen over the operated area in a near future. Since most of the incisional hernias are symptomless to the patient

fails to recognize it or even after recognizing it he fails to return to the same doctor. It is difficult to estimate the real incidence of post operative hernias. So actual incidence will be much more than that is recorded.

In the best centers, the incidence of post operative hernia has been at least 10% as shown by long term followup studies.<sup>18,19</sup> Where less emphasis is placed on the niceties of abdominal wound closure, the incidence is much higher.<sup>49</sup>

Earlier short term studies have the erroneous impression that most post operative hernias appear within the first year after the operation and that 80% appear within the first 2 years. Recent studies however show that about 2/3<sup>rd</sup> appear in the first 5 years and that atleast another 1/3<sup>rd</sup> appear 5 to 10 years after the operation.<sup>19</sup>

As longer and more accurate follow up studies are done, it will probably be shown with aging and weakening of the tissues, postoperative hernias may appear even more than 10 years after the original operation.

With the all around improvement in surgical management and the constant perfecting of better methods for abdominal closure, the incidence of postoperative ventral hernia can be expected to drop.

## **SEX**

More common in women than in men.<sup>50</sup> Among Akman series, he has noticed no much change between male and female.

## **AGE**

The incidence is greatest among persons more than 39 years old. "The age of occurrence for incisional hernias is usually between 28 to 58 years of age with the peak incidence between 48 and 53.

Data on the importance of patient age for the development of wound infection are contradictory. In some studies infection has been found to occur more frequently in older patients, suggesting that this might correlate to a low host defense capability in the elderly patient. A lower rate of wound infection in elderly patients has also been reported and this may relate to overweight being uncommon among the elderly. Over weight is most common in the middle aged population and the proportion is gradually reduced as age increases.

## **TIME**

Recent studies however show that about  $2/3^{\text{rd}}$  appear within the first 5 years and that at least another third  $1/3^{\text{rd}}$  appear 5 to 10 years after the operation. Postoperative hernias may appear even more than 10 years after the original operation.

## **SITE**

According to one study in Mayo's Clinic, 33.8% of all post-operative hernias occurred through low midline incisions.

Analysis of Shouldice series reveal lower midline incision 33%, right lower paramedian incision 22%, McBurney's incision 21%, right upper paramedian incision 9.5%, upper midline incision 5.4% and miscellaneous 9%.

High incidence of lower midline incisional hernia may be explained by the greater number of operations performed through lower midline incisions and also partially by gravity which is greater in the lower part of the abdomen than on the upper. Certain authors also emphasize deficit of the posterior rectus sheath in the lower quadrants, particularly below the linea semicircularis.

## **TYPE OF OPERATION**

Certain types of operations have a tendency to be followed by hernia. These include laparotomy for generalized or localized peritonitis in patients with perforated peptic ulcer, Appendicitis, Diverticulitis and acute pancreatitis. Also operations for intra abdominal malignant disease, chronic inflammatory bowel disease, and re – operation through original wound, within first 6 months after the initial procedure. The cause of the wound failure is not in the operation itself but in the presence of many of

the factors.

## **PREDISPOSING FACTORS AND ETIOLOGY OF INCISIONAL HERNIAS**

Many factors singly or in various combinations cause failure of the wound to heal satisfactorily and lead to the development of postoperative hernia. The two main causes are proper surgical technique and sepsis. There are two types of incisional hernias early and late.

**EARLY HERNIAS:** The early occurring type which appears soon after the laparotomy closure. Often involves the whole length of the wound, grows rapidly and becomes large.<sup>20</sup> This early failure is iatrogenic and several factors are involved. The surgeon fails to understand the anatomy, physiology and pathology of abdominal wall, the process of wound healing and physics of strain, stresses and the tensions involved in suturing the abdominal tissues.

### **A) FACTORS IN PATIENTS**

#### **a) AGE**

For a condition which is iatrogenic no specific age can be given. Obney Ponka (1980) found that the peak incidence of incisional hernia occurred as patients 40 to 70 years of age group.

Since aged patients are subject to a great variety of diseases requiring operative procedure and further more they are affected with other degenerative diseases as decreased muscle tone with age, poor wound healing and other metabolic diseases.

#### **b) SEX**

It is commoner in females than males. It has been reported by Nyphus and Condon, Burton, Zimmerman, Goel and shah. They attribute this to:

- 1) Lower mid line incision employed for gynaecological and obstetrical incisions, where the posterior rectus sheath is deficient.
- 2) Comparatively lax abdominal wall and poor muscle tone, according to Watson, distension of the abdomen during pregnancy weakens the anterior abdominal muscle leading to flaccidity after delivery.
- 3) Comparatively more amount of subcutaneous fat which holds the sutures very poorly and predisposes to post operative wound infection (Mann, 1962).

#### **c) OCCUPATION**

Incisional hernia is a disparity between intra abdominal pressure and the retaining abdominal wall (Zimmer man and Anson). Workers

requiring severe straining and heavy lifting predisposes to the formation of hernia (Light 1905).

**d) ECONOMIC STATUS**

Because of poor economic status they are obviously unable to provide themselves with costly high protein diet which is essential for proper wound healing (Jamieson and Key). Moreover these patients have to undertake heavy work immediately after discharge from the hospital which again predisposes to the formation of postoperative ventral hernia (Light HC).

**e) OBESITY**

Fat people are the bane of the surgeon's existence – Koontz (1963). Obesity is an important factor in caesarian as noted by (Moore 1968, Schwartz 1979). Obesity delays wound healing by increasing Intraabdominal pressure by the huge amount of intra abdominal and omental fat but also infiltrates all tissues and fascia rendering them weak (Watson). Predisposition to formation of seroma and subsequent infection of the wound (Bottcher G). Poor holding and healing power of adipose tissue (Bottcher G).

## **f) FACTORS PERTAINING TO PATIENTS SYSTEMIC DISEASES**

Other factors pertaining to systemic diseases such as bronchitis, asthma and other cardiorespiratory diseases giving rise to chronic cough, causes of chronic constipation and obstructive uropathy. Bailey and Love (Schartz and Bailey and Love) add malnutrition, anemia, hypoproteinemia and vitamin "C" deficiency to the list.

## **g) OTHER ASSOCIATED DISEASES IMPAIRING WOUND HEALING**

Multiparity

Chronic Bronchitis

Hypoproteinemia

Hypotension

Ischemia of heart, Diabetes

Asthma ,Anemia ,Smoking

Jaundice

Malignancy.

It was shown by Light (1965) that cough, distension and vomiting causes more rise in infra abdominal pressure than weight lining, so should be taken into account. According to Watson distension of the abdomen during pregnancy weakens the anterior abdominal wall muscles

leading to flaccidity after delivery These factors should be properly assessed before planning elective surgery or repair of an incisional hernia.

## **B) FACTORS DURING OPERATIVE PROCEDURE**

- 1) Operative technique
- 2) Anaesthesia
- 3) Incision
- 4) Hemostasis
- 5) Drain
- 5) Suture material
- 6) Surgeon

## **POOR SURGICAL TECHNIQUES**

**1) Non-anatomic incisions:** Non-anatomic incisions are typified by the vertical pararectus incisions along the outside of the lateral border of rectus sheath which destroys the nerve and vascular supply to the tissues medial to the incisions, causing them to atrophy. The further lateral the incision greater is the damage. The best and the simplest incisions for access to the abdominal cavity are through the midline or transverse incisions.<sup>21</sup>

**2) Layered closure:** Layered closures are followed by greater incidence of incision hernia than are wounds closed by single layer mass closure technique. This may be because usually many more sutures are

used, which are closely placed and because insufficiently large bites of each thin layers are taken.

**3) Inappropriate suture material:** The process of wound healing, collagen formation and maturation, the laying down of the collagen, fibres in parallel lines of stress, and the healed wound gaining its maximum strength takes about one year. Approximately 80% of the final wound strength is reached after 6 months. So the wound must be protected at least for 6 months. The sutures are entirely responsible for the integrity of the wound for 6 months. So any material that does not survive for 6 months and maintain its strength is unsuitable for wound closure. So non absorbable suture material is preferred to absorbable suture material.<sup>22</sup> Biological suture materials like thread and silk also lose their integrity within two months. Furthermore silk perpetuate wound infection and sinuses.

The ideal suture material for abdominal closure especially midline is monofilament stainless steel wire but somehow not routinely used. Interrupted heavy monofilament polypropene or polyamide sutures are also used but are not as convenient to knot. Multiple knots are put to re-enforce. Selection of suture material is left to the surgeon's choice. But in presence of infection synthetic suture material like polyglactin, polyglycolic acid, polypropylene, poly-amide and PTFE are preferred.

Steel wire is difficult to handle and but stronger and not routinely preferred by the surgeons. It may also break in the long run.

**4) Suturing technique:** In vertical abdominal incisions at or near the midline, small sutures pull the line of fibres of the aponeurotic muscles and since they are so close to the incision easily cut out of the tissues. A small tightly tied suture causes ischaemia and necrosis of the tissues it contains and also of an area on each side of the suture.<sup>17</sup> When these small tightly tied sutures are placed close to each other, their ischaemic areas merge and thus cause necrosis of the strip of tissue all along the edge of the incision which separates together with the sutures from rest of the abdominal wall leading to failure of the wound.

**5) Tension:** Closing wounds with tension is bad surgery. The lateral pull of abdominal wall muscles against the suture which tends to pull them in opposite direction creates an area of pressure necrosis. The pressure necrosis is a primary cause of wound dehiscence as shown by Bartlet in 1985.<sup>17</sup>

**SEPSIS** is the second major cause of failure. It may range from frank acute cellulitis, with fasciitis and necrosis of the tissues on each side of the incision, to low grade chronic sepsis around sutures such as abraded silk. In a braided or twisted silk infecting organisms lurk in the spaces between the filares of the suture and constantly reinfect the tissues. The

infection causes inflammation and edema of the tissues which become soft and so that the sutures tear the tissues and pull out the strain of the intra abdominal pressure.

**DRAINAGE TUBES:** Drainage tubes brought out through the operation wound are a potent cause of post-operative hernias as pointed out by Ponka in 1980. Since the tissues planes along the track of the drain are not sutured an open and weak passage is present through all the layers of the wound through which a hernia may develop. Furthermore after the first 24 hours there is a rapid rise in the wound infection rate since the drain allows for two way traffic of secretions outwards and the organisms inwards to the wound and abdominal cavity. Drain is a foreign body elicits reaction, oedema or softening and tearing of the tissues and cutting out of the sutures.

**OBESITY AND PREGNANCY:** Stretching of the abdominal musculature because of an increase in contents as in obesity and in pregnancy predispose the development of incisional hernia. Fat acts as a pile driver for it separates the muscle bundles and layers, weakens the aponeurosis. Obesity and repeated pregnancies are also predisposing factors for recurrence after hernia repairs. Routinely all the obese patients with incisional hernia are advised to loose weight before undertaking

surgery.<sup>23</sup>

**POST-OPERATIVE COMPLICATIONS:** Prolonged post-operative intestinal obstruction, paralytic ileus, chest complications such as chronic obstructive pulmonary diseases, collapse of lung, bronchopneumonia, emphysema and asthma, chronic cough increase the incidence of incisional hernia. Smoking is blamed as it promotes pulmonary complications.

**TYPE OF OPERATION:** Emergency operations and laparotomies are more prone for developing incisional hernia than elective surgeries. Patients with peritonitis, perforation of peptic ulcer, appendicitis, diverticulitis, and acute pancreatitis, abdominal malignancies, chronic inflammatory bowel diseases and reoperation through the original wound have higher incidence of developing incisional hernia.

**POST-OPERATIVE WOUND DEHISCENCE:** Burst abdomen whether covered by skin or frank evisceration is often followed by incisional hernia whether resutured or treated by open method.

### **LATE HERNIAS**

**TISSUE FAILURE:** Hernia develops in apparently healed wound 5 to 10 years after the operation. The defect is not with the wound closure but presumably due to failure of the collagen in the scar. The ageing and

weakening of the tissues and the raised intraabdominal pressure associated with chronic cough, constipation and prostatism predispose herniation.

**COLLAGEN ABNORMALITIES:** Abnormal collagen production and maintenance were shown by Peacock in 1975, 1978 and 1987 to be associated with recurrent hernias.<sup>24</sup> There is deficiency of the collagen and abnormalities in its physicochemical structure, manifesting in reduced hydroxyproline production and changes in the diameter of collagen fibres. Read in 1970 observed that the rectus sheath in patients with direct inguinal hernias was lighter for a given area than that of normal controls. This widespread disorder associated with emphysema was named by Cannon in 1981 as metastatic emphysema.<sup>25</sup>

## **ANAESTHESIA**

Irritant gases like ether give rise to post operative cough and vomiting which leads to increased intraabdominal pressure during immediate postoperative period (Me Vay). This leads to giving way of stitches of inner layers of the wound and subsequent postoperative incisional hernia formation. Spinal anaesthesia gives a good muscle relaxation but this anaesthesia has got complications like nausea, vomiting, headache and retention of urine.

## **ANATOMY OF INCISIONAL HERNIAS**

A hernia may develop in any abdominal incision, but most are found in midline or paramedian incisions. Most recently hernias being reported in the incisions for the ports used to gain access to the abdominal cavity in laparoscopic surgery.

Incisional hernias like any other hernias contain 3 parts. The sac, contents of the sac and coverings of the sac.

The sac contains a diverticulum of the peritoneum which is divided into mouth, neck, body and fundus. Usually the neck is well defined but in many incisional hernias there is no actual neck. The neck is very wide and rarely go for strangulation. The body of the sac varies greatly in size and is not necessarily occupied. In long standing cases the wall of the sac is very much thick. Incisional hernias may be small but often they are large. They are frequently multilocular and thin walled sac lies between cutaneous scar and the abdominal viscera. Although the sac may represent protrusion of the parietal peritoneum, it is much more likely that is formed by metaplasia membrane. Adhesions between sac and contents are very common.

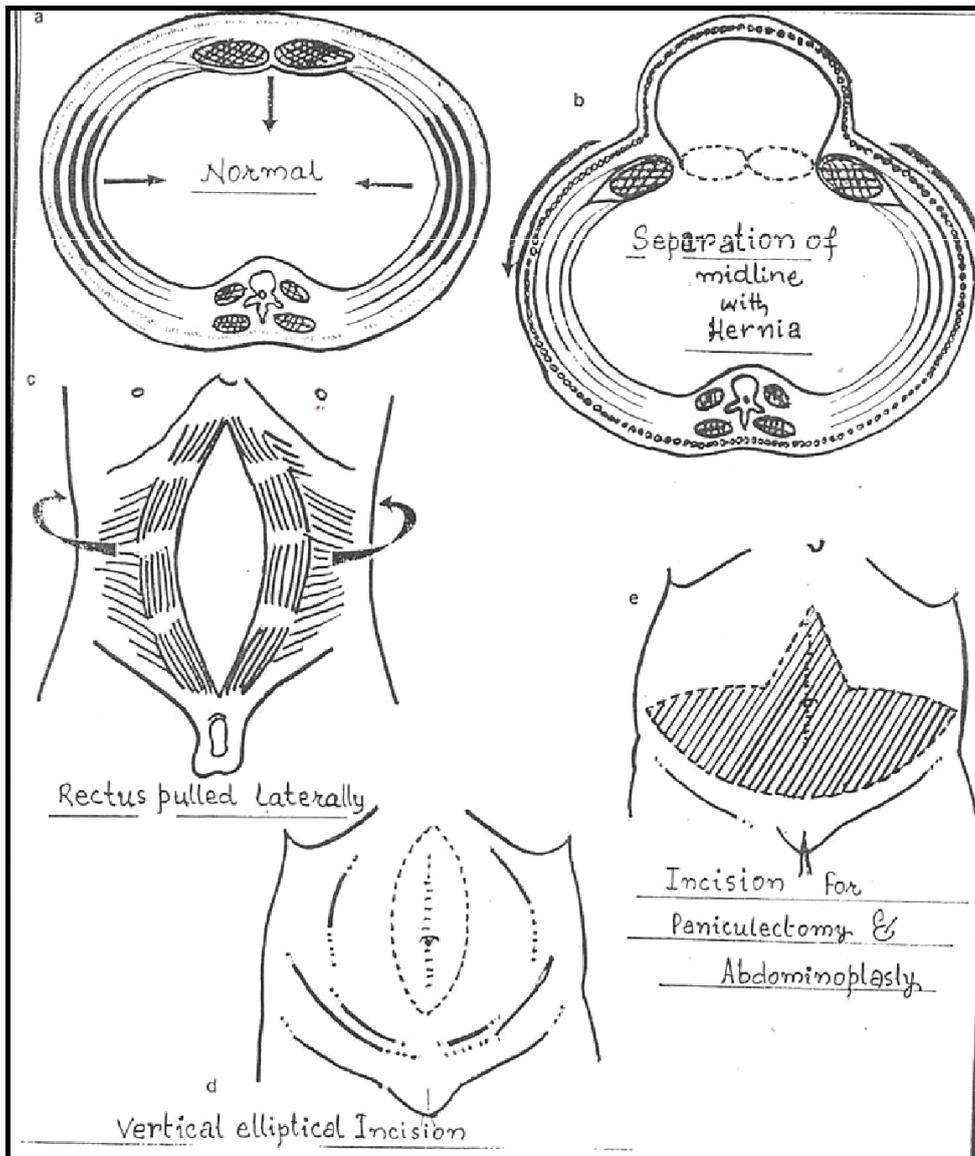
Most common contents of the hernial sac are one or more of the following:

- 1) Omentum - Omentocele

- 2) Intestines – Enterocele (Small Bowel, Transverse Colon, Stomach)
- 3) Portion of the bladder
- 4) Ovary, Gravid uterus
- 5) Fluid.

Coverings are derived from the layers of the abdominal wall through which the sac passes.

In different types of hernias are reducible, irreducible, strangulated and inflamed. Because of the large size of the neck strangulation is relatively infrequent but it may occur in hernia through small rigid aperture. In type I hernias which follow after midline incisions the sac is usually very large and accounts to complete divarication of rectus abdominis muscle. In type II following oblique muscle splitting incisions the sac is with narrow neck and is potential for strangulation. Incarceration is relatively common by adhesions between the sac and its contents. Several cases of strangulation developed in previously incarcerated hernias. Herniation of full term gravid uterus through incisional hernia is reported. Lower segment caesarean section and repair of incisional hernia was done in a single sitting.



**Figure 3: Pathophysiology of incisional hernia**

## **7. CLINICAL FEATURES AND DIAGNOSIS OF INCISIONAL HERNIAS**

Incisional hernia presents no difficulty in diagnosis. There is great variation in the degrees of herniation. The symptoms are extremely variable. The most common symptom is swelling which the patients tell is progressively increasing in size during coughing, sneezing and standing

up. Some patients complain of pain over the scar.

Many people with large hernias are not at all convinced by the hernias and many are unaware of its existence. This is particularly the case in diffuse bulging of the entire scar.

Other patients complain of discomfort, digestive disturbances and feeling of weakness. Supervention of obstruction or strangulation is with acute attack of pain abdomen, vomiting and distention of abdomen.

As hernia progressively increases in size become more and more irreducible some times skin overlying is so thin and atrophic that normal peristalsis can be seen in the underlying coils of intestine. Attacks of subacute intestinal obstruction are common. On examination there will be diffuse swelling over an operation scar; size varies and increases on coughing and standing up. Impulse on cough can be elicited. The contents of the sac in most of the times are reducible with characteristic gurgling sounds. The neck of the sac and the defect in the abdominal wall can be measured. This is more important to decide the type of operation to be undertaken. On auscultation bowel sounds are heard over the swelling. On general examination the patient may be anaemic, obese suffering from protein calorie malnutrition or he may be diabetic, cirrhotic. The tone of the abdominal muscle may be weak. In some cases of incisional hernia is

associated with pulmonary infection.

## **INVESTIGATIONS**

There is no definite investigation for diagnosis of incisional hernia since it is straight forward. But certain investigations are necessary to prepare the patient for surgery and for the treatment of underlying intercurrent diseases which are the predisposing causes for the formation of incisional hernia. Blood - Hb%

Total count, differential counts Erythrocyte sedimentation rate  
Blood group Blood sugar Liver function tests.

**Urine:** Albumin; Sugar; Microscopy

**Stools:** Ova: Cyst: chest X-ray ULTRA SOUND, CT, MRI

## **DIAGNOSIS**

Incisional hernia presents no difficulty in diagnosis. On examination of the patient both supine and standing positions and increasing the abdominal tension by having the patient elevated the head from the bed or asking the patient to cough will render the hernia visible and enable to palpate. The contents and neck can be palpated.

## **DIAGNOSTIC IMAGING IN THE EVALUATION AND MANAGEMENT OF ABDOMINAL WALL HERNIA**

Pathologic findings of the abdominal wall are usually readily recognized due to their superficial location. In most cases correct diagnosis can be reached on the basis of history, symptoms, and clinical examination.

Ultrasound investigations, which are part of our standard routine, merely confirm the clinical findings in the majority of our patients.

There are two groups of patients for whom ultrasonography is particularly valuable.

1. Patients, especially obese people, with palpable masses within deep layers of the abdominal wall.

2. Patients with pain and complaints located within the abdominal wall or the inguinal region but without causative clinical findings.

Most cases ultrasound is the method of choice, but in some cases, computed tomography (CT) or magnetic resonance imaging (MRI) may be helpful.

### **SONOGRAPHY<sup>27</sup>**

Is performed with the patient in the supine position and upright position. Sub cutaneous tissue, rectus sheath, muscles, fascial and vessels

are identified.

Under observation of the questionable are dynamic examinations are performed with valsalva's maneuver (by coughing or by pressing down on the abdomen).

### **Pre operative examinations**

- Diagnosis of hernia, types of hernia.
- Differential diagnosis to the surgeon for the correct surgical treatment.
- Undetermined palpable masses of the abdominal wall.

### **Sonographic criteria for hernias:**

- Fascial gap with protruding hernial contents.
- Intestinal structures are characterized by peristaltic movements and air bubbles.
- Omentum appears as stationary, highly reflective, space occupying structure.
- In addition after mesh repair for hernia, a recurrence can occur at the edge of the mesh.
- Abdominal wall relaxation following surgery, mainly after retroperitoneal approaches to the kidney, can clinically mimic an incisional hernia.

Sonographically there is no discontinuity of the aponeurosis or fascial gap. All muscle layers of abdominal wall are present but appear thinner in comparison with the unaffected side.

### **Post operative investigations**

1. Hematoma
2. Seroma
3. Abscess
4. Hematoma of the Rectus sheath.
5. Wound rupture (Burst Abdomen).

### **COMPUTED TOMOGRAPHY OF THE ABDOMINAL WALL<sup>28</sup>**

CT is an excellent method for evaluating the abdominal wall and its relations to the abdominal viscera. CT becomes the modality of choice in obese patients after surgery or if hernia is located in an uncommon site. It can be useful in demonstrating the condition of bowel loops.

To achieve the highest diagnostic accuracy, they recommended using Valsalva's maneuver and oral radio opaque material. CT is also used to differentiate post operative findings such as hematoma, abscess, or recurrence of hernia after laproscopic repair of ventral hernia.

## **MAGNETIC RESONANCE IMAGING<sup>29</sup>**

Compared to CT, MRI offers the advantage of direct multiplane imaging without imaging radiation and the use of contrast agents. A relative merit of MRI is the excellent demonstration of abdominal wall layers.

### **DISADVANTAGES**

Higher cost

Limited availability

Potential allergic reactions to contrast medium.

**Abel and Clain:** Classified incisional hernias according to the type of incision through which it develops.

#### **Type I**

Incisional hernia following vertical incisions.

#### **Type II**

Hernia through oblique muscle cutting incisions. This is a rare variety but as the neck of the sac is narrow, chances of irreducibility, obstruction and strangulation are high. So early operation is indicated.

#### **Type III**

Hernia through transverse incisions, hernia is often large with wide neck and gives an ugly bulge.

## **BURTON'S CLASSIFICATION**

I. Those hernias in which edges of the parietal wall can be approximated or imbricated without tension on the suture line. Ordinarily they are not troublesome to the patients and are often asymptomatic and present no problem in their repair. These contribute bulk of the series.

II. Those that preclude the edge to edge contact but with only 2-3 cm of separation. Relieving incisions on the anterior sheath on either side may be adequate to permit approximation of edges. Another alternative type of repairing this type of hernia is the interlacing of autogenous graft of fascial sutures so as to obtain a lattice like bridging of the intraperitoneal defect. Devlin 1986 says if doubt exists in approximation of margins, the keels operation may be recommended

III. Those in which the ring is so large that no Method of suture can adequately close the opening in these massive hernias. Internal separation measures 8 cms or more in width and is usually associated sometimes with multiple tissue deficiency and often weakness of the abdominal wall. It is this type of hernia that challenges the skill of a surgeon in attaining a solid wall. It is this type of hernia in which fascia lata, cutis graft, tantaleum or wire mesh imputation is really indicated.

IV. Hernias which are complicated especially by irreducibility are

large in size and remains outside the peritoneal cavity for some time. These require careful handling when such massive hernias have remained unreduced for a long time, abdominal cavity may no longer be able to contain their added volume. Such hernias are said to have lost their site of domicile and may present with difficult therapeutic problems (Burton and Watson). These patients require pneumoperitoneum before repair can be taken.

## **8. MANAGEMENT**

The management of incisional hernia is essentially surgical. Because once the incisional hernia develops it inevitably enlarges with passage of time. Incisional hernia can incarcerate, obstruct, strangulate or develop skin necrosis and rupture. In general incisional hernias do not improve spontaneously and tend to increase in size (Zimmermann and Anson).

Hamilton RW reported spontaneous rupture of incisional hernia.

## **INDICATIONS<sup>30</sup>**

According to Abel and Clain, indications for repair of hernia:

- 1) Liability of gut to become incarcerated.
- 2) Minor attacks of irreducibility with discomfort.
- 3) Large incisional hernia in working man.

- 4) For cosmetic purpose for ugly bulge.
- 5) Thinned out scar, prone for rupture.

According to them age is no contraindication for surgery.

As per **Burton C.**, the treatment for postoperative incisional hernia depends up on the size of the hernia, the symptoms produced, the presence or absence of the general complications and the general condition of the patient.

**Watson** is of the opinion that prior to surgery a good muscle tone of the abdomen is essential.

### **PREOPERATIVE PREPARATION OF THE PATIENT**<sup>30,31</sup>

- 1) The repair should be delayed for minimum of one year after the operation. This is the time taken for the collagen to mature and the tissue finely reach a dry state. Surgeon should also wait for one year after all infection and sinuses have healed.

- 2) **ROUTINE EXAMINATION:** All patients are thoroughly investigated in terms of hemogram, urine examination, Blood sugar, Blood urea. X-ray chest and electrocardiogram.

- 3) Obese patients are advised weight reduction, they are advised fat free diet and exercise after consulting a dietician average weight reduction advised is 10% of body weight.

4) Cases of chronic cough and bronchitis were advised to stop smoking. Steam inhalation, deep breathing exercises are advised and underlying pathology was treated before surgery.

5) Patient with poor abdominal tone are advised to improve the tone of the muscle for a period of actual 2 months which is achieved by leg or head raising exercises.

6) Patient with chronic constipation are treated with softening agents like liquid paraffin at bedtime. Patients with stricture urethra, enlarged prostate should be treated before repairing incisional hernia.

7) Associated systemic diseases as HT. Ischemic heart disease, diabetes, renal condition and respiratory problem should be treated. Any other systemic symptom should be thoroughly investigated and treated.

8) Treatment of debilitating diseases in elective cases must be eliminated to ensure proper wound healing such as a) Anemia, b) Cachexia, c) Malnutrition, d) Hypoproteinemia, e) Avitaminosis especially vit. C deficiency.

The patient is investigated for coexisting abdominal maladies That can be dealt with at the time of operation and reduce the humiliation undergoing reoperation on a repaired abdominal wall.

The defect should be measured. The size of the defect is a measure of the operative method and material to be used to repair.

Preoperative pneumoperitoneum therapy was tried so that the abdominal wall can accommodate hernial contents.<sup>31</sup>

Patient who comes with signs and symptoms of acute obstruction should be operated at the earliest after admission. Patient should be kept nil orally and was treated with Ryle's tube aspiration i.v. fluids and serum electrolyte concentration done before surgery.

Focus of infection of the patient should be dealt with before admission of the patient.

All cases should be admitted two days prior to surgery. Fresh investigations should be done and blood should be grouped and cross matched. The skin should be prepared with pre operative painting povidone iodine and thorough scrubbing. Liquid diet should be advised on previous night. Patient should be given laxatives the previous night and simple enema was given early in the morning, kept nil by mouth after 10 pm. Ryles tube should be passed in the morning and aspiration should be done. Prophylactic broad spectrum antibiotics should be given intravenously 4 hours prior to surgery.

## **OPERATIVE MANAGEMENT<sup>32</sup>**

Operative incision Koontz in a review of John Hopkins cases came to the conclusions that midline incisions should be abandoned in favour of the one to be closed in layers.

**A) Operative technique** – Following points merit attention.

- 1) Refined atraumatic dissection.
- 2) Avoiding mass ligation.
- 3) Adequate hemostasis.
- 4) Avoidance of extremely heavy suture materials.
- 5) Minimal interference with nervous and vascular supply of the muscles.
- 6) Gentle retraction for short period.
- 7) Meticulous approximation of layers.

**B) The suture material-** Ideal suture material should possess the following qualities:

- 1) Available universally
- 2) Handling should be comfortable
- 3) Minimum tissue reaction
- 4) Not favourable to bacteria
- 5) Smaller calibre

- 6) High tensile strength
- 7) Knot should hold well without cutting
- 8) Easy to thread
- 9) Ought to be nonelectrolytic, nonallergic, non carcinogenic
- 10) Inexpensive Prolene mesh is claimed to be superior but lacks universal availability.

### **C) Drainage Factor**

- 1) Unnecessary drain should be avoided.
- 2) Separate stab incision should be used for insertion of drain.
- 3) Drain should be removed as soon as the purpose is over.

### **OPERATIVE METHODS OF REPAIR**

Repair of incisional hernia is done by two methods

**a) Anatomical repair** (example) repair by resuture, Maingot's keel resuturing, Nuttals operation Mayo's repair and Shoelace darn repair.

**b) Prosthetic mesh repair** like proline or marlex mesh.

The size of the defect can be ascertained by asking the patient to stand and cough or head raising or leg raising test in recumbent position. The test should be done both with hernia out and reduced fingers should

be inserted into the abdomen easily. A small defect is one in which musculo aponeurotic edges come almost close together, such cases can be resutured and repaired or shoelace repair can be done. Hernia wider defects are ideally suited for mesh repair which involves use of sheets of woven or knitted mesh of synthetic nonabsorbable material such as polypropylene, polyamide or sheets of expanded polytetrafluoroethylene (PTFE) placed across the defect.

**REPAIR BY RESUTURE:** The operation is best done with patient under general anaesthesia with good relaxation. The old scar is excised in an Elliptical fashion and carefully separated from hernial sac. The skin on each side of incision is then further, freed to expose the complete hernial sac down to musculoaponeurotic borders of the hernial defect and part of the abdominal wall beyond it. The sac is opened and all adherent omentum and loops of bowel are dissected off its inner surface and also off the inner surface of abdominal wall for a few cms.

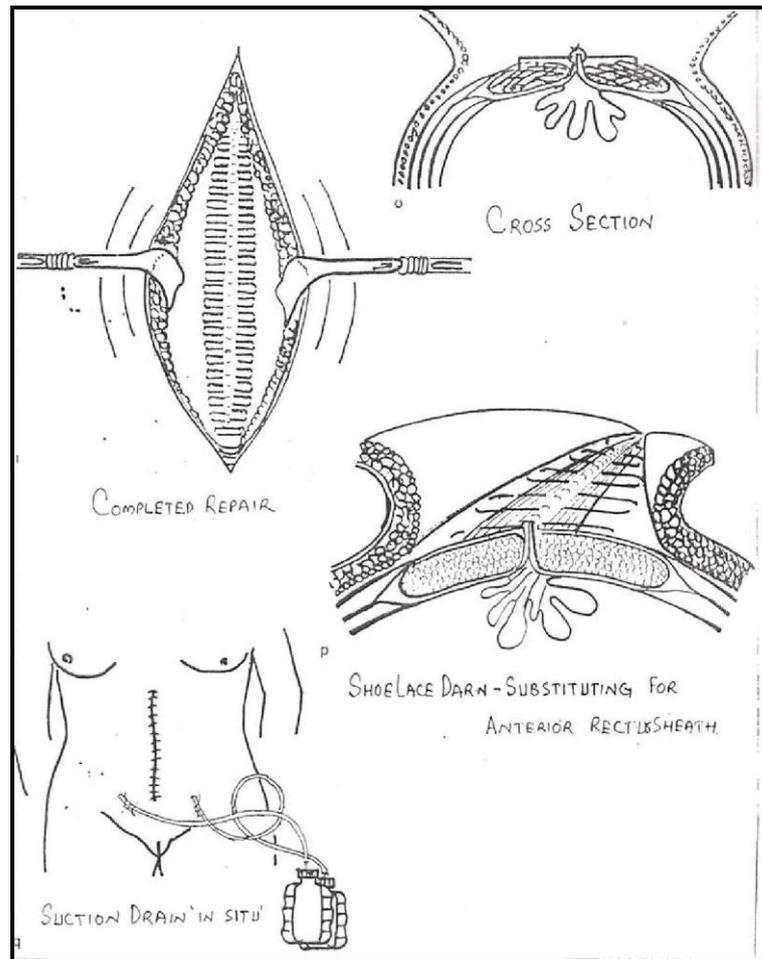
On each side of the defect, remembering that it is better to leave bits of sac wall or peritoneum adherent to the wall of the freed bowel rather than to leave bits of the bowel wall stuck to the sac or peritoneum. The sac and its peritoneal lining, scar tissue and old suture material are excised upto the edge of the hernial defect to expose the normal tissues of

linea alba.

The abdomen is then closed with interrupted mass sutures of monofilament stainless steel wire of SW gauge 28 thickness passing through the abdominal wall at least 3 cm from the edge of the defect. They should not, be too tightly closed and should not be placed closer than 2 cm. A heavy monofilament nylon thread may be used instead of steel wires. The excess skin is excised. The wound is closed over the repair.

#### **ABRAHAMSON'S SHOELACE DARN REPAIR:**

It was described for repair of midline incisional hernia with wider vertical defect. In 1988 Abrahamson described this repair involving two suture lines. The first involves the use of reflected and undermined strip of medial edge of each anterior rectus sheath to form a new linea alba. The second one passes to and fro in between the remaining cut edges of anterior rectus sheaths, substituting for the missing sheaths and lacing up the abdomen back to its original contours. This repair resembles the Hunter's technique



**Figure 4: Showlace darn**

### **MAYO'S REPAIR<sup>34</sup>**

In 1901 Mayo reported the first case series of patients to undergo the classic overlapping fascia operation for umbilical hernia through transverse umbilical incision using non absorbable suture. This method had been soon adopted for repair of incisional hernia. This method is suitable for incisional hernia with vertical small defect. This technique consists of first freeing the hernia defect of all the adhesions and mobilization of the rectus and then rectus is overlapped over one another

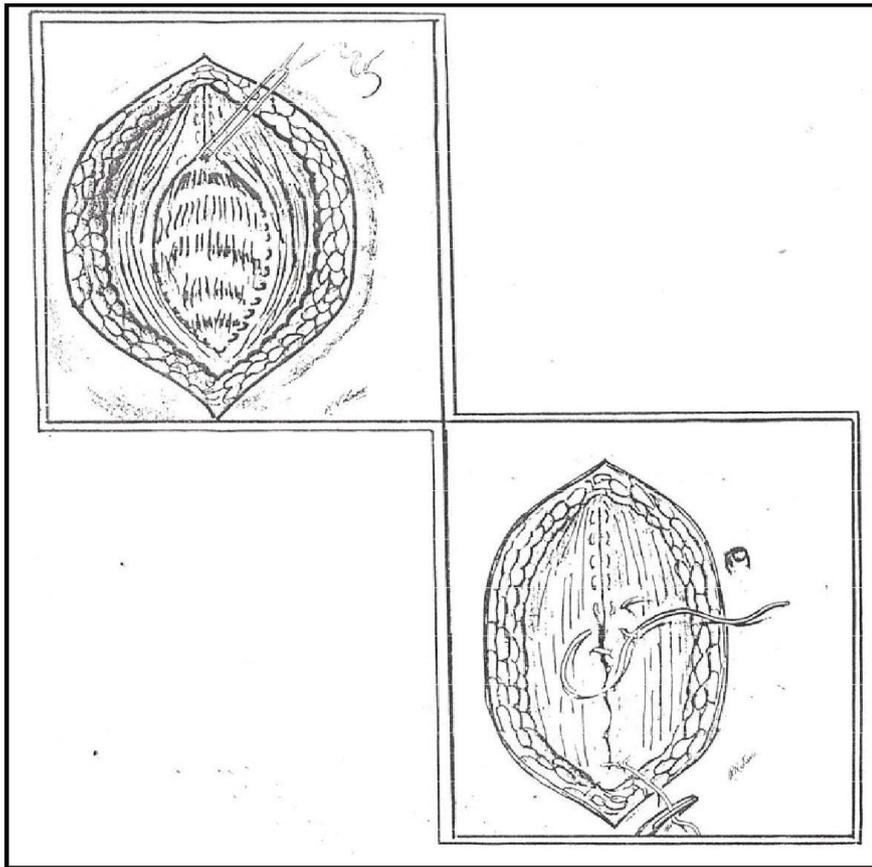
and secured by suturing.

### **NUTTAL'S OPERATION:**

Recommended for midline subumbilical hernias with large defect present above the pubic symphysis. In this method the rectus muscles are detached from the pubic symphysis and transposed to the opposite side. The exerted tension is minimal to the underlying tissues, and prosthetic material is not required to reinforce the abdominal wall.

### **MAINGOT'S KEEL REPAIR:<sup>3</sup>**

In 1958 Rodney Maingot described the method for repair of large hernias. Longitudinal incision over anterior rectus sheath is made, and the medial edge is let to rotate behind the rectus abdominis. This results in the lengthening of the posterior rectus sheath, allowing it to be closed under less tension. Lateral edges of incised rectus sheath on both sides are then approximated to each other. It is useful in those hernias where margins of defect can be approximated together but the sac is large, diffuse and pendulous. The contents may be any viscera with many adhesions, but with no obstructive features. The procedure doesn't involve opening of the sac.



**Figure 5: Keel operation**

**REPAIR BY FASCIAL SUTURE OR BY SKIN RIBBON SUTURES<sup>33</sup>**

This is probably the most satisfactory method when the defect is considerable and cannot be closed without tension or when side spread scarring is present. The peritoneum should be, if possible freed and sutured by itself but no attempt is made to separate the other abdominal layers. When the defect can be closed by a single running suture a second layer of sutures inserted in interlacing manner to include the circular

areas of musculature on each side, thus relieving the tension on the first suture. If the margins of the defect cannot be approximated the fascial suture is applied from the outset in the form of lattice work or darn.

**Anatomical restoration:** This is an ideal method of repair and is suitable to small hernias where scarring is minimal. The edges of the defect are excised and by careful dissection the surrounding abdominal wall is separated into constituent layers. Each layer is freed sufficiently to allow it to be sutured individually without tension.

## **DISADVANTAGES**

Due to adhesions, separation of different layers of abdominal wall becomes difficult. All these anatomical repairs are associated with recurrence rate of 9 to 21%.

## **PROSTHETIC MESH REPAIR**

The use of non-absorbable synthetic mesh prosthesis placed across the defect and stitched to the abdominal wall has revolutionized the repair of the abdominal wall defect. It is an excellent method of repair for large incisional hernias with wide divergence of recti and poor tone of musculoaponeurotic layers.<sup>33,35,49</sup>

## **INDICATIONS FOR PROSTHETIC MESH**

Preferably to reserve it for cases with,

1. Large defect of ant abdominal wall hernia.

2. Following post operative infection with fasciitis, sloughing, Trauma, excision for tumors of the ant abdominal wall.
3. Multiple attempts of repair with destruction of tissue.

### **CHOICE OF PROSTHETIC MATERIAL**<sup>36</sup>

1. The Ideal one is it should be universally available and cheap.
2. Easily cut to the required shape.
3. Is flexible, pleasant to handle.
4. Slightly elastic.
5. Practically indestructible.
6. Capable of being fixed and incorporated by human tissues.
7. Must be inert.
8. Little tissue reaction.
9. Not rejected even in presence of infection.
10. Must be sterilizable.
11. Non carcinogenic

### **I. POLYPROPYLENE MESH (PROLENE)**<sup>36,37</sup>

Of the materials available today, knitted polypropylene proline mesh is the most popular followed by polyamide and new expanded polytetrafluoro ethylene (PTFE). They are nontoxic, pliable, strong durable and resistant to fatigue and aging. They can be easily cut to any size and shape. They are practically indestructible in human times and will last

and serve their purpose for the rest of their patient's life. Prolene elicits only a very minimal tissue response as does PTFE. Prolene mesh is constituted from an isotactic crystalline stereoisomer of a linear hydrocarbon: polymer containing little or no unsaturation. The mesh is approximately 0.69 mm thick. This mesh has high burst strength approximately 17.5 kg/89 cm. and tensile strength. This material when used as a suture material has been found to be essentially inert and retains its strength indefinitely. Unused polypropylene mesh which is removed from its package may be resterilised for not more than three times by the conventional autoclaving process, 121 c for 30 minutes without loss of strength. The product should not be flash autoclaved.<sup>36,37</sup>

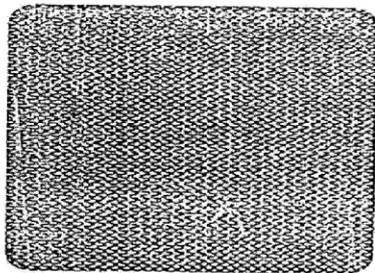
Prolene mesh is available in sizes

1. 11 cm X 4 cm 5 / 7.5 cm x 15 cm
2. 15 cm x 15 cm and 15 x 30 cm

Animal studies show that the implanted mesh causes a minimal transient acute inflammatory reaction. Fibrovascular tissue grows through the pores of the mesh which is eventually converted to a pliable collagen that the normal wound healing is not noticeably impaired. When it is placed on the inner surface of abdominal wall the surface in contact with bowel will soon be covered by peritoneum with minimal adhesion formation between the mesh and the bowel. If the patient undergoes

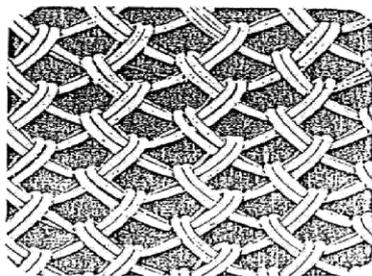
surgery in future the mesh can be slit open and during closure can be simply resorted with continuous synthetic non-absorbable suture material like prolene. Since these materials elicit little tissue response, sinuses are uncommon in the presence of infection. There is no crevices and the surface of the thread is extremely smooth and so that it is hardly colonise bacteria and withstands infection.

### (Monofilament Polypropylene Mesh)



An actual photograph of the Mesh.

Knitted mesh for Hernia Repairs and closing Tissue Defects.



A magnified photograph showing the interlocking weave

#### ADVANTAGES:

- INERT
- STRONG
- NON-BIODEGRADABLE
- DOES NOT UNRAVEL
- RESTERILISABLE

## II. DACRON (MERSILENE)

- Next popular prosthesis is also a knitted mesh but a multifilament polyester fibre thread.

- Cheap and easily available in French.

**Advantage:** Light, extremely supple, pleasant, soft feel, strong and elastic.

Its surface is granular and excites a tissue inflammatory response than polypropylene. They believe that granular surface creates friction between the mesh and tissues.<sup>37</sup> Thus prevents slippage of the mesh and creates rapid invasion of mesh by fibroblast and granulation tissue, strongly fix the tissue. For this reason it is suitable for Stoppa Rives procedure when no sutures are used to fix the mesh.

### **Disadvantages**

Tends to tear easily if tension.

Multifibered, less resistant to infection. Bacterial colonize the crevices, reinfect and recurrence.

### **III. EXPANDED POLYTETRAFLUROETHYLENE (PTFE)<sup>37</sup>**

#### **(Teflon, Goretex)**

- Extensively used for vascular prosthesis.
- Available in microporous sheets of varying size thickness.
- Strong / Pliable / Soft / Smooth / Slippery.
- Inert, no reaction, No Rejection.

- Poor penetration of new fibroblasts – Poor fixation Recurrence.
- Many of spaces are < 10 microns in size.
- Biologically inert leads to poor incorporation is the disadvantage.
- High cost

#### **IV. ABSORBABLE SYNTHETIC MESHES (POLYGLACTIN, POLYGLYCALIC ACID)<sup>36</sup>**

Are proved to be unsuccessful for the repair of incision hernia.

- Used in infected area to bridge hernia defects / generally abdomen infection.
- Places where you hesitate to use non absorbable mesh hope that hernia will close and mesh absorbed learning only scar tissue.
- Recurrence rate is very high.

#### **COMPLICATIONS OF ALL MESHES<sup>38</sup>**

- Adhesions
- Bowel obstruction
- Erosion into bowel and cause enterocutaneous fistula / urinary bladder.
- Intra peritoneal placement of prothetic mesh or other contact of mesh with the bowels should be avoided, if possible. If it is not possible care should be taken to place omentum between the bowel and mesh

in peritoneal approach.

- Where not tissue are available to place between the bowel and the non absorbable mesh recommended screen or double patch together absorbable and non absorbable mesh.
- Prosthetic mesh placed superficially and covered only skin may erode the skin and becomes exposed ulcer.
- Mesh be fixed with only synthetic non absorbable monofilament suture material preferably same material itself PTFE, Polyamide, Polypropylene (available).
- Some authors using absorbable synthetic suture material to fix as mesh is rapidly invaded by fibroblasts by the tissue absorbable suture disappears.

## **DIRECTIONS FOR USE**

It is desirable that prolene sutures ate used with the prolene mesh. These non absorbable sutures are put 1/4 to 1/2 inch apart at a distance approximately 1/4 inches form the edges of the mesh. Some surgeons prefer to suture a piece of mesh larger than the defect into position over the defect starting on the side of the mesh. The opposite sides are then sutured to assume proper closure under correct tension. When the margin sutures have been placed the extra mesh is trimmed away, leaving approximately 1/4 inch of mesh extending from the suture line.

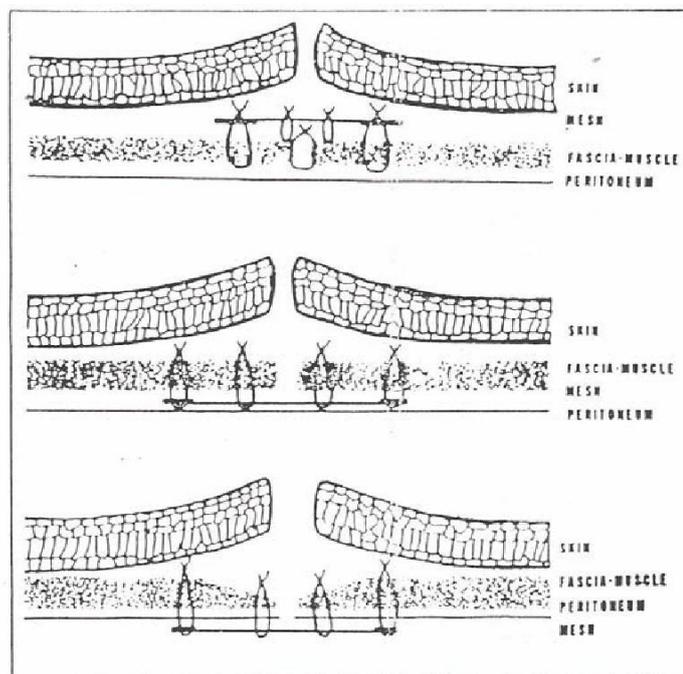
## **TYPES OF OPERATIONS**

Many variations and combinations of mesh repair have been described.<sup>39,40</sup>

- a) Onlay - Above musculoaponeurotic layer
- b) Inlay - Subfascial extraperitoneal
- c) Underlay - Intraperitoneal
- d) Combined underlay and overlay
- e) Large underlay
- f) Large overlay
- g) Combined large underlay and overlay
- h) Reinforcement
- i) Wrap around mesh reinforcement
- j) Two piece mesh

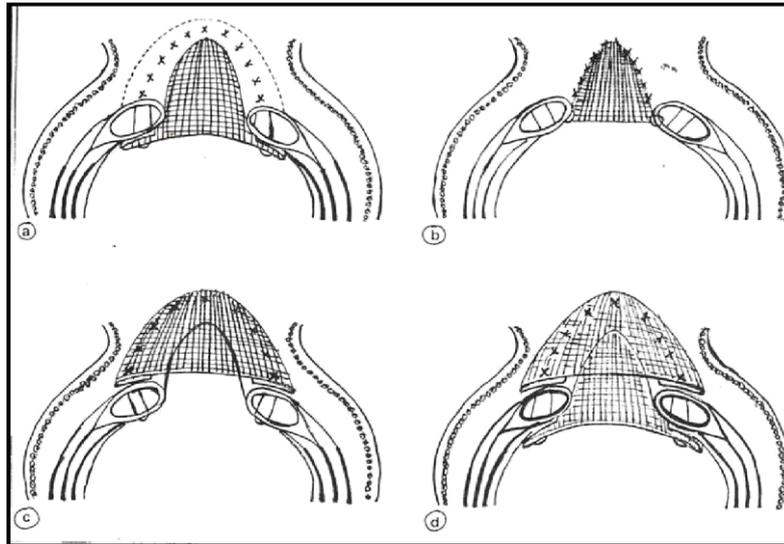
A piece of mesh cut to the shape of the defect but slightly larger may be sutured in place deep to the peritoneum or between peritoneum and abdominal wall as an underlay graft. A piece of mesh of the size and shape of the defect maybe sutured as an inlay graft to the edges of the defect. A large piece may be used as onlay graft on the abdominal wall. A large sheet of mesh may be sutured to almost the whole of the inner surface of the abdominal wall, deep to the peritoneum or to the outer

surface of musculoaponeurotic abdominal wall as an inlay graft between the abdominal wall and subcutaneous fat. Reinforcing strips of mesh may be used to hold sutures more securely or to hold fat sheets of mesh unwrapped around the edges of the hernial opening to avoid sutures cutting out. Another interesting variation is the use of equal pieces of mesh sutured to a huge area of abdominal wall on each side of the defect by several vertical row of sutures. Their opposing medial edges are then approximated and sutured together under some tension Bringing two sides of abdominal wall defect close together.



**Figure 6: Three methods of mesh placement and fixation**

A) Onlay, B) Subfacial extraperitoneal, C) Intraperitoneal



**Figure 7: Variations of prosthetic mesh repair**

- a. Underlay, b. Inlay, c. Overlay, d. Combined underlay and overlay

### **OPERATIVE TECHNIQUE**

Prosthetic mesh repair is a major proceeding and attention must be paid to the, good preoperative assessment of the patient and preparation of the patient. The skin is painted with povidone iodine solution. The old scar is excised by vertical or elliptical incision and carefully separated from the hernial sac. The skin flaps on each side are dissected off the sac to well beyond the edges of the defect clearing the fat and the rectus sheath, the aponeurosis and muscle. The sac is vertically opened along the middle and the inner surface as well as the peritoneal surface of the anterior abdominal wall is cleared of all adherent omentum and bowel. A piece of prolene mesh may now be prepared and sutured to the inner aspect of abdominal wall with prolene interrupted sutures. The four edges are clipped with artery forceps. The suture ends are passed through the

holes of the graft without a needle. Each suture runs parallel to the edge of the graft and 1 cm space is left between sutures. The ends of suture on one side are threaded into a large needle and passed through the abdominal wall. Each end is tied to its fellow in a mattress fashion pulling the mesh into position. This is then repeated with the lower border, the upper border and finally the remaining lateral border. In this way all the omentum and bowel are returned to the abdominal cavity and retained by mesh.

The two halves of the hernial sac are thus sutured to each other with a continuous simple over and over suture of prolene. This does not add strength to the repair and serves to cover and isolate the polypropylene mesh. A second full sized sheet of mesh is then used as an onlay graft the borders are folded over and the graft is laid on the outer surface of the external oblique and is sutured down all along its edges with a continuous over and pendulous abdomen transverse suprapubic incision is used and panculectomy with abdominoplasly is added.

## **POSTOPERATIVE CARE**

### **A) IMMEDIATE**

Anaesthetist surgeon rapport, at the end of an operation a non-attentive and competent anaesthetist can in one moment undo a most meticulously performed work of surgeon. The wound should be

generously supported by adhesive and anaesthetist should ensure smooth recovery.

## **B)EARLY**

1) Postoperatively patients are kept nil by mouth with Ryle's tube aspiration done one hourly and is continued till patient passes flatus or bowel sounds heard by auscultation. This is necessary to keep stomach empty and to prevent postoperative abdominal distension and vomiting.

2) Nourishment and hydration is maintained by fluids which is monitored by tongue dryness, urine output, tissue turgor and jugular venous pressure for at least 2-3 days. Alternative day blood urea and serum electrolytes are done to know the disturbances.

3) Postoperative pain- Almost every patient expresses it which is relieved by injection of analgesics.

4) Post operative retention of urine is avoided as this may lead to straining. If patient is unable to pass urine, catheterisation can be done.

5) Postoperative cough is avoided by putting patient in propped position, steam inhalation, breathing exercises and chest physiotherapy. Few patients may require an expectorant.

6) Care of wound and drains-subcutaneous suction drains are maintained for a minimum of 48 hours, or longer if drainage is excessive. Aseptic precautions should be taken while removing drains.

7) Sepsis-It is the commonest cause of incisional hernia or recurrence Prevention of sepsis requires energetic team work by hospital staff.

**Following suggestions are offered**

- 1) Short postoperative stay
- 2) No dressings in open wards
- 3) Segregation of septic cases
- 4) Use of masks by doctors and nurses
- 5) Keeping dust with its contents of bacteria down
- 6) Proper sterilisation of dressings, instruments and other operation equipment.

7) Prophylactic use of antibiotics. Cases of wound infection were treated with appropriate antibiotics according to the report of culture and sensitivity of pus. Cases of wound infection treated with aspiration with wide bore needle under all aseptic precautions.

8) Bowel care - all patients are advised not to strain at stools. Enema are recommended for patients who do not pass motion until 4th postoperative day.

## **C)LATE**

1) **AMBULATION:** Ambulation in cases of incisional hernia differ from other abdominal operation. Early ambulation is discouraged, but leg movements are encouraged on first postoperative day to prevent venous thrombosis. Patients are allowed to turn in the bed and sit up in bed on 3rd postoperative day. Patients are then allowed to walk on 7th or 8th days. Too drastic ambulation should be avoided.

2) **REMOVAL OF SUTURES:** Alternate sutures are removed alter 9<sup>th</sup> postoperative day and remaining on 10th day who are having wound infections and stitch abscess.

3) **WOUND DEHISCENCE:** This is a commonest feature noted in postoperative phase and may occur regardless of nutritional status of the patient as a result of faulty technique. Once disruption is diagnosed unless the condition of the patient contra indicates, it an immediate closure of wound is conducted instead of strapping.

## **POST-OPERATIVE COMPLICATIONS**

**GASTROINTESTINAL:** Paralytic ileus occurs because of mobilization and excessive handling of bowel. Ileus leads to poor healing through raised intra abdominal pressure with resultant poor circulation to the repair site, which may result in recurrence of hernia.

**PULMONARY:** Pulmonary diseases impairs healing of suture line and puts stress on the suture line by increasing the intra abdominal pressure. Allergic conditions produce coughing or sneezing, which must be properly treated.

**URINARY:** After surgery on lower abdominal incisional hernia, often patients will have urinary retention. Catheterization of the bladder with Foley's catheter should be done to avoid those complication.

**THROMBOPHLEBITIS:** When the contents of the massive hernial sac are reduced back into the peritoneal cavity, the rise in intra abdominal pressure leads to venous hypertension in the lower limbs with an increase in the incidence of DVT. This can be prevented by low dose heparin prophylaxis, frequent position change and active limb movements in early postoperative period

## **LOCAL COMPLICATIONS**

### **Seroma**

The wound seroma is the recurring accumulation of serum in abdominal wall which usually calls for repeated needle aspirations and external application of mild pressure, but negative suction drain tube is inserted to prevent seroma.

## Wound Infections

### **BOX 13-2 Centers for Disease Control and Prevention Criteria for Defining a Surgical Site Infection**

#### **Superficial Incisional**

Infection less than 30 days after surgery

Involves skin and subcutaneous tissue only, *plus* one of the following:

- Purulent drainage
- Diagnosis of superficial surgical site infection by a surgeon
- Symptoms of erythema, pain, local edema

#### **Deep Incisional**

Less than 30 days after surgery with no implant and soft tissue involvement

Infection less than 1 year after surgery with an implant; involves deep soft tissues (fascia and muscle), *plus* one of the following:

- Purulent drainage from the deep space but no extension into the organ space
- Abscess found in the deep space on direct or radiologic examination or on reoperation
- Diagnosis of a deep space surgical site infection by the surgeon
- Symptoms of fever, pain, and tenderness leading to wound dehiscence or opening by a surgeon

#### **Organ Space**

Infection less than 30 days after surgery with no implant

Infection less than 1 year after surgery with an implant and infection; involves any part of the operation opened or manipulated, *plus* one of the following:

- Purulent drainage from a drain placed in the organ space
- Cultured organisms from material aspirated from the organ space
- Abscess found on direct or radiologic examination or during reoperation
- Diagnosis of organ space infection by a surgeon

Adapted from Mangram AJ, Horan TC, Pearson ML, et al: Guideline for prevention of surgical site infection. *Infect Control Hosp Epidemiol* 20:252, 1999.

## **Haematoma**

Small haematoma need not be disturbed. Large hematoma must be evacuated. Small subcutaneous drains are desirable if necessary.

## **Abdominal Wall Sinuses**

As a result of infection in wounds containing foreign bodies, persistent draining sinuses are frequent. These sinuses may be due to the infection in sutures or infection in sheets of implanted materials.

## **PROSTHETIC MESH REPAIR (LAPAROSCOPIC METHOD)<sup>41</sup>**

Laparoscopic repair of incisional hernia was introduced in the 1990's with the expectation that recurrence rates similar to those of open mesh repair could be obtained, with an improvement in recovery time, Hospital stay and complications rate. Since 1996, 14 reports of laparoscopic repair have been published all placing mesh in an intraperitoneal position.

The techniques used were very similar. After achieving a pneumoperitoneum a variable number of trochars were inserted. Most surgeons placed the trochars as far laterally from the hernial defect as possible. The majority of surgeons preferred using a 30° or 45° laparoscope. Adhesions were divided and the contents of the hernial sac reduced. The edges of the defect or defects were exposed on all sides. In all cases hernial sac was left in situ.

Once the size of the hernial defect was defined, the proper size of mesh was determined. The prosthetic mesh was then inserted into the peritoneal cavity. There appears to be universal agreement that an overlap of at least 3 cm between the mesh and the fascial edge is necessary. Fix the mesh in place by using staples or sutures.

Most surgeons have not used drains, in contrast to the fashion with open mesh techniques where the use of drains is almost universal.

The recurrence rates obtained with laparoscopic incisional hernia repair vary between 0 to 9%.<sup>53</sup> Common complications of laparoscopic repair includes seroma, wound infection, Ileus, hematoma and pain.<sup>54</sup>

## **PREVENTION**

Armed with the knowledge of aetiological factors, various authors proposed various preventive methods, which may help in preventing incisional hernia. Many of the factors identified as being important for the rate of wound complications are not possible to correct preoperatively.

### **A. Incision**

Use of lateral paramedian incision is best and should be used to wherever it is possible to use it.<sup>21</sup> Donaldson and colleagues in 1982 found 0.37% incisional hernia. Guillow et al. (1980) had 0% incidence.

Cox et al. in 1986 had two incisional hernias in 431 patients.

## **B. Use of correct suture material**

For closure of fascia, sheath and aponeurosis use non-absorbable suture material (Nylon, Prolene and Vicryl). Twin strands of suture are better than a thick single strand.

## **C. Closure of laparotomy wound**

Mass closure of abdominal incision is better and faster than layered closure.<sup>17</sup> Peritoneal layer can be left behind unsutured.<sup>24</sup> Use of nylon and prolene to close skin as stitch abscess is less common.

## **D. Meticulous operating technique**

Thorough skin preparation prior to incision and draping towels should be carefully clipped to the wound edges. Gentle handling of the tissues and to take minimum tissue in haemostat is necessary. Cauterize small bleeders rather than tying. Perfect haemostasis, as haematoma commonly leads to wound sepsis. No dead space should be left in the wound.

## **E. Prophylactic antibiotics**

Used to prevent wound sepsis which may lead to wound failure. Polk et al.<sup>25</sup> recommended prophylactic antibiotic therapy, both in clean

and contaminated wounds. These antibiotics attain therapeutic concentration along the incision and prevent wound sepsis. Rios et al.<sup>26</sup> concluded that antibiotic chemoprophylaxis is useful in abdominal incisional herniorrhaphy surgery with implantation of prosthetic material for reducing local septic complications.

#### **F. Use of mesh/darn**

When it is not possible to approximate the rectus sheath without tension, use of PTFE, 2- Marlex mesh<sup>12</sup> or Darn repair<sup>27</sup> should be done using monofilament non-absorbable sutures.<sup>28</sup>

#### **G. Wound sepsis**

Irrigate wound margins with saline, betadine, tetracycline where wound sepsis is probable. Skin and subcutaneous tissue can be left open if sepsis is considerably feared. Antibiotic irrigation with 1 gm of Kanamycin/Bacitracin to irrigate the wound margins and mesh soaked in antibiotic solution helps to decrease wound infection rate.

#### **H. Drainage tube**

It is advisable to use drains in case of incisional hernia repair. In case seroma formation occurs, and is not drained, it can get infected. A negative suction drain should be kept for 5 to 6 days or till the output is

very less. Drainage of the subcutaneous tissues through separate stab wounds may prevent hematoma formation, which in turn may lower the incidence of incisional hernias. With mesh repairs, combined data of the literature revealed seroma formation to be 30.4 percent in the single series in which suction drainage was not used and averaged 4.7 percent when drainage was applied.

Also, by negative suction, dead space is being avoided. To prevent introduction of microorganisms drainage should presumably be short term. No randomized trials are available.

### **I. Obesity**

It should be corrected as much as possible in all elective situations.

### **J. General build of patient**

Build up of patient's general state prior to surgery. In debilitated patients wound failure is common. Correct anemia, correct asthma and give good chest physiotherapy in COPD prior to surgery.

## **MATERIALS AND METHODS**

A sum of 30 patients with incisional hernia admitted in General surgical wards of Govt. Rajaji Hospital during the period from September 2013 to August 2014 were taken into study.

### **DATA COLLECTION:**

Clinical features, symptomatology, investigations, operative findings, post operative wound complications, and length of hospital stay were analysed using the proforma.

### **INCLUSION CRITERIA:**

All patients of incisional hernia admitted in Govt. Rajaji Hospital with

- Age >35
- Defect size : 3 – 7 cm
- BMI > 30
- Diabetes

### **EXCLUSION CRITERIA:**

Patients with

- Recurrent incisional hernia,
- Pregnancy with incisional hernia
- BMI < 30

- Non diabetes
- Defect size < 3cm and/or >7 cm will be excluded from the study.

#### **METHODOLOGY:**

- Procedure: Onlay mesh repair with prolene mesh of size 15 \* 15 cm. After mesh repair, in 15 patients redivac drain is being kept and in other 15 patients , no drain is kept. The drains were removed when there was less than 30 ml of drainage in 24 hours on 5<sup>th</sup> or 6<sup>th</sup> post-operative day.
- Parameters studied
  - wound seroma
  - wound infection
  - reoperation for wound healing complication
  - post operative length of hospital stay

## RESULTS AND DISCUSSION

Study consists of analysis of efficacy of wound drain in mesh repair of incisional hernia in 30 patients of incisional hernia admitted in General surgical wards of Govt. Rajaji Hospital, Madurai from September 2013 – August 2014

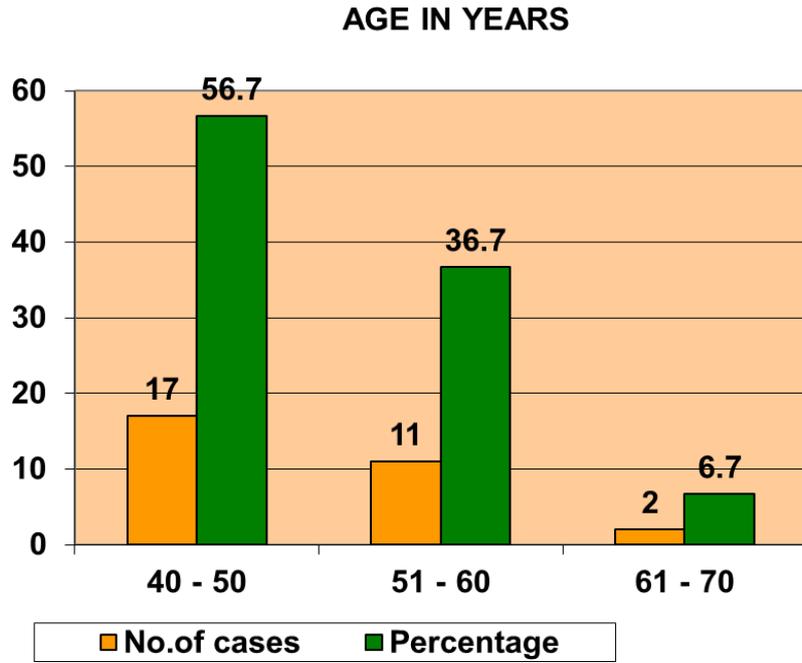
### 1. AGE DISTRIBUTION:

Age distribution of incisional hernia in our study is as follows.

Table-1: Age distribution

In our study, among 30 cases, most of incisional hernia occurred in the age group of 40 – 50 years.

Age in years	No. of cases	Percentage
40 – 50	17	56.7%
51 – 60	11	36.7%
61 – 70	2	6.7%



Among 30 patients , 17 patients were in the age group of 40 – 50 years which was calculated as 56.7%. 11 patients were in the age group of 51 – 60 years which was calculated as 36.7%. The remaining two patients were in the age group of 61 – 70 years which was calculated as 6.7%.

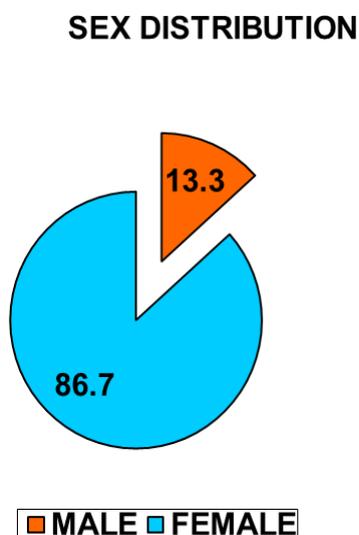
## 2. SEX DISTRIBUTION:

Sex distribution of incisional hernia in our study is as follows

**TABLE-2: SEX DISTRIBUTION:**

SEX	No.of cases	Percentage
MALE	4	13.3%
FEMALE	26	86.7%

In our study, out of 30 patients, 26 patients were females which was calculated as 86.7% . The remaining 4 patients were males which was calculated as 13.3%.



### 3. DETAILS OF PREVIOUS SURGERY:

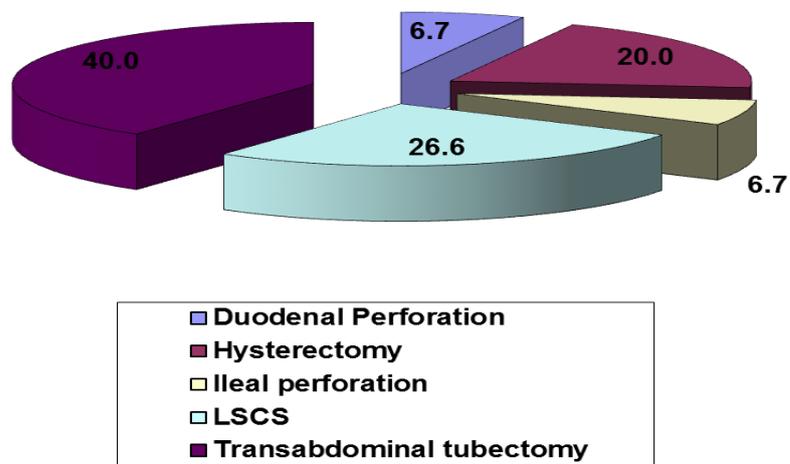
The details of previous surgery of our study subjects is as follows

**TABLE-3: DETAILS OF PREVIOUS SURGERY**

Previous surgery	No. of cases	Percentage
Duodenal Perforation	2	6.7%
Hysterectomy	6	20.0%
Ileal perforation	2	6.7%
LSCS	8	26.6%
Transabdominal tubectomy	12	40.0%

In our study, out of 30 patients, twelve patients of incisional hernia had previous surgery of trans-abdominal tubectomy which was calculated as 40%. Eight patients had previous surgery of lower segment caeserean section which was calculated as 26.6%.

### **DETAILS OF PREVIOUS SURGERY:**



Six patients had hysterectomy done which was calculated as 20%. Two patients had history of surgery done for duodenal perforation which was calculated as 6.7% and the remaining two patients had operated for ileal perforation which was calculated as 6.7%.

#### 4. PREVIOUS INCISIONS:

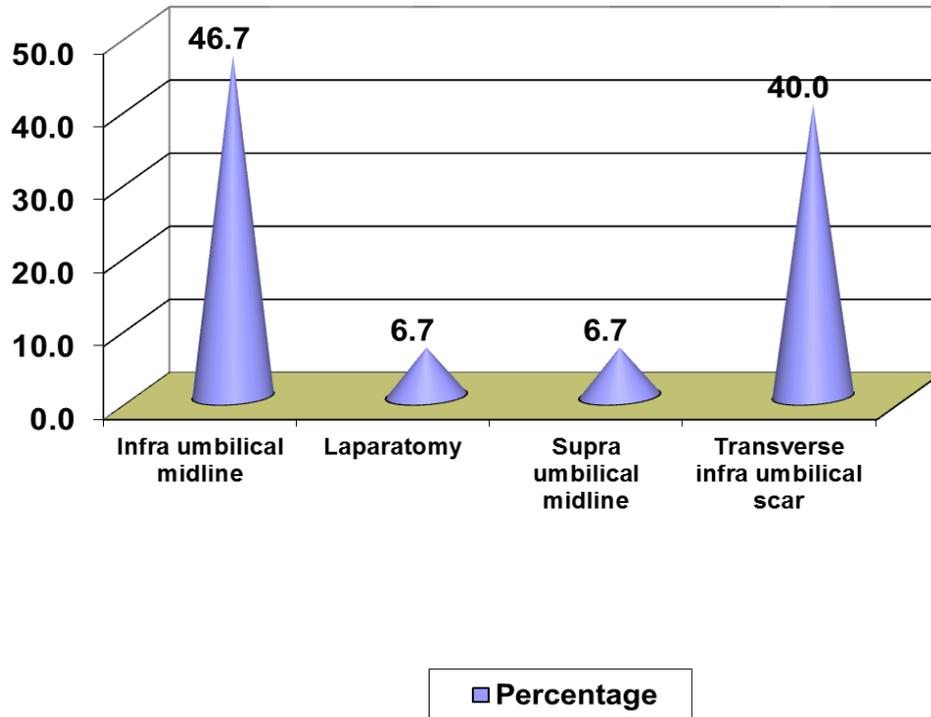
The details of previous incision of our study population as follows.

**TABLE-4: PREVIOUS INCISIONS:**

Incision	No. of cases	Percentage
Infra umbilical midline	14	46.7%
Laparotomy	2	6.7%
Supra umbilical midline	2	6.7%
Transverse infra umbilical	12	40.0%

In our study group, out of 30 patients, fourteen patients had undergone surgery through infraumbilical midline incision which accounts for about 46.7 %. Twelve patients were operated through transverse infraumbilical incision which accounts for about 40 %. Among the above said incisions constituting about 86.7 %, all were done for obstetrics and gynaecological procedures.

## INCISION



Among our study group, two patients had undergone laparotomy for ileal perforation which constituted about 6.7% of total incisions. The remaining two patients had undergone surgery for DU perforation through supraumbilical midline incision which constituted about 6.7% of total incisions.

## 5. USG DEFECT

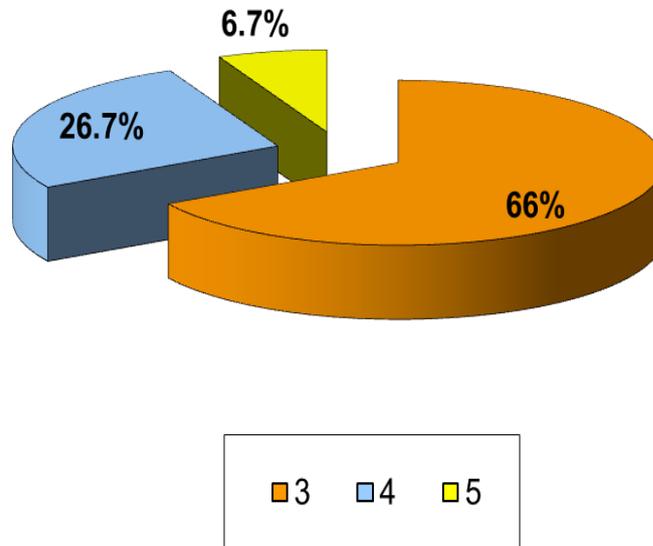
The ultrasound defect size of our study group is as follows

TABLE-5: USG DEFECT

USG defect cm	No.of cases	Percentage
3 cm	20	66.7%
4 cm	8	26.7%
5 cm	2	6.7%

In our study group, out of 30 patients, twenty patients had defect in the incision site in the anterior abdominal wall which was found out in the ultrasonogram to be of size of 3 cm which accounts for about 66.7 % of total study group. Eight patients had defect size of about 4 cm in incision site in AAW in ultrasonogram which constituted about 26.7% of total study group.

### USG DEFECT (CMS)



In our study population, two patients out of thirty had defect in the anterior abdominal wall in the incision site of size of about 5 cm detected by ultra sound which accounted for about 6.7%.

### 6. WOUND DRAIN

In our study population , after chevrel onlay mesh repair for all patients, redivac suction drain was being kept over the mesh in fifteen patients and then subcutaneous tissue and skin was closed with 2- 0vicyl and 1 -0 silk respectively. This was drain arm group. In the remaining fifteen patients, no drain was kept and hence after mesh repair the

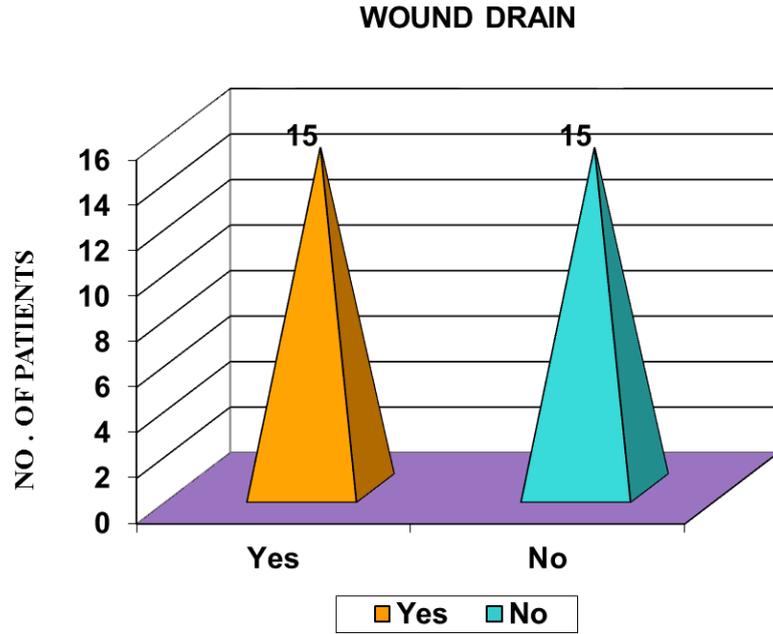
subcutaneous tissue and skin was closed with 2- 0vicryl and 1 -0 silk. This was the no drain arm

**TABLE-6: WOUND DRAIN**

Wound drain	No.of cases	Percentage
Yes(Drain arm)	15	50.0%
No(No drain arm)	15	50.0%

**DIAGRAM: REDIVAC DRAIN**



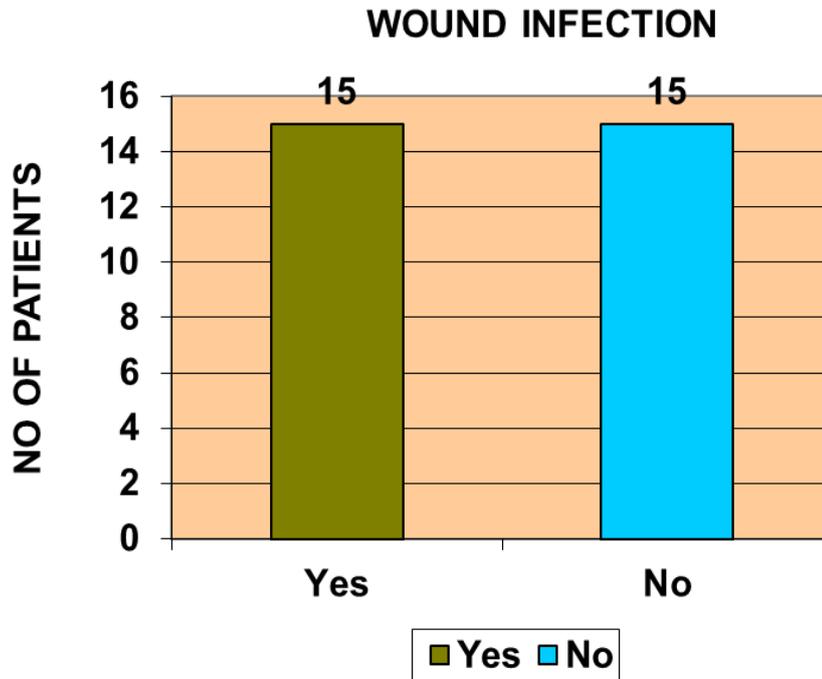


## 7. WOUND INFECTION

The wound infections as defined by CDC recommendations were followed. In our study, all wound infections are superficial incisional only neither deep incisional nor organ space infections. Results were tabulated below.

TABLE-7: WOUND INFECTION

Wound infection	No. of cases	Percentage
Yes	15	50.0%
No	15	50.0%



**TABLE-8: COMPARISON OF WOUND INFECTION**

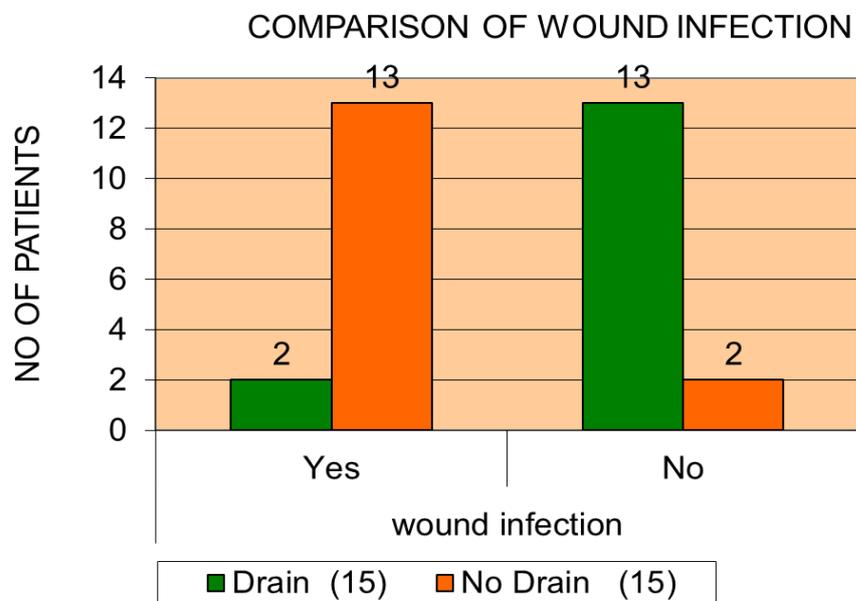
wound drain	wound infection	
	Yes	No
Drain (15)	2 (13.3%)	13 (86.7%)
No Drain (15)	13 (86.7%)	2 (13.3%)
P' VALUE	0.039 Significant	

In the drain arm of 15 subjects, only two patients shown signs of superficial incisional SSI according to CDC criteria which accounts for

13.3% in drain arm . The remaining thirteen patients returned home without any SSI which constituted of about 86.7% in drain arm .

In the no drain arm of 15 subjects, thirteen patients shown signs of superficial incisional SSI which accounted for 86.7% and the remaining two patients were not infected which accounted for 13.3% in this group.

P value of 0.039 was obtained and it was significant.

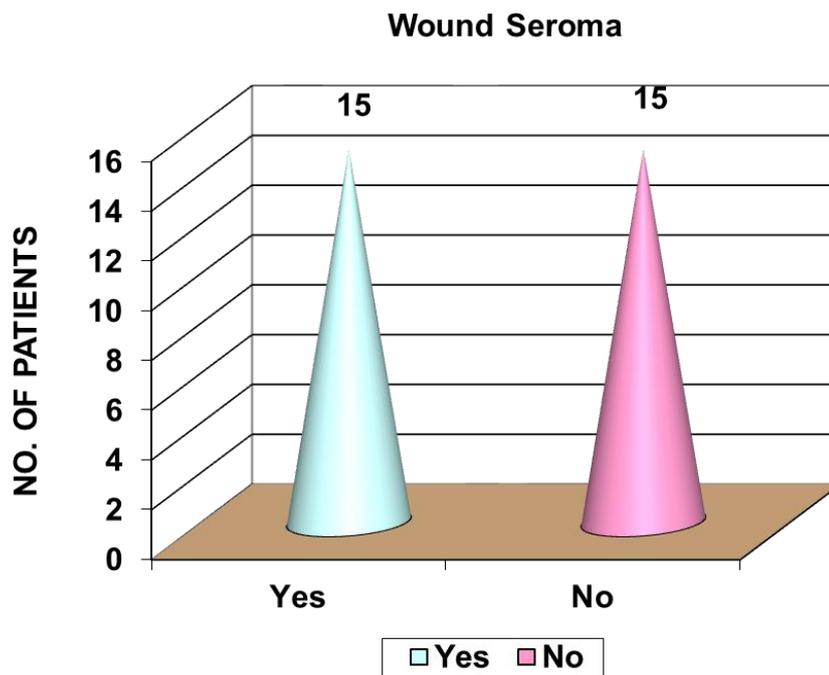


## 8. WOUND SEROMA

Seroma was defined as the collection of any volume of subcutaneous fluid without debris. Wound seroma was assessed clinically in the postoperative period and the results were tabulated below.

**TABLE-9: WOUND SEROMA**

Wound seroma	No.of cases	Percentage
Yes	15	50.0%
No	15	50.0%



**TABLE-10: COMPARISON OF WOUND SEROMA**

	wound seroma	
	Yes	No
wound drain		
Drain (15)	0.0	15
No Drain (15)	15.0	0
P' VALUE	0.003 Significant	

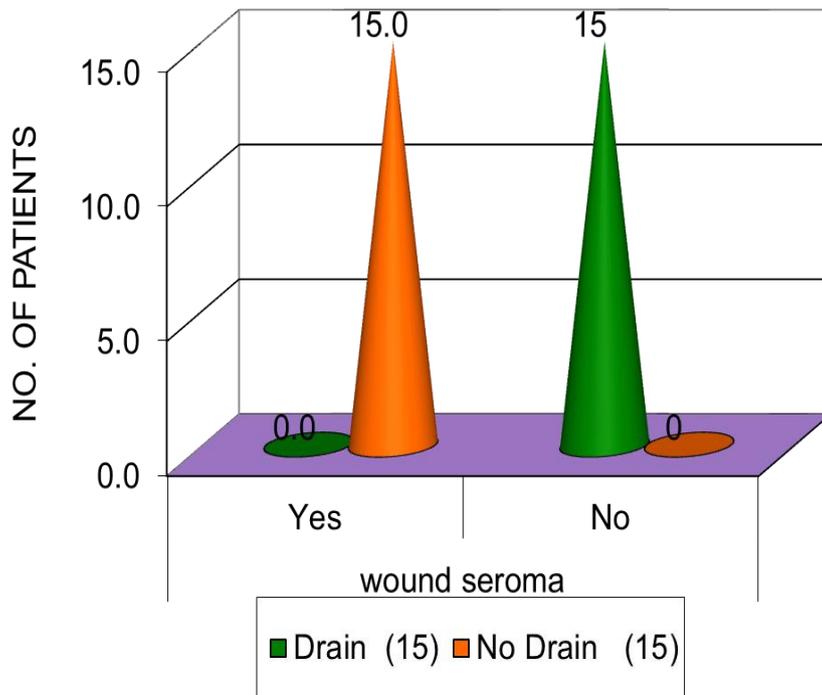
Wound seroma can be assessed clinically as well as through ultrasound. In our study, we assessed the seroma clinically.

In the drain arm of fifteen subjects, there were no cases of clinical seroma. In the no drain arm of fifteen subjects, almost all the patients had clinical seroma among which thirteen of them got infected. Among them nine of the patients were managed conservatively with antibiotics which constituted about 60 %. P value of 0.003 was obtained and it was statistically significant

The development of seromas relates to fluid accumulation in the residual space of the hernia along with inflammation, disruption of lymphatics and continuous irritative effect caused by the foreign body like the prosthesis.

For the prevention of postoperative seromas, suction drains are placed in the subcutaneous dissection space allowing aspiration of fluid produced, along with measures of elastic compression postoperatively. Since 1997 it has been described the use of negative pressure therapy to treat complex and open wounds.

### COMPARISON OF WOUND SEROMA

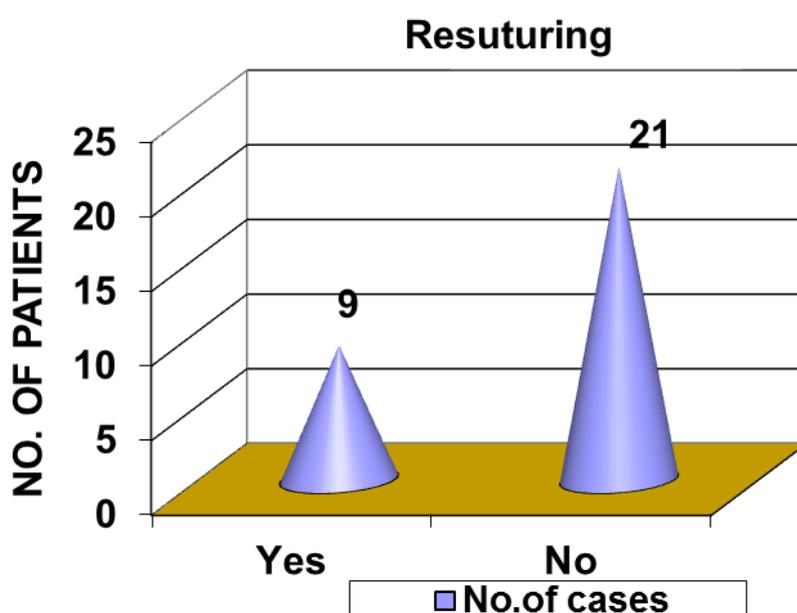


### 9. SECONDARY SUTURING

Secondary suturing is defined as being done to remove the unhealthy, infected and dead tissue in the primarily sutured wound , to close the wound gaping with healthy tissue , to freshen the wound edges and to approximate the wound edges in conditions like unhealthy wounds, unapproximated and infected wounds.

**TABLE-11: SECONDARY SUTURING**

Resuturing	No.of cases	Percentage
Yes	9	30.0%
No	21	70.0%



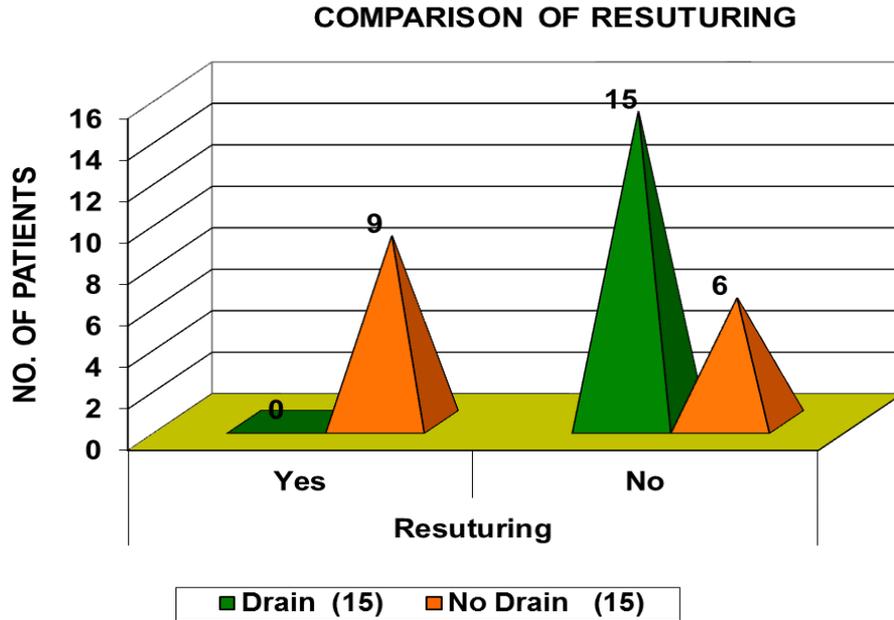
In our study, there were about nine patients who got resutured in the total sum of thirty subjects. In the drain arm of fifteen subjects, there was no reported case of any secondary suturing.

TABLE 12: COMPARISON OF SECONDARY SUTURING

wound drain	Resuturing	
	Yes	No
Drain (15)	0	15
No Drain (15)	9 (60%)	6(40%)
P' VALUE	0.003 Significant	

In the no drain arm of fifteen subjects, about nine patients got secondary suturing done which accounted for about 60% and the causes were due to continuous seroma formation and wound infection unresponsive to antibiotics. The remaining six patients of no drain arm group returned home without undergoing secondary suturing.

Secondary suturing was done under local anaesthesia using bupivacaine and lignocaine under strict aseptic precautions in elective theatre. Secondary suturing was done using non absorbable monofilament suture material such as prolene.



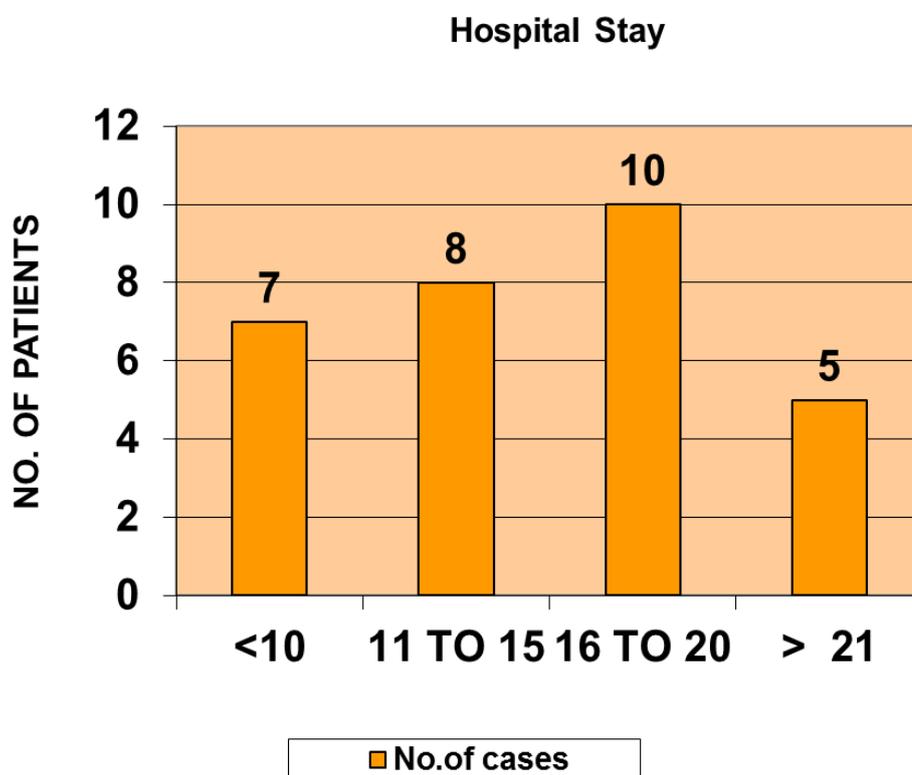
### **10. POSTOPERATIVE LENGTH OF HOSPITAL STAY**

In the preoperative period, patients were evaluated. Routine blood investigations, urinary parameters, ultrasound abdomen, ECG, echocardiogram and cardiology fitness for the patients above 40 years were done. All diabetic patients were switched over from oral hypoglycemic drugs to insulin and their blood sugar levels were maintained according to the diabetologist opinion. Patients with hypertension were controlled with antihypertensives. Patients having chest infection were treated with antibiotics. Hence the patients were completely evaluated and assessed and then they were taken up for surgery. Total length of hospital stay was not taken into consideration because of differing health aspects of the patient in the Preoperative

period. And hence the postoperative length of hospital stay was taken into consideration.

TABLE-13: LENGTH OF HOSPITAL STAY

Stay	No.of cases	Percentage
<10 days	7	23.3%
11 TO 15 days	8	26.7%
16 TO 20 days	10	33.3%
> 21 days	5	16.7%



In our study population of thirty subjects, about seven patients got discharged within 10 days after surgery constituting about 23.3%. Eight

patients got discharged within eleven to fifteen days constituting about 26.7%.

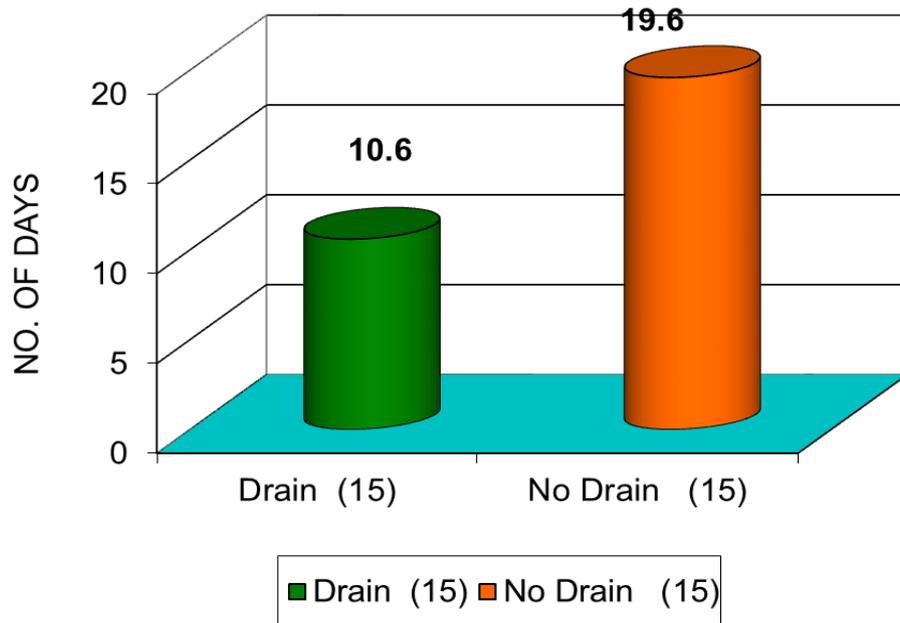
About ten patients got discharged between sixteen to twenty days constituting of about 33.3%. Lastly, five patients got discharged only after twenty one days constituting of about 16.7%.

TABLE-14: COMPARISON OF POST OP STAY

wound drain	length of hospital stay	
	Mean	SD
Drain (15)	10.6 days	1.55
No Drain (15)	19.6 days	2.13
P' VALUE	<0.001 Significant	

In the drain arm of fifteen subjects, the mean postoperative length of hospital stay was about 10.6 days with standard deviation of 1.55. In the no drain arm of fifteen subjects, the mean postoperative length of hospital stay was about 19.6 days with standard deviation of 2.13. The drain arm group were discharged nine days earlier than no drain arm group. The P value of <0.001 was also statistically significant

COMPARISON OF POST OP. HOSPITAL STAY



**ACROSS THE GLOBE:**

There were no RCTs comparing wound drainage with no wound drainage after incisional hernia repair. There was only one trial that compared two different types of drains after incisional hernia repair. There was no difference in any of the outcomes measured.

Wound drains after incisional hernia repair by Gurusamy KS, Allen VB, Samraj K et al stated that there was no difference in any of the outcomes measured, however this trial involved only 24 patients and therefore was grossly underpowered to detect clinically important differences in outcome.

It is surprising that we have identified no research evidence relating to this commonly used intervention. RCTs are needed to establish the clinical benefit of inserting wounds drains after repair of incisional hernias.

## **SUMMARY**

Our study consists of analysis of efficacy of wound drain in mesh repair of incisional hernia in 30 patients of incisional hernia admitted in General surgical wards of Govt. Rajaji Hospital, Madurai from September 2013 – August 2014. This is the comparative study comparing the postoperative complications such as wound seroma, wound infection, secondary suturing and length of hospital stay in drain arm with respect to no drain arm.

The development of anterior abdominal wall, anatomy of AAW, types of incision, healing of abdominal wound, etiology and predisposing factors of incisional hernia, types of incisional hernia and various modalities of management of incisional hernia are described in detail.

The evaluation of the patient is done as shown in the proforma. Routine blood investigations, urinary parameters, ultrasound abdomen, ECG, echocardiogram and cardiology fitness for the patients above 40 years were done. All diabetic patients were switched over from oral hypoglycemic drugs to insulin and their blood sugar levels were maintained according to the diabetologist opinion. Patients with

hypertension were controlled with antihypertensives. Patients having chest infection were treated with antibiotics. Hence the patients were completely evaluated and assessed and then they were taken up for surgery

For all 30 patients of our study subjects, Chevrel onlay mesh repair was done using 15\*15 cm prolene mesh. Among them, in fifteen patients redivac suction drain was kept over mesh before closing the wound. This was the drain arm. In the remaining fifteen patients no drain has been placed and the subcutaneous tissue and skin has been closed over the mesh. Cases were equally distributed in both groups.

In our study, among 30 cases, most of incisional hernia occurred in the age group of 40 – 50 years (56.7%). 26 patients were females which was calculated as 86.7%. Regarding previous surgery, twelve patients of incisional hernia had previous surgery of trans-abdominal tubectomy (40%), eight patients had previous surgery of lower segment caeserean section calculated as 26.6% and six patients had hysterectomy done calculated as 20%.

Regarding previous incisions, fourteen patients had undergone surgery through infraumbilical midline incision which accounts for about 46.7 %. Twelve patients were operated through transverse infraumbilical incision which accounts for about 40 %. Hence 86.7 % of incisions and surgeries were done for obstetrics and gynaecological procedures. Twenty patients had 3cm defect in the incision site in the AAW in USG (66.7 %).

#### **COMPARISON OF WOUND INFECTION:**

In the drain arm of 15 subjects, only two patients shown signs of superficial incisional SSI according to CDC criteria which accounts for 13.3% in drain arm . In the no drain arm of 15 subjects, thirteen patients shown signs of superficial incisional SSI which accounted for 86.7%. P value of 0.039 was obtained and it was significant.

#### **COMPARISON OF WOUND SEROMA:**

In the drain arm of fifteen subjects, there were no cases of clinical seroma. In the no drain arm of fifteen subjects, almost all the patients had clinical seroma(100%) among which thirteen of them got infected . Among them nine of the patients(60%) were managed conservatively

with antibiotics and six of them(40%) got resuturing done. P value of 0.003 was obtained and it was statistically significant.

### **COMPARISON OF SECONDARY SUTURING**

In the drain arm of fifteen subjects, there was no reported case of any secondary suturing. In the no drain arm of fifteen subjects, about nine patients got secondary suturing done which accounted for about 60% and the causes were due to continuous seroma formation and wound infection unresponsive to antibiotics

### **COMPARISON OF POST OP STAY**

In the drain arm of fifteen subjects, the mean postoperative length of hospital stay was about 10.6 days. In the no drain arm of fifteen subjects, the mean postoperative length of hospital stay was about 19.6 days. The drain arm group were discharged nine days earlier than no drain arm group. The P value of <0.0001 was statistically significant.

## CONCLUSION

Over the years the advantages of the negative pressure therapy have been demonstrated, as it improves healing times

- by increasing blood flow,
- extracting secreted fluid,
- maintaining the wound margins and
- Protecting the wound from contamination.

Hence from our comparative study, in a case of incisional hernia during mesh repair the usage of negative pressure redivac suction drain helps in

- Reducing the wound infection rate
- Preventing the formation of seroma
- Reducing the number of secondary suturing.
- Reducing the postoperative length of hospital stay.

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## Photographs

### **DRAIN ARM**

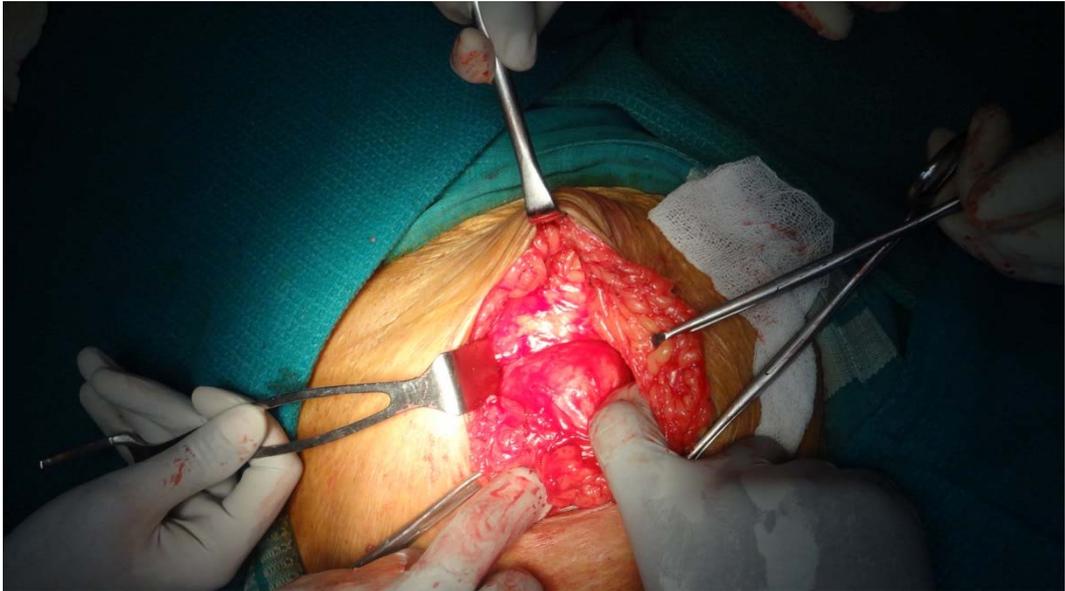
#### **Incisional hernia in IUM incision in previous LSCS**



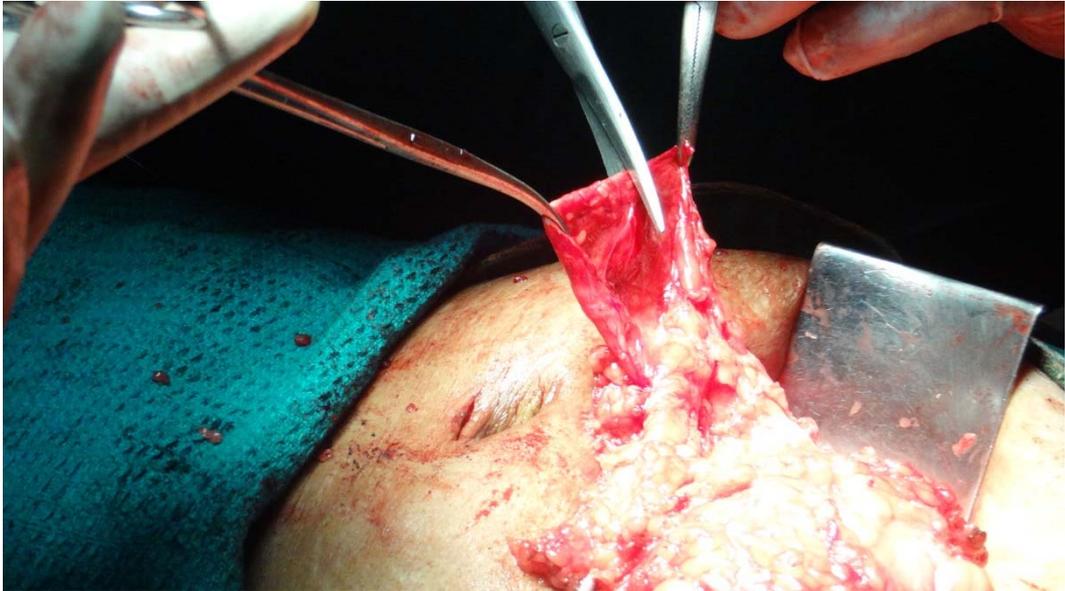
#### **Excision of Scar**



**Defect in rectus sheath**



**Opening of Sac**



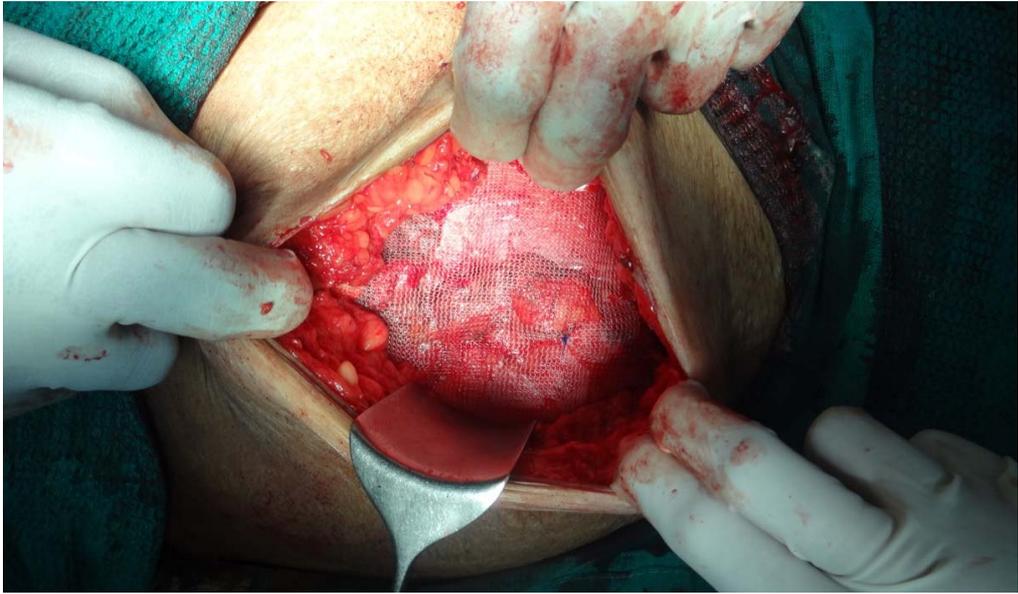
## **Reduction of Contents**



## **Rectus closure with 1prolene**



### **Onlay mesh repair**



### **Redivac drain**

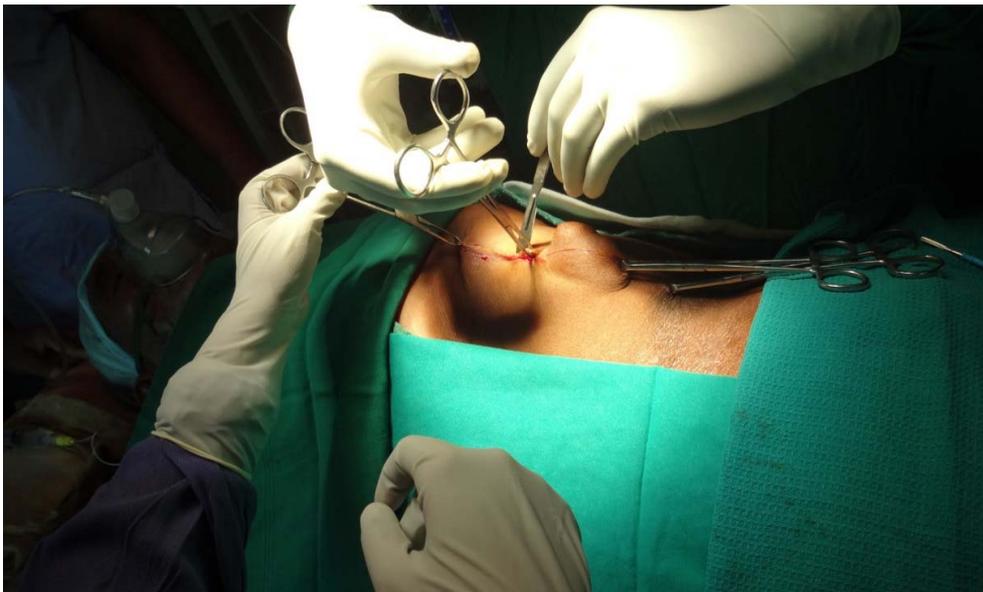


## **No Drain Arm**

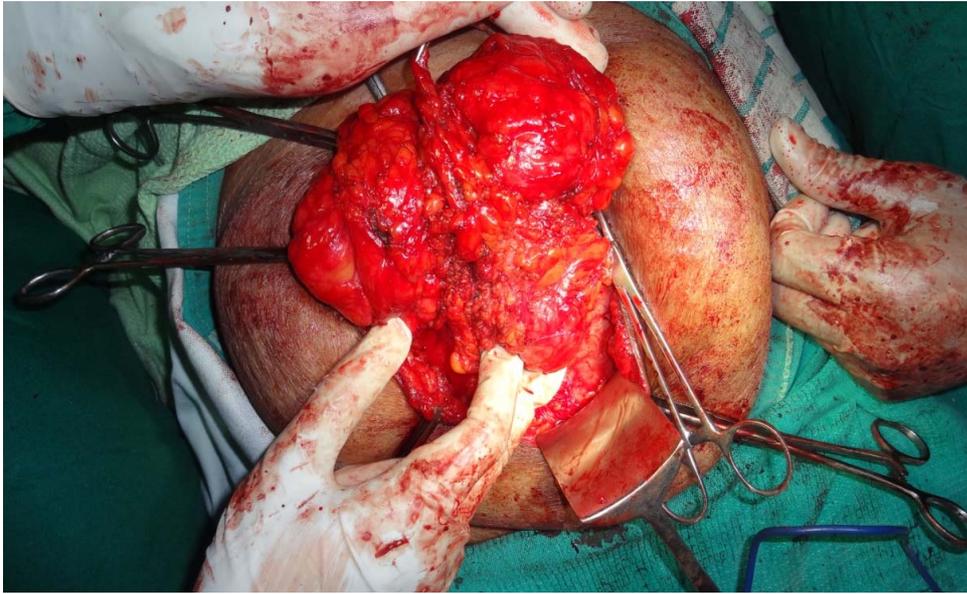
**Incisional hernia in IUM incision in previous hysterectomy**



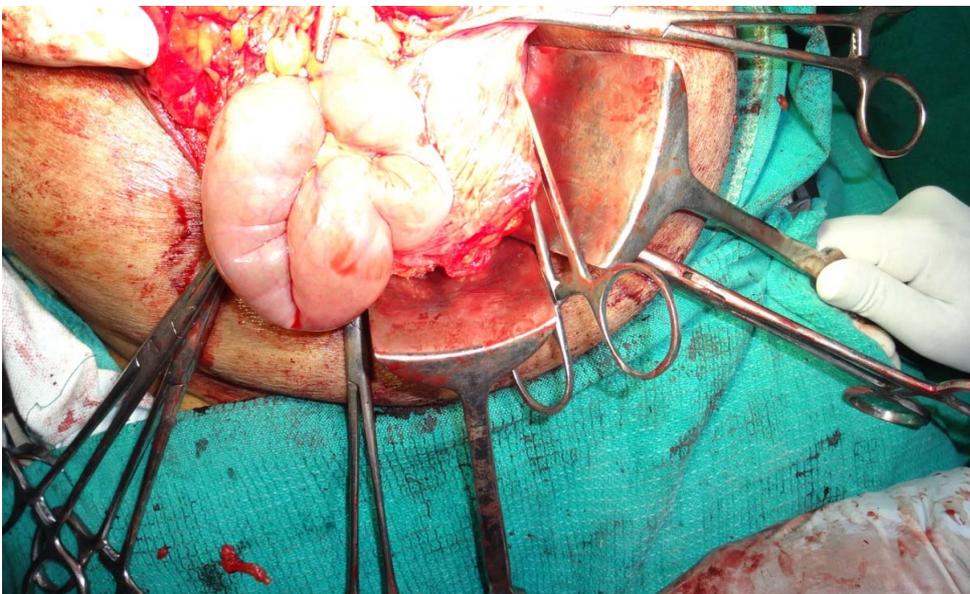
**Incision being made**



## Identification of sac



## Reduction of contents



**Rectus closure with prolene**



**Onlay mesh repair without drain**



**Wound seroma and infection in no drain arm**



**Secondary suturing in no drain arm**



# PROFORMA

## I. Patients Particulars

Name	Religion	Case No.
Sex	DOA	IP No.
Age	DOO	
Address:	DOD	

## Occupation

Sedentary / Semi - Sedentary / Heavy worker

## II. Diagnosis

### III. Chief Complaints

(With duration)

A. Swelling

Duration

Pain / No Pain

Course      Progressive

Static

Reducible / Irreducible

B. Pain

Duration

Nature      Colicky

Constant

Relation      Exercise

Straining

Food

C. Other Complaints

- 1) Vomiting
- 2) Constipation
- 3) Urinary complaint
- 4) Per Rectal Bleeding
- 5) Prolapse
- 6) Cough

**PAST HISTORY**

Diabetes

Tuberculosis

Hypertension

Bronchial Asthma

Jaundice

Chronic Bronchitis

Stricture urethra

Miscellaneous

Malignancies

**HISTORY OF PREVIOUS OPERATION**

No of Operations –

Incision used –

Nature – Planned / Emergency

Complications -

- 1) Cough
- 2) Distension of Abdomen
- 3) Straining at Bowel.
- 4) Micturition.
- 5) Wound infection
- 6) Others

Cause of operation -

- 1) Caesarean Section
- 2) Hysterectomy
- 3) Other causes.

Period between operation and appearance of Hernia –

Type of Anaesthesia – General Anaesthesia / Spinal Anaesthesia

### **PERSONAL HISTORY**

Smoking -

Diet

Obstetric History - Para

Constipation -

Full Term Normal Delivery

Micturition -

Section

### **GENERAL EXAMINATION**

Built and Nourishment – Good / Average / Poor

Weight -

Normal / obese

Oedema

Pallor -

Lymphadenopathy

Pulse -

Temperature

Blood Pressure

### **LOCAL EXAMINATION**

#### **A) INSPECTION**

Incision Site (Old Scar)

Type: Vertical / Transverse / Oblique

Site: Supraumbilical mid line / Infraumbilical mid line

Right Paramedian / Other Type - Pfannestil

- Grid Iron

Number:

Previous scar: Linear / Broad

Impulse on Coughing:-

Visible Peristalsis:-

### **Signs of Inflammation**

### **B) PALPATION**

GAP (CMS) – DEFECT IN ANTERIOR ABDOMINAL WALL

Tone of Abdominal Muscle – Flabby / Normal

Tenderness:- Present / Absent

Palpable Impulse:- Present / Absent

Reducibility:- Present / Absent

Consistency:- Elastic / Doughy

### **C) PERCUSSION**

Resonant / Dull

### **D) AUSCULTATION**

**BS + / -**

### **SYSTEMIC EXAMINATION**

Respiratory system

Perabdomen

Cardiovascular system

Central Nervous System

### **INVESTIGATION**

Hb%

Blood Sugar Level

Chest X-ray

X- ray Abdomen:-

ECG

## **MANAGEMENT**

Redivac drain – yes/no

## **POSTOPERATIVE COURSE**

Recovery - Uneventful / Eventful

Complications - Wound Infection

Wound seroma

Secondary suturing

## MASTER CHART

S.No.	Name	Age	sex	IP NO	PS	I	U	WD	WI	WS	SS	L
1	selvakumari	40	F	17920	tat	tiu	3	Y	n	n	n	9
2	Geetha	45	F	21915	tat	tiu	3	N	n	y	n	17
3	Revathi	42	F	11515	tat	tiu	3	Y	n	n	n	8
4	Muthu	44	F	42407	tat	tiu	3	N	n	y	n	18
5	Muthupetchi	46	F	43600	tat	tiu	3	Y	n	n	n	10
6	Joibunisha	48	F	46161	tat	tiu	3	N	y	y	n	16
7	Panchali	45	F	93009	tat	tiu	3	Y	n	n	n	9
8	Lakshmi	45	f	9132	tat	tiu	3	N	y	y	n	18
9	Renukadevi	46	f	24615	tat	tiu	3	Y	n	n	n	9
10	Davood beevi	41	f	30112	tat	tiu	3	N	y	y	n	19
11	Santhi	48	f	37308	tat	tiu	3	Y	n	n	n	9
12	Sellamani	43	f	43296	tat	tiu	3	N	y	y	n	17
13	Backiam	55	f	71382	lscs	ium	4	Y	n	n	n	10
14	Chandra	50	f	82488	lscs	ium	3	N	y	y	y	20
15	Nirmala	58	f	93378	lscs	ium	4	Y	n	n	n	11
16	Kamalam	53	f	789	lscs	ium	4	N	y	y	y	20
17	Seeniammal	60	f	13624	lscs	ium	3	Y	n	n	n	12
18	Marudayee	56	f	19543	lscs	ium	3	N	y	y	y	23
19	Soundammal	55	f	19632	lscs	ium	4	Y	n	n	n	13
20	Pandiammal	48	f	57536	lscs	ium	4	N	y	y	y	22
21	Ganga	45	f	22189	hyst	ium	3	Y	n	n	n	12
22	Sarabegam	48	f	23623	hyst	ium	3	N	y	y	y	20
23	Geetha	40	f	29169	hyst	ium	3	Y	n	n	n	11
24	Sakkubai	58	f	30588	hyst	ium	4	N	y	y	y	21
25	Manimekalai	56	f	36514	hyst	ium	4	Y	n	n	n	12
26	Leelavathi	57	f	38164	hyst	ium	4	N	y	y	y	22
27	Chinnappan	60	m	29523	du	sum	3	Y	y	n	n	12
28	Rathinavel	68	m	43081	du	sum	3	N	y	y	y	19
29	Meiraj	60	m	4329	iu	lap	5	Y	y	n	n	12
30	Palaniappan	61	m	6324	iu	lap	5	N	y	y	y	22

## KEYS TO MASTER CHART

f – Female

PS – previous surgery

U – ultrasound defect in cm

m – Male

I - previous incision

WD – wound drain

y - yes

WS – wound seroma

WI- wound infection

n - no

SS – secondary suturing

L – length of postoperative hospital stay

tat – trans-abdominal tubectomy

lscs – lower segment caesarean section

hyst – hysterectomy

iu – ileal ulcer perforation

du – duodenal ulcer perforation

tiu – transverse infraumbilical

ium – infra umbilical midline

sum – supra umbilical midline

lap – laparotomy

## Institutional Review Board/Independent Ethics Committee

Capt.Dr.B.Santhakumar,MD (FM).

[deanmdu@gmail.com](mailto:deanmdu@gmail.com)

Dean, Madurai Medical College &amp;

Government Rajaji Hospital, Madurai 625 020 .

Convenor

Sub: Establishment – Madurai Medical College, Madurai-20 –  
Ethics Committee Meeting – Meeting Minutes - for August 2014 –  
Approved list – reg.

The Ethics Committee meeting of the Madurai Medical College, Madurai was held on 05<sup>th</sup> August 2014 at 10.00 Am to 12.00 Noon at Anaesthesia Seminar Hall at Govt. Rajaji Hospital, Madurai . The following members of the Ethics Committee have attended the meeting.

- |  |   |           |
|--|---|-----------|
| 1.Dr.V.Nagarajan,M.D.,D.M(Neuro)   | Professor of Neurology<br>(Retired)             | Chairman  |
| Ph: 0452-2629629   | D.No.72, Vakkil New Street,                     |           |
| Cell No.9843052029   | Simmakkal, Madurai -1                           |           |
| <a href="mailto:nag9999@gmail.com">nag9999@gmail.com</a> .                                     |   |           |
| 2.Dr.Mohan Prasad, MS.M.Ch.  | Professor & H.O.D of Surgical                   | Member    |
| Cell.No.9843050822 (Oncology)  | Oncology (Retired)                              | secretary |
| <a href="mailto:drbkemp@gmail.com">drbkemp@gmail.com</a>                                       | D.No.32, West Avani Moola Street,<br>Madurai.-1 |           |
| 3. Dr.L.Santhanalakshmi, MD (Physiology)   | Vice Principal, Prof. & H.O.D.                  | Member    |
| Cell No.9842593412   | Institute of Physiology                         |           |
| <a href="mailto:dr.l.santhanalakshmi@gmail.com">dr.l.santhanalakshmi@gmail.com</a> .           | Madurai Medical College                         |           |
| 4.Dr.K.Parameswari, MD(Pharmacology)   | Director of Pharmacology                        | Member    |
| Cell No.9994026056   | Madurai Medical College.                        |           |
| <a href="mailto:drparameswari@yahoo.com">drparameswari@yahoo.com</a> .                         |   |           |
| 5.Dr.S.Vadivel Murugan, MD.,<br>(Gen.Medicine)   | Professor & H.O.D of Medicine                   | Member    |
| Cell No.9566543048   | Madurai Medical College                         |           |
| <a href="mailto:svadivelmurugan_2007@rediffmail.com">svadivelmurugan_2007@rediffmail.com</a> . |   |           |
| 6.Dr.A.Sankaramahalingam, MS.,<br>(Gen. Surgery)   | Professor & H.O.D. Surgery                      | Member    |
| Cell.No.9443367312   | Madurai Medical College.                        |           |
| <a href="mailto:chandrahospitalmdu@gmail.com">chandrahospitalmdu@gmail.com</a>                 |   |           |
| 7.Mrs.Mercy Immaculate<br>Rubalatha, M.A., Med.,   | 50/5, Corporation Officer's                     | Member    |
| Cell.No.9367792650   | Quarters, Gandhi Museum Road,                   |           |
| <a href="mailto:lathadevadoss86@gmail.com">lathadevadoss86@gmail.com</a>                       | Thamukam, Madurai-20.                           |           |
| 8.Thiru.Pala.Ramasamy, B.A.,B.L.,  | Advocate,                                       | Member    |
| Cell.No.9842165127   | D.No.72,Palam Station Road,                     |           |
| <a href="mailto:palaramasamy2011@gmail.com">palaramasamy2011@gmail.com</a>                     | Sellur, Madurai-20.                             |           |
| 9.Thiru.P.K.M.Chelliah, B.A.,  | Businessman,                                    | Member    |
| Cell No.9894349599   | 21 Jawahar Street,                              |           |
| <a href="mailto:pkmandco@gmail.com">pkmandco@gmail.com</a>                                     | Gandhi Nagar, Madurai-20.                       |           |

The following Project was approved by the Ethical Committee

Name of P.G.	Course	Name of the Project	Remarks
Dr.P.Mukesh kumar <a href="mailto:iammuki@gmail.com">iammuki@gmail.com</a>	PG in M.S (General Surgery), Government Rajaji Hospital & Madurai Medical College, Madurai	"A prospective study in management of incisional hernia".	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain it Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution or to Government.
2. She/He should inform the institution Ethical Committee, in case of any change of study procedure, site and investigation or guide.
3. She/He should not deviate the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/He should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and if any Extension of time is required He/She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.



Member Secretary  
Ethical Committee



Chairman  
Ethical Committee



19.8.14

DEAN/Convenor  
Madurai Medical College & Govt.  
Rajaji Hospital, Madurai- 20.

To  
The above Applicant  
-thro. Head of the Department concerned



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### **INTRODUCTION**

Incisional hernia is the protrusion of abdominal viscera through the site of previous operation or traumatic wound of the abdominal wall except hernial site.<sup>1</sup>

The incidence of incisional hernia has been atleast 10 per cent. Incidence of incisional hernia is next only to inguinal hernia and may be higher than reported, since most of these are asymptomatic. Abdominal incisions defer from most other incision in that abdominal wall itself is subject to variable pressure from within. Hence physiological incisions should be preferred which produces less anatomical distortions. Among abdominal incisions highest incidences of incisional hernia occurs in the lower abdominal incisions. Through this incision only, most of the gynaeological operations are being done. The posterior rectus sheath is deficient below the umbilicus and pressure in lower abdomen is more than upper abdomen and the stress and strain on the lower abdomen predispose for herniations. There are numerous aetiological factors for the development of incisional hernia but wound infections and increased intra abdominal pressure are the most important causes.

There are numerous methods of repair of abdominal incisional hernias, simple resuturing, Shoelace dam repair<sup>2</sup> Cattell's and

**INTRODUCTION**

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