# COMPARISION OF PROPERITONEAL NON TENSION SUTURED MESH REPAIR VERSUS CONVENTIONAL MESH REPAIR FOR REDUCING POSTOPERATIVE PAIN IN DIRECT INGUINAL HERNIA - A RANDOMISED CONTROL TRIAL.

**Submitted by:**

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## DISSERTATION

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**KLE University, Belgaum, Karnataka.**

**In partial fulfillment of the requirements for the award of the degree of**

## M.S IN GENERAL SURGERY

**Under the Guidance of :**

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***Dr. Ajay Kumar G***

# ABSTRACT

**Introduction**

Many techniques exist for the repair of direct inguinal hernias,each one has its own self limitations.The use of prosthetic meshes for open surgical repair of inguinal hernia has become increasingly popular in western countries as well as in India. Numerous techniques are there for the repair of direct inguinal hernias. The Properitoneal nontension sutured mesh repair is the new technique of placement of mesh, as it provides a tension-free repair with minimal postoperative pain

**Background and Objectives**:

Numerous repairs exist for direct inguinal hernias. These repairs are limited by the shortcomings of their respective technique. Each study has its own self limitations for the reduction of postoperative pain. With the introduction of Properitoneal nontension sutured mesh repair, the postoperative pain has been lessened,proving efficacy in terms of decreased hospital stay, patient comfort and early return to activities. Hence there is need for comparing Properitoneal nontension sutured mesh repair with Conventional mesh repairs for the reduction of postoperative pain.

**Methods:**

A Randomized clinical trial was designed with a sample size of 50 patients, which were divided into 2 groups; Group A (properitoneal non tension sutured mesh repair) & Group B ( conventional mesh repair). This technique performed under spinal anaesthesia, offers the beneficial aspects of contemporary mesh repair while avoiding its limitations. These two groups were analyzed for postoperative pain (visual analogue score) from 2 weeks to 12 weeks.

**Results**:

On analysis, three months follow up pain score is significantly less in the group A patients at 2week and even upto 8weeks, thereafter no patients experienced any pain. In group B the pain is significantly more than Group A and minimal pain persisted until 11weeks. The percentage of people experiencing mild pain and no pain on VAS are more in Group A , where as in group B severe pain and moderate degree of pain on VAS are more in number. Results of the study showed statistically significant values.

Postoperative pain was measured by visual analogue score(VAS). In group A pain score at 2week is 5.7 and from 9week onwards it is 0,where as in group B at 2week is 8.1 and at 11week is 1.625 by Mann Whitney U Test. Analysis showed statistical difference between the two groups. Most significantly 100% of patients in group A had resumed full recreational activities by 8weeks.

**Conclusion:**

The results of the new technique demonstrate that it provides less postoperative pain than has been reported in other nontension mesh repairs.There is apparent advantage in the use of properitoneal nontension sutured mesh repair compared to conventional mesh repair. Short term follow up of the study did not allow any conclusion regarding recurrence rates, thus larger cohorts with longer follow up are needed.

**Key words:** Hernia repair, Properitoneal nontension sutured mesh repair, Lichenstein mesh repair.

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| **DC** | **:** | **Differential count** |
| **ESR** | **:** | **Erythrocyte sedimentation rate** |
| **Hb** | **:** | **Haemoglobin** |
| **HBsAg** | **:** | **Hepatitis-B surface antigen** |
| **HIV** | **:** | **Human immunodeficiency virus** |
| **IP No** | **:** | **Inpatient number** |
| **TC** | **:** | **Total count** |
| **PNSMR** | **:** | **Properitoneal nontension sutured mesh repair** |
| **CMR** | **:** | **Conventional mesh repair** |

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# INTRODUCTION

Many techniques exist for the repair of direct inguinal hernias,each one has its own self limitations.The use of prosthetic meshes for open surgical repair of inguinal hernia has become increasingly popular in western countries as well as in India. Numerous techniques are there for the repair of direct inguinal hernias. The Properitoneal nontension sutured mesh repair is the new technique of placement of mesh, as it provides a tension-free repair with minimal postoperative pain. In addition, several randomized clinical trials have reported minimal postoperative pain with this repair than with conventional mesh techniques. For decades long-term analysis of results of hernia repair concentrated on post operative pain and recurrence rates. More recently however, several studies have focused on aspects of chronic pain and quality of life after hernia repair. This technique differs from the Lichtenstein's in only few steps which has the advantage post-operatively in minimal post-operative pain. Hence the study has been taken as the initiative.

# REVIEW OF LITERATURE

## HISTORY

Since the dawn of surgical history, hernias have been the subject of interest and their treatment has evolved through distinct stages.

"The history of hernia is the history of surgery".

### I. Ancient times:-

The earliest reference to hernia has appeared in "Egyptian Papyrus of Ebers" (Circa 1552 BC).

### II. Greeko Roman Medicine:-

Hippocrate has mentioned about hernia in the "Corpus Hippocraticum". Herophilus, Erasstratus, Aulus Cornclius and Leonardo gave description of hernia operation with hemostasis by ligature of vessels and careful efforts to preserve the testicles. Later Galen of Pergamum, recommended the operation which consists of ligature of sac and cord with amputation of testicle.

### III. The Middle Age (AD476 to 5$^{th}$ century)

Paulus Aegineta, Albucasis and Salerno gave accurate description of the operation for hernia. While William, rejected mutilation of testicle as essential part of the operation for the cure of hernia.

## IV. The Renaissance (15th to mid 17th century)

Ambroise Pare in his book "The Apologic and Treatise" mentioned about treatment of rupture of hernias and described about diverse trusses for control of hernias. Pierre Franco gave the description of a radical operation which included original technique that left unharmed, the spermatic vessels and testis and also a description of an operation for strangulated hernia. Kaspar Stromayer established the distinction between direct and indirect hernias.

## V. Post Renaissance Era

Antonio Scarpa described about sliding hernia. Astely Paston Cooper of Norfolk, described about superior pubic ligament and fascia transversalis, with their role in pathogenesis of hernia.

## VI. Ninteenth and Twentieth century

Edoardo Bassini, revolutionized the treatment of inguinal hernia by introducing the 'Bassini's repair' while Marcy described about transabdominal approach and La Roque about the intrabdominal approach of inguinal hernia repair. George Loeithessen and Chester Mcvay described about the Cooper's ligament repair.

## VII. Contemporary times

Local anesthesia for the repair of hernias was reported by Harry Cushing who used field block anesthesia by cocaine infiltration. Shouldice, Obney and Ryan described about the Canadia experience in the repair of hernia in 1950, which was a layered reconstruction of posterior wall of inguinal canal. Concept of tension free

repair was first introduced by Lichtenstein and colleagues in 1989 which is a prosthetic hernioplasty. Condon described the anterior iliopubic track repair using anterior approach through the inguinal canal.

## ANATOMY OF GROIN[13]

The groin or inguinal region is a transitional area in which the thigh and the abdomen are joined.

### The pelvic skeleton

The pelvic bones include the iliac bones, pubic bones and ischial bones which with sacrum forms a complete circle. These pelvic bones attached to the lumbar vertebral column via sacrum at approximately 60.

### Superficial fascia of anterior abdominal wall

The superficial fascia above umbilicus is single layer and contains fat. Below umbilicus, it divided into

1) Superficial fatty layer (fascia of Camper).

2) Deep membranous layer (fascia of Scarpa) which is continuous below with Colle's fasica and above umbilicus it merges with fatty layer.

### The Fasciae contain -

(a) Variable quantity of fat

(b) Cutaneous nerves

(c) Cutaneous vessels

(d) Superficial lymphatics

**Cutaneous nerves of anterior abdominal wall**

1) Lower six thoracic nerves

2) First lumber nerve (iliohypogastric)

3) Ilioinguinal nerve

**Cutaneous arteries**

1) Anterior cutaneous arteries, branches of superior and inferior epigastric arteries

2) Lateral cutaneous arteries, branches of lower intercostal arteries

3) Superficial inguinal arteries which supply lower abdomen,

    a) Superficial epigastric artery

    b) Superficial external pudendal artery

    c) Superficial circumflex iliac artery

**Cutaneous veins:**

These veins accompany the arteries and the superficial inguinal veins drain into great saphenous vein.

**Lymphatics**

Lymphatics above the umbilicus, drain into the axillary lymph nodes and those below the umbilicus, drain into the superficial inguinal lymph nodes.

**Anterior abdominal wall musculature**

The muscle bundles and fibrous tissues are arranged in layers and each muscle is covered by fascia. The flat lateral abdominal muscles are inserted via a laminated

aponeurotic sheet which further enhances integrity of abdominal wall. These laminae contribute to rectus sheath. Ultimately, it inserts in the midline, thereby forming the linea alba.

**Muscles**

(1) External oblique muscle

(2) Internal oblique muscle

(3) Transverse abdominis

(4) Rectus Abdominis

(5) Cremaster muscle

(6) Pyramidalis muscle

**Ligaments and Fasciae**

**I. Inguinal Ligament -**

Formed by lower border of the external oblique aponeurosis, is thickened and folded backward on itself which extends from anterior superior iliac spine to pubic tubercle. The lateral half is rounded and oblique, medial half is grooved upward and horizontal.

Extensions form: 1) Lacunar ligament

2) Ligament of Cooper

3) Lateral crus of superficial inguinal ring

**II. Fascia Transversalis**

It lines the inner surface of transverses abdominis and separates the anterior abdominal muscles from the peritoneum

Consists of 2 laminae: 1) Posterior Lamina

2) Anterior Lamina

**Rectus Sheath**

This is an aponeurotic sheath covering the rectus abdominis muscle. It has 2 walls, anterior and posterior.

**a) Above the costal margin**

Anterior wall –- External oblique aponeurosis

Posterior wall – Deficient, rectus rest directly on costal cartilage

**b) Between costal margins and the arcuate line**

Anterior wall – Aponeurosis of external oblique

Anterior lamina of the aponeurosis of internal oblique

Posterior wall – Posterior lamina of the aponeurosis of internal oblique

Aponeurosis of transverses muscle

**c) Below the arcuate line (semilunar line of Dogulas)**

Anterior wall – Aponeurosis of all the three flat muscles of abdomen

Posterior wall – Deficient, rectus rests on fascia transversalis

**Contents of rectus health**

| | | | |
|---|---|---|---|
| (A) | Muscles | –- | 1) Rectus abdominis |
| | | | 2) Pyramidalis muscle |
| (B) | Arteries | – | 1) Superior epigastric artery |
| | | | 2) Inferior epigastric artery |
| ( C) | Vein | – | 1) Superior epigastric vein |
| | | | 2) Inferior epigastric vein |
| (D) | Nerves | – | Terminal parts of lower six thoracic nerves. |

## INGUINAL CANAL

This is an oblique passage in the lower part of the anterior abdominal wall situated just above the medial half of inguinal ligament. It is about 4 cm (1.5 inches) long and is directed downwards, forwards and medially which extends from the deep inguinal ring to superficial inguinal ring.

**Deep inguinal ring is** an oval opening in the fascia transversalis situated half an inch (1.5 cms) above the midinguinal point.

**Superficial inguinal ring** is a triangular gap in the external oblique aponeurosis. It is shaped like an obtuse angled triangle. The base of triangle is formed by pubic crest. The two sides of the triangle forms lateral and medial margins of the opening. At and beyond the apex of the triangle the two crura unite by intercrural fibres.

**Boundaries**

**A) Anterior wall – formed by**

In its whole extent by - (1) skin (2) superficial fascia (3) external oblique aponeurosis

In its lateral 1/3 by - fleshy fibers of the internal oblique muscle.

**B) Posterior wall – formed by**

In its whole extent by - (1) The fascia transversalis (2) extra peritoneal tissue (3) The parietal peritoneum.

In its medial 2/3 by - conjoint tendon and reflected part of inguinal ligament

In its lateral 1/3 by - the interfoveolar ligament.

C) **Roof –** It is formed by the arched fibers of the internal oblique and transverus abdominis muscle.

D) **Floor –** It is formed by the grooved upper surface of the inguinal ligament and medial end by the lacunar ligament.

**Structures passing through the canal**

1) The spermatic cord in males or round ligament of uterus in females enters the inguinal canal through deep inguinal ring and passes out through superficial inguinal ring.

2) The ilioinguinal nerve enters the canal through the interval between external and internal oblique muscles and passes through superficial inguinal ring.

**Constituents of spermatic cord**

1) The ductus deferens

2) The testicular arteries, cremasteric arteries and artery of the ductus deferens

3) The pampiniform plexus of veins

4) The genital branch of genitofemoral nerve

5) The plexuses of sympathetic nerves around artery to Ductus deferens

6) Remnants of processus vaginalis

**Coverings of spermatic cord**

From within outwards –

1) Internal spermatic fascia derived from fascia transversalis and it covers the cord in its whole extent.

2) The cremasteric fascia consists of the muscle loops of cremasteric muscle and the intervening areolar tissue. It is made up of internal oblique and transverses abdominis muscles and covers the cord below the level of these muscles.

3) The external spermatic fascia is derived from external oblique aponeurosis and covers the cord below the superficial inguinal ring.

**Hesselbach's triangle -** It is a weak spot in the anterior abdominal wall through which the direct inguinal hernia protrudes. It is bounded

1) Medially by outer border of rectus abdominis muscle

2) Laterally by inferior epigastric vessels

3) Inferiorly by medial part of inguinal ligament.

The floor of this triangle is formed by fascia transversalis. This triangle is bisected by median umbilical fold which is formed by obliterated umbilical artery.

**Mechanisms which prevent hernia in inguinal region**[13]

The defensive mechanisms which prevent hernia to occur are -

1) The obliquity of the inguinal canal - When there is rise in intrabdominal pressure, the posterior wall is apposed against the anterior wall and thus prevents coming out of the abdominal content, through inguinal canal.

2) The shutter mechanism - The arched fibers of the internal oblique and the transverse abdominis will bring down these muscles towards the floor, when they contract during the rise of intra abdominal pressure.

3) The ball valve action of cremaster muscle - Cremaster pulls up the spermatic cord into the canal, which plugs it during a rise in intra abdominal pressure.

4) In floor of deep inguinal ring, there are strong fibers of internal oblique muscle; these prevent entry of the any abdominal contents through deep inguinal ring.

5) The strong conjoint tendon in front of Hesselbach's triangle prevents direct inguinal hernia.

## INGUINAL HERNIA

An Inguinal hernia is the protrusion of part of the contents of the abdomen through the inguinal region of the abdominal wall.

### Aetiology[13]

Mainly 2 factors play in the causation of a hernia

**(I) Weakness of the abdominal musculature –**

This can be (a) Congenital

(b) Acquired.

(c)Primary fascial pathology

**(a) Congenital weakness**

1) Persistence of the processes vaginalis causes indirect complete inguinal hernia.
2) Patent canal of Nuck in the female causes indirect inguinal hernia.

**(b) Acquired weakness**

1) Excessive fat in the abdomen causes weakness of the abdominal musculature
2) Surgical incisions may lead to division of nerve fibers and thus causes muscle weakness.
3) Muscle weakness may follow repeated pregnancy.

**(c) Primary fascial pathology**

Abnormal collagen metabolism was an early biological metabolism in patients with inguinal hernias. Immature collagen defects were present in the skin biopsies remote from hernia site,supporting a genetic basis for hernia formation. Acquired collagen defects were ascribed to cigarette smoking or nutritional deficiencies.

**(II) Increased abdominal pressure[31] – Examples**

1) Whooping cough in children
2) Chronic cough in bronchitis, Tuberculosis etc.
3) Bladder neck obstruction or urethral stricture
4) Benign prostatic hyperplasia
5) Constipation
6) Repeated pregnancy.

**Composition of hernia**

Hernia consists of 3 parts – (1) Sac

(2) Coverings

(3) Contents

(1) The sac – is a diverticulum of the peritoneum consisting of

i) The Mouth is the opening of the sac through which content enter the sac.

ii) The Neck is the most constricted part of the sac and strangulation of bowel is likely to occur at a narrow neck.

iii) The Body is the main portion of the sac.

iv) The Fundus is the most redundant part of the sac.

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

(3) Contents – These can be

- Omentum – omentocele
- Intestine – enterocele
- A portion of circumference of intestine – Richter's hernia
- A portion of bladder – sliding inguinal hernia
- A Meckel's diverticulum – Littre's hernia

**Classification (NYHUS)[11]**

**Type I –** Indirect hernia with an internal ring of normal size, configuration, and structure. The hernial sac is contained within the inguinal canal and the floor is intact.

**Type II –** Indirect hernias characterized as having an enlarged and distorted internal ring, without disruption or encroachment into the direct floor of the inguinal canal. The sac can occupy the entire inguinal canal but does not extend into scrotum.

**Type III**

III A – contains all direct hernias wherein "the protrusion does not herniate through the internal ring".

III B – Large indirect hernias where the defect has expanded medially and encroaches on posterior inguinal wall or direct floor. The sac is inguino-scrotal in size.

III C – Hernias consist of femoral hernia that emerges through the femoral ring.

**Type IV –** Recurrent hernias

IV A – Direct

IV B – Indirect

VI C – Femoral

VI D- Combination of A , B and C.

**Other Classifications**

**A Bendavid / TSD**

Type (T) – Anterolateral (indirect)

Antero medial (direct)

Posteromedial (femoral)

Posterolateral (Perivascular)

**Stage (S) -** Stage I Sac in canal

Stage II Sac outside external ring

Stage III Sac in scrotum

Dimension (D) – orifices maximum in centimeter

**B Gilbert classification**

**Indirect**

Small I

Medium II

Large III

**Direct**

Entire floor IV

Diverticular V

**Combined**

Indirect and direct VI

Femoral VII

**C Halverson and MCVAY classification**

Small indirect

Medium indirect

Large indirect & direct

Femoral

Combined – any mixture of above

**Clinical features**

**(A) Symptoms**

1) Many hernias present as an asymptomatic swelling in the groin.

2) Pain – The patient complains of a dragging or aching type of pain in the groin. This is often noticed when there is a tendency for a hernia to develop, so the pain appears long before lump is noticed. When a hernia becomes very painful and tender, it is probably strangulated.

3) Systemic symptoms – If the hernia is obstructing the lumen of the bowel (incarcerated hernia), the cardinal symptoms of intestinal obstruction will appear, colicky abdominal pain, vomiting, abdominal distension and absolute constipation.

4) Other Complaints – the causes of hernia may be present like, whooping cough or chronic bronchitis, dysuria due to BPH or urethral stricture.

5) Past history – History of Appendicectomy, previous hernia repair (recurrent hernia etc)

**Local examination –** The patient should be first examined in the standing position and then in the supine position.

1) **Position and Extent –** When the hernia is confined to the groin, it should be differentiated from femoral hernia. An inguinal hernia is positioned above the inguinal ligament and lateral to the pubic tubercle, whereas femoral hernia lies below the inguinal ligament and lateral to pubic tubercle.

2) **To get above the swelling –** This examination differentiates a scrotal swelling from an inguino-scrotal swelling. In case of inguinal hernia one cannot get above the swelling, whereas in case of pure scrotal swelling one can get above the swelling.

3) **Consistency –** If the inguinal hernia contains omentum the swelling feels doughy and granular. If it contains intestine it feels elastic. A strangulated hernia feels tense and tender.

4) **Impulse on coughing –** This is a classical sign of an uncomplicated hernia.

5) **Reducibility –** This is another classical sign of an uncomplicated hernia.

6) **Invagination test –** After reduction of hernia one can perform this test. If the palpable impulse is felt on the pulp of the finger then it is a direct hernia and if impulse is felt on the tip it is an indirect hernia.

7) **Ring occlusion test –** This is done after occlusion of the deep inguinal ring ,the direct hernia will show a bulge medial to occluding finger but an indirect hernia will show no bulge on coughing.

**Investigations**

1) Routine

2) Ultrasonography – Inguinal hernias are found by placing the transducer over the inguinal ligament. The reference structures are the rectus sheath medially and internal oblique and transverse abdominis muscle laterally. Epigastric vessels are identified by color – coded duplex scan. It helps in identifying the defect ( size and location) and also the nature of the contents.

**Treatment of inguinal hernia**

**(A) Conservative treatment –** Operation is undoubtedly the treatment of choice. Treatment is divided into 2 groups.

1) **Watchful waiting[20] –** in cases of small direct hernias watching waiting can be done.

2) **TRUSS** – A truss is used to prevent hernia to come out of superficial inguinal ring.

**The Requirements are –**

1) The hernia should be easily reducible

2) The patient should be reasonably intelligent

3) The patients should be physically capable of putting a truss.

**Indications**[13]

1) Those who refuses operation and those who are not fit for surgery

2) In old patient suffering from diseases like chronic bronchitis, enlarged prostate and constipation where surgery even if performed runs the risk of recurrence.

**Contraindication**

1) When the hernia is irreducible

2) When the patient does strenuous job or suffer from chronic bronchitis

3) When the hernia is associated with an undesended testis

4) If there is an associated huge hydrocele

5) If the patient is not intelligent enough to position the truss properly and to clean the hernial area.

**Mode of action**

1) A truss acts by pressing the anterior wall against posterior wall. It also presses on deep inguinal ring and prevents hernia from coming out.

2) Adhesions gradually develop in the inguinal canal so that hernia may not find access to come out.

**Dangers of using Truss –** As a rule use of truss should be condemned

1) It causes pressure atrophy of the muscles of inguinal region and considerably reduces the chance of successful operation at a later date.

2) Improper use can lead to obstruction or even strangulation of the hernia.

3) If it is not used after complete reduction of hernia it may induce damage to the hernial contents e.g. bowel.

4) Improper cleanliness of the inguinal region will produce an unhealthy skin which may lead to difficulty in wound healing if operation is undertaken later on.

5) Adhesions may develop between the hernial sac and the inguinal canal which is also not good for subsequent operation if required.

6) Chance of strangulation are there.

**Method of use**

1) A truss should be used in lying down position after reducing the hernia completely

2) Truss should be used throughout the day.

3) Operative treatment – 3 types of operations are performed

(a) Herniotomy

(b) Herniorrhaphy

(c) Hernioplasty

a) **Herniotomy –** In this operation the neck of sac is transfixed and ligated, then the hernial sac is excised. No repair of inguinal canal is performed. It is indicated.

(a) In infants and children in whom there is preformed sac

(b) In case of young adults with very good inguinal musculature

b) **Herniorrhaphy –** It consists of herniotomy and repair of the posterior wall of inguinal canal by opposing conjoint tendon to inguinal ligament. The suture materials which are used for such repair are usually non absorbable material example- prolene or silk.

**Indications**

1) In all cases of indirect hernia except in children below 18 years

2) In adult patients whose muscle tone is quite good.

**Types**

**(1) The modified Bassini's repair**

The main aim is to strengthen the posterior wall of the inguinal canal by stitching ( 3 to 5 interrupted sutures) the lower margin of the muscles (internal oblique and tranversus)and the conjoint tendon to the inner margin of the inguinal ligament behind the cord. and the most medial suture should be passed through periosteum of pubic tubercle.

**The Bassini variants**

There were a number of modifications made to improve the results of the procedure, most of which have been minor.

**(2) The Shouldice repair –**

In this technique the tranversalis fasciais incised from the deep inguinal ring to medially as far as possible near pubic tubercle. The deep inferior epigastric vessels are safe guarded and the fascia is carefully separated from extraperitoneal fat. The fascia is now sutured by double breasting method. The repair is performed using monofilament continuous suture of polypropylene or stainless steel.

(3) **The Marcy repair**

**(4)Halsted operation with subcutaneous transplantation of cord (Halsted I)**

**(5) The Ferguson operation**

**(6) The Andrews operation**

**(7) Halsted II (Ferguson – Andrews operation)**

**(8) Nylon darn inguinal hernia repair**

## HERNIOPLASY

Earlier in the 1960, techniques using biocompatible meshes were introduced. Later in the1980's and 1990's amazing spread of prosthetic methodologies took place and in 1984 Lichtenstein introduced tension free hernioplasty.

It is herniotomy and reinforced repair of post wall of the inguinal canal by filling the gap between the conjoined tendon and inguinal ligament by either autogenous material or heterogeneous material.

**Indications of hernioplasty-**

(1) Cases of indirect hernia – in patients with poor muscle tone

(2) All cases of direct hernias

(3) All cases of recurrent hernias

(4) Patient who do strenuous jobs or suffering from chronic bronchitis, enlarged prostate etc

### (1) LICHTENSTEIN TENSION – FREE HERNIOPLASTY[4]

A 5cm skin incision which starts from the pubic tubercle and extends laterally within Langer's line is made. External oblique aponeurosis is opened and its lower leaf freed from spermatic cord and upper leaf from underlying internal oblique muscle. The cord with its cremasteric covering is separated from the floor of inguinal canal and pubic bone.[18] Cremasteric sheath is incised longitudinally and indirect hernial sac is freed from the cord to a point beyond the neck of sac and inverted into the abdomen. In complete nonsliding scrotal hernia, the sac is transected at the midpoint of the canal leaving the distal section in place and anterior wall of distal sac

is incised to prevent postoperative hydrocele. In case of direct hernias, the large sacs are inverted with absorbable suture.A thorough exploration of groin is necessary to rule out co- existing femoral hernia.

A sheet of 6 x 11 cm of mesh is used. The medial end of the mesh is cut to the shape of the medial corner of inguinal canal with the cord retracted upwards, the rounded corner is sutured with nonabsorble monofilamented suture material to the anterior rectus sheath above the public bone and overlapping the rectus sheath by 1 to 1.5 cm. This is a crucial step in the repair, because failure to cover this bone with the mesh can result in recurrence. This suture is continued to attach the lower edge of the mesh to the inguinal ligament up to a point just lateral to internal ring. If there is a concurrent femoral hernia, the mesh is also sutured to Cooper's ligament 1 to 2 cm below its suture line with the inguinal ligament to close the femoral ring. A slit is made at the lateral end of the mesh, creating two tails, a wide (2/3) one above and a narrower (1/3) below. The upper wide tail is grasped with hemostat and passed underneath the spermatic cord, this positions the cord between two tails of the mesh. The wider upper tail is crossed and placed over the narrower one and held with hemostat and sutured to the inguinal ligament lateral to the deep ring. The upper edge of the patch is sutured in place with two interrupted abosorbable suture, one to rectus sheath and other to the internal oblique aponurosis just medial to the internal ring.Upward retraction of upper leaf of external oblique during this phase of repair is important because it results in the appropriate amount of laxity in giving a dome like configuration for the patch when the retraction is released. This laxity assures a true tension free repair.

Using a single nonabsorbable monofilament suture the lower edges of each of the two tails are fixed to inguinal ligament just lateral to completion knot of the lower running suture. This creates new internal ring made of mesh and maintains normal integrity of internal ring. The excess mesh on lateral side is trimmed, leaving at least, 5cm beyond the internal ring. This is tucked underneath the external oblique aponeurosis which is then closed over the cord with an absorbable suture.

**Advantages**

1) It is easier to perform, teach and learn

2) Postoperative pain is less compared to other inguinal hernia repairs

3) Return to work after tension free hernioplasty is earlier between 2 to 14 days.

**Complication**

Infection, hematoma and seroma occur in approxmately 1% of cases.

**Technical consideration**

Using a wide piece of mesh to overlap tissue beyond the boundary of Hasselbach's triangle for 3 to 4 cm is important in order to reduce the chance of recurrence. After incorporation is complete, this overlap results in uniform distribution of intrabdominal pressure over the much wide surface of the overlapped area. It compensates for future shrinkage of mesh.

Placement of mesh over inguinal floor and behind the external oblique aponeurosis uses the intrabdominal pressure in favour of repair. Contraction of the external oblique keeps the mesh tightly in place by acting as an external support when intraabdominal pressure rises with straining.

## 2) Plug Repair Of Inguinal Hernia

Indication – Recurrent inguinal hernias and femoral hernias are primary indication for a mesh umbrella.

Under local anesthesia a small incision is made above the hernial orifice With the patient actively straining to demonstrate the hernia the external aponeurosis is exposed only in the region of the location where hernia can be seen. Spermatic cord is dissected only to the extent that is necessary for detaching the hernial sac. Hernial sac is pushed back through the hernial orifice into the preperitional tissue.The plug is then prepared by coiling one or two polypropylene strips with a dimension of 20x 2cm. It must fit into the hernial orifice so tightly that it cannot push it out even before the suture is fixed. The cylinder is fixed in hernial annulus by six prolene sutures placed above cylinder, the external aponeurosis, the subcutaneous tissue and the skin is closed in a conventional manner.

## 3) Tension – free hernioplasty using a bilayer prosthesis[9]

The bi layer polypropylene device is known as prolene hernia system (PHS) and is constructed in a three in one model. Its underlay component is designed to protect the canal's posterior wall. Inferiorly it reaches beyond Cooper's ligament to protect the femoral triangle and superiorly it reaches well above the transverse arch, medially it reaches behind the pubic ramus and laterally it reaches to well beyond the internal ring. It is flat and pliable, and it covers and protects the entire myopectineal orifice and should be placed deep to deep epigastric vessels. Its 2cm diameter connector will sit within the defect or internal ring. The onlay component of the device covers and protects the entire posterior wall. Laterally, it is positioned between

the internal and external oblique muscles, and medially, it extends over the transverse arch and the pubic bone. It extends along the shelving edge of the inguinal ligament, protecting the entire Hasselbach's triangle .The onlay patch makes it wide enough and long enough to cover the full width and breadth of the vulnerable posterior wall.

**4) Preperitoneal hernia repair**

**Indication –** repair of recurrent, incarcerated, strangulation with obstructed hernias, femoral hernias and high risk patients.

It is the most anterior approach of hernial repair. After opening the inguinal canal, an incision is made to enlarge the transversalis fascia defect both laterally and medially. In case of incarceration and strangulation the peritoneum is opened and the sac is reduced from within. Peritoneum is closed after the sac is reduced. The sac is then amputated and distal end left open. Access to peritoneal cavity and its content is excellent with this approach. In case of direct hernia, nonabsorbable, running or interrupted suture is done and in case of indirect hernia, the defect in the internal ring is repaired. Then transversalis arch to iliopubic tract is repaired with or without mesh reinforcement.

**Advantages-**

1) It provides exposure of the entire groin area, thus visualization of all areas of inguinal herniation as well as the confounding structures including the element of sliding hernias are possible.

2) This method minimizes potential for injury to bowel and bladder, and contents of hernial sac.

**Materials used in hernioplasty**[30]

(a) Autogenous materials –these are patients own tissue. The materials used are:

1) Strip of fascia lata from the lateral side of the thigh.

2) A strip of external oblique aponeurosis

3) A flap of anterior rectus sheath which is turned down to cover inguinal canal

4) Skin flap may be used in two ways, an elliptical portion of skin is tensely sutured to conjoined tendon and inguinal ligament to cover posterior wall (dermoplasty) or the skin is made into a ribbon (skin ribbon) which is now used as strip.

(b) Heteroenous material - Prolene or a stainless steel wire has been used for darning. Prolene mesh or stainless steel mesh has also been used.

## COMPLICATIONS OF INGUINAL HERNIA REPAIR

### (I) Wound infection in hernia repair

Bacterias commonly involved are – Staphylococcus aureus

Staphylococcus Epidermidis

Group A streptococcus

E-coli

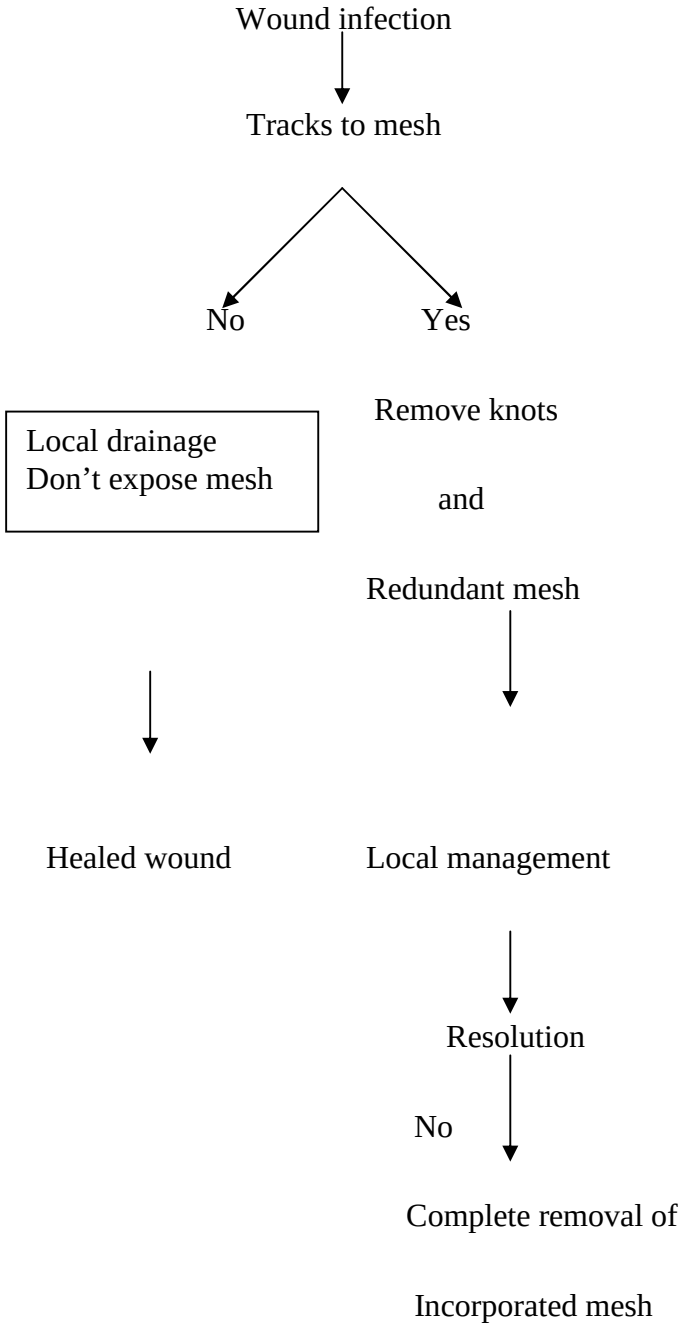
**Clinical presentation–** Fever, pain and signs of inflammation around infected area.

**Treatment –**

1) If a localized area of infection- drainage of pus

2) If extensive area of infection- requires opening of wound / debridement with antibiotics depending on culture sensitivity

3) If case of infected mesh[23]-



**(II) Cord and testicular complications**

1) Hydrocele

2) Hematocele

3) Complications involving vas deference

(a) Dysejaculation syndrome

(b) Transsection of vas

4) Nerve injuries - Commonly genitofemoral and ilioinguinal nerve involved.

5) Damage to blood vessels of testicles

6) Ischemic orchitis and testicular atrophy

7) Testicular pain

8) Infertility

**(III) Chronic pain after inguinal herniorrhaphy - classified as**

(a) Nociceptive

1) Somatic

2) Visceral dysejaculation

(b) Neuropathic

1) Neuroma pain

2) Projected pain

## LAPAROSCOPIC INGUINAL HERNIA REPAIR

The use of laparoscopic or minimal access surgery has become the trend of the day and it has added an exciting and highly controversial dimension to hernial repair.

The first report of laparoscopic hernia repair was in 1982, when Ger et al used a Michel staple applied with a kocher clamp to close the peritoneal opening of a hernia sac under laparoscopic guidance. In 1989, filling of an indirect hernia defect with a plug of polypropylene mesh followed by laparoscopic suture closure of the internal ring was tried. In 1990 closing of an indirect hernia with extra corporeally tied sutures and closure by placing a 4x5 cm dural patch over the area was reported.[25]

Two techniques are used.

1. TAPP – Transabdominal preperitoneal repair
2. TEPP– Totally extraperitoneal approach.

The main hernial repair technique is same in both these methods, the difference lies in the manner in which access to the preperitoneal space is achieved. In TAPP intra peritoneal approach is made and the peritoneal flap over the posterior inguinal area is incised to reach the preperitoneal space. In TEPP the preperiotoneal space is reached without entering the peritoneal cavity.

**Advantages-**

1) Reduces post operative pain and resultant disability
2) Entire myopectineal orifice can be inspected bilaterally allowing for repair of any unexpected contralateral hernia.
3) For patients with a previous anterior herniorraphy laparoscopic repair avoids the previous operative site in patient with recurrent hernia.

**PROPRITONEAL NONTENSION SUTURED MESH REPAIR[1]:**

A standard 4-6 cm transverse skin incision is centered over the internal ring.The skin, fat, and scarpa's fascia are opened down to the aponeurosis of external oblique musvle. The external ring identified. The external oblique aponeurosis is opened,and the inguinal canal opened.. The spermatic cord and its coverings are mobilized and retracted. The superior leaf of the aponeurosis of external oblique is mobised off the aponeurosis of the internal oblique muscle. The iliohypogastric, ilioinguinal, and genital branches of the genitofemoral nerves should be protected when possible. The transversalis fascia is incised to expose the underlying fat. The inferior epigastric vessels are identified. The superior leaf(conjoint tendon) is retracted caudally with a small snap to allow for wide dissection between it and properitoneal fat. The inferior leaf is similarly freed of underlying fat beyond the free edge of inguinal ligament to expose superior pubic rami. Lateral to inferior epigastric vessels, the peritoneum is mobilized from cord structures and the internal ring. After adequate creation of the properitoneal pocket a small guaze piece is placed in this space to prevent prolapsed of fat. A standard sheet of polypropylene mesh is custom fashioned inti an oval approximately 5cm*10cm in dimension and is brought in proximity of the incision. The conjoint tendon is increased with two small snaps and 3-0 polypropylene stay sutures are placed to secure the superior edge of mesh deep to under surface of conjoint tendon. The guaze piece is removed and the mesh is placed over fat resting inferiorly over superior pubic rami,medially over pubic tubercle and laterally under the internal ring. A continuous 0-prolene suture is used to fix the mesh inferiorly to shelving edge of inguinal ligament. A locking stich is placed adjacent to spermatic cord and a single stich is placed in mesh alone to prevent strangution of spermatic cord. Running the suture along the free edge of conjoint tendon superiorlr completes

the repair. One or two centimeters of mesh is kept exposed to avoid undue tension between inguinal ligament and conjoint tendon.

## BIOMATERIALS[30]

### History of surgical meshes

More than 160 years ago Belams used the air bladders of fish to close the gap of an inguinal hernia. He intended to provoke “an adhesive inflammation” and applied this technique on 30 dogs and then in three patients with success. In 1886, Macewan used gathered hernial sac to seal the internal hernial ring, a year later Trendelenburg proposed the implantation of a 4 x 4 $cm^2$ strip of periost.

Artificial material was introduced in 1889 by Witzel who used a mesh of silver wire for abdominal wall hernias. Busse in 1901 used meshes made of gold wire. In 1931 Fiescher proposed the implantation of rubber sponges. In 1949 Preston took meshes of metallic wire to treat hernial patients.

The triumphant progress of meshes had its beginning after World War II. With development of synthetic polymer for medical purposes.

### Principles of mesh repair

The mesh induces an inflammatory foreign body reaction with a consecutive intense fibrosis, resulting in a compound of nonabsorable mesh filaments as a

mechanical – sealing mechanism and embedding collagen rich scar tissue. Both components form a mechanical stable artificial abdominal wall.

**Mesh materials**

Meshes used for hernia repair are-

(I) Nonabsorbable

(a) Polypropylene

(b) Polytetrafluroethylene

(c) Polyvinyl

(d) Polyamide

(e) Polyethylene terephtalate

**(II) Absorbable**

(a) Polyglactin 910

(b) Polyglycolic acid

**(a) Polypropylene(PP) :**

PP ( -CH2 – CH (CH3) - ) n) is a thermoplast based on propane with a molecular wt of 100,000.It is supposed to resist physical decay even after years of being implanted PP meshes shows a considerable shrinkage of about 20% in length and 40% of original area.

**Disadvantages**

1) High bending stiffness of the monofilaments, being susceptible to increase even during incorporation

2) Direct contact with intestine, tend to form intense adhesions and later fistulas.[30,31]

3) Intense fibrosis entirely embedding the mesh into scar plate is frequently followed by a restriction of abdominal wall mobility.

4) Formation of fibrinous seroma.

**Polyethylene Terephthalate(PE) :**

PE is a macromolecular compound made by polycondensation of polybasic carbonic acids usually of ethylene glycol and tetrephalic acid.

**Disadvantages**

1) PE undergoes obligate degradation with an entire loss of mechanical stability.

2) Durable strength is less than PP.

3) Complications like infection, recurrence, fistula formation are more with Pes

**Polytetrafluroethylene (PTFE)**

It is made up of a hydrophobic PTFE. They have comparatively small pores, with a size of 1 to 6 um. The PTFE material is mainly encapsulated by fibrous tissue and not embedded into a scar plate. This material shows an increased rate of eventration, so for a sufficient mechanical strength it requires a tight and durable fixation of the mesh in the surrounding tissue.

**Absorbable meshes**

In principle all absorbable materials whether synthetic or natural, cannot provide a sufficient strength of repair and is followed by a high rate of recurrence. These materials have a mean time of 2 to 3 weeks to halve their mechanical strength and 6 to 8 weeks for complete absorption. These meshes are preferred for temporary wounds or peritonitis. The temporary implantation as an inlay permits daily revision and reduces the intrabadominal pressure, promoting the blood supply to bowel, kidney etc.These also used to cover the nonabsorable meshes to prevent direct contact with the intestine until the peritonalization is finished.

**Influence of the mesh weight**

Connective tissue formation are closely related to amount of material implanted, type of filament (multi/ monofilament) and proportion of pores that define the surface area with the recipient tissues. Larger amount of the material with huge surface induce a strong and active inflammatory tissue reaction, resulting in a mesh completely embedded in a scar plate with a domination of neutrophils, whereas the reduction of the material and diminishing of the plane area support chronic macrophage controlled tissue response, thus low weight meshes with large pores permits the formation of fibrous tissue just around the mesh filament with mainly fat tissue filling up the pores, preserving most of its flexibility..

**Mesh related tissue reaction**

1) Foreign body reaction with typical foreign body granuloma, including epitheloid cells and giant cells.

2) Persistent acute inflammation with varying amount of CD 15 positive neutrophils and focal fibrinoid necrosis.

3) Perifilamentous fibrosis with extensive amount of deposited collagen fibers. In periphery connective tissue with numerous collagen fibers form a thick capsule in which the whole mesh is integrated and complete penetration of connective tissue into the pores. As result, mesh and the newly formed connective tissue around the mesh forms a complex unit.

**Tissue response of the host**

The tissue response mainly determines the biocompatibility and suitability of the mesh. The type of material, the amount, the surface area and the mesh structure all affect the extent of inflammation and the level of the persisting foreign body reaction. The histological picture of implant bed is different for different material which are decisive for the estimation of inertness and biocompatibility of surgical meshes. Following are some common histological changes shown by all type of meshes.

1) A persisting inflammation over the year after implantation.

2) Continuous cellular stress response to the presence of polymer fibers characterized by the induction of heat shock.

3) Consistent tissue damage with features of apoptosis, DNA strand breaks and necrosis.

4) Persistent and compensating tissue repair indicated by proliferating cells in the interphase.

# METHODOLOGY

**Patients**

This is an Randomised control study done in our hospital over period of one year between Jan 2007 to Dec 2007.

All the patients (50patients) scheduled for Direct inguinal hernia repair using the Properitoneal nontension sutured mesh repair and conventional mesh repair technique and who met the inclusion criteria were considered for the study.

**Inclusion criteria:**

1. All patients requiring mesh repair with direct inguinal hernia repair
2. Unilateral or bilateral inguinal hernia

**Exclusion criteria:**

1. Immunocomprimised induviduals
2. Patients with tuberculosis
3. Patients with postop cough & wound infection (redness & purulent discharge)
4. Patients with pantaloon hernia
5. Patients with recurrent hernia
6. Patients with complicated hernia
7. Patients immunocompromised status

Randomization was done by IP Numbers into 2 groups, odd IP No as group A (Properitoneal nontension sutured mesh repair ) and even IP No as group B (conventional mesh repair)

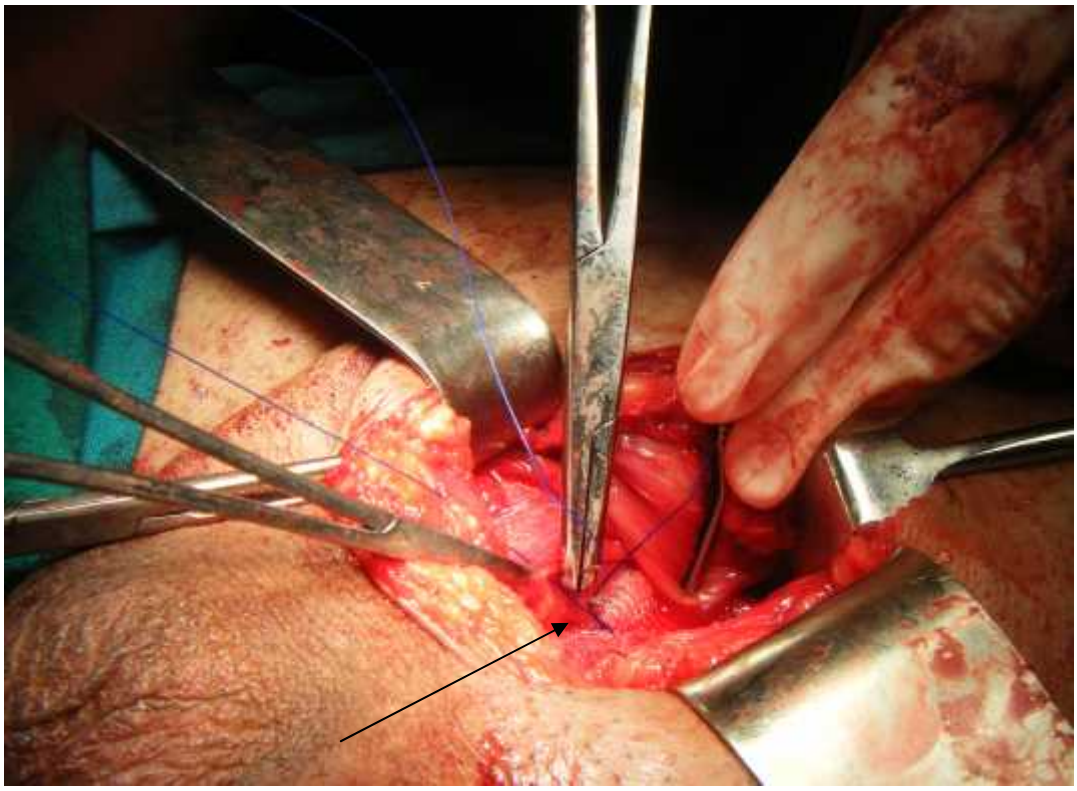
Group A patients underwent Properitoneal nontension sutured mesh repair using standard polypropylene mesh (5*10 cm prolene mesh) and group B patients underwent conventional mesh repair (Lichenstein mesh repair).

**Method of study**

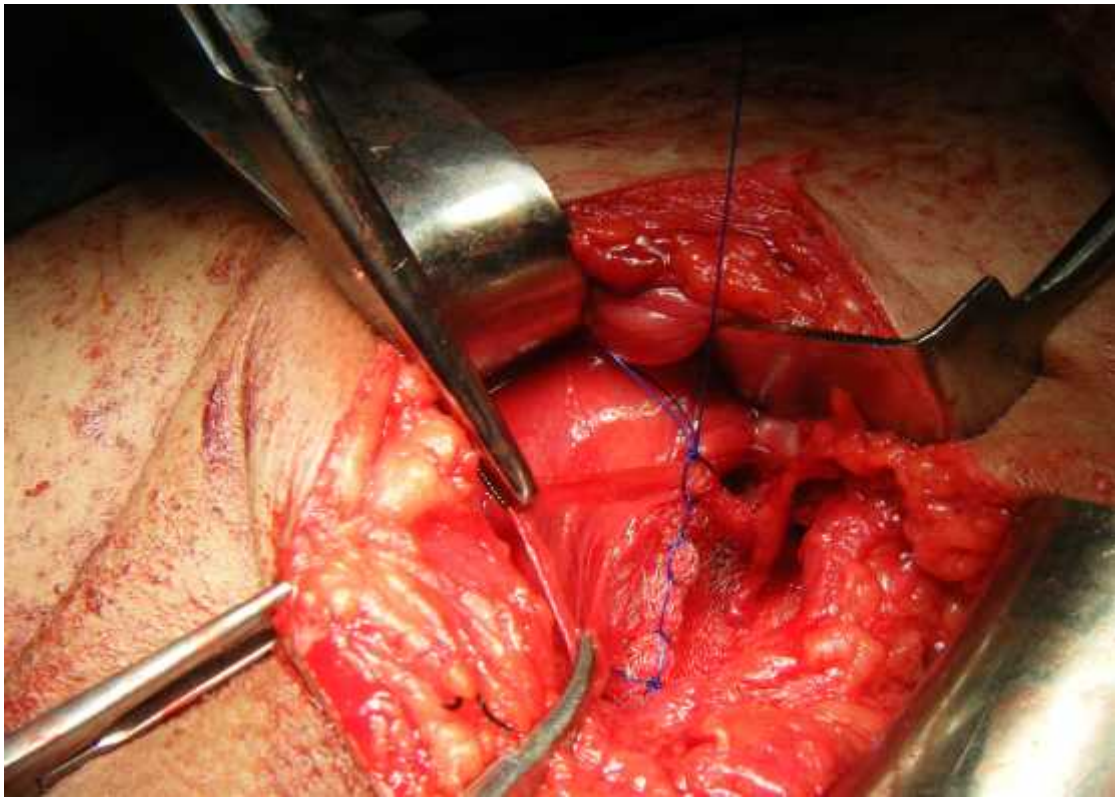
**The criteria for the study is described below:**

**Groin pain –** This was measured on a visual analogue scale ranging from 0 (no pain) to 10 (unbearable /worst pain) from 2wks to 12wks post operatively. Each reading was taken at rest and exercise (repeated flexion of hip and cycling movements)

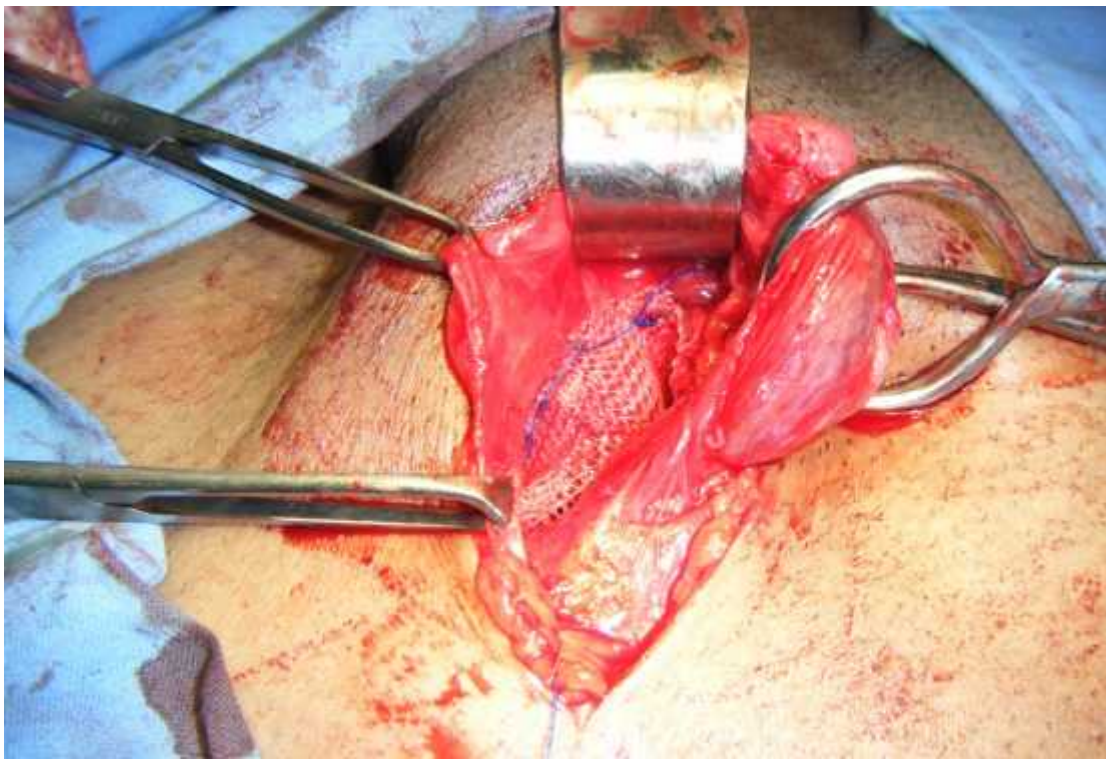
# PHOTOGRAPHS

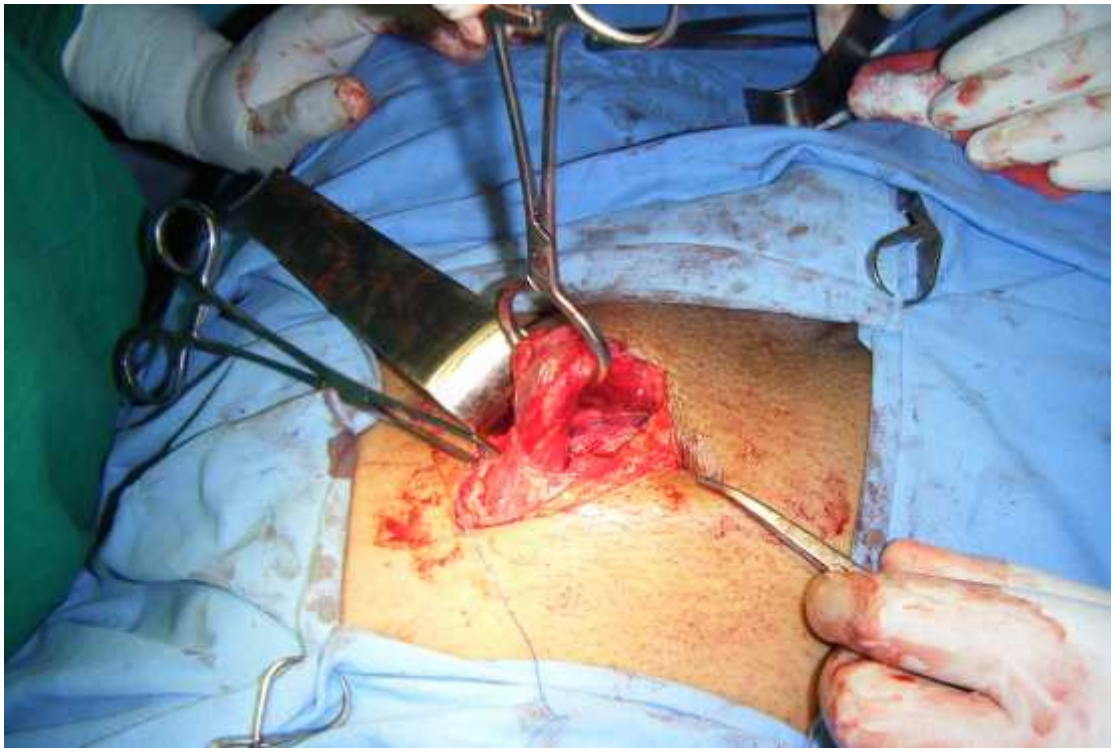


***MEDIALLY FIRST BITE TO PUBIC TUBERCLE***



***RUNNING SUTURES INFERIORLY TO REFLECTED PART OF INGUINAL LIGAMENT***



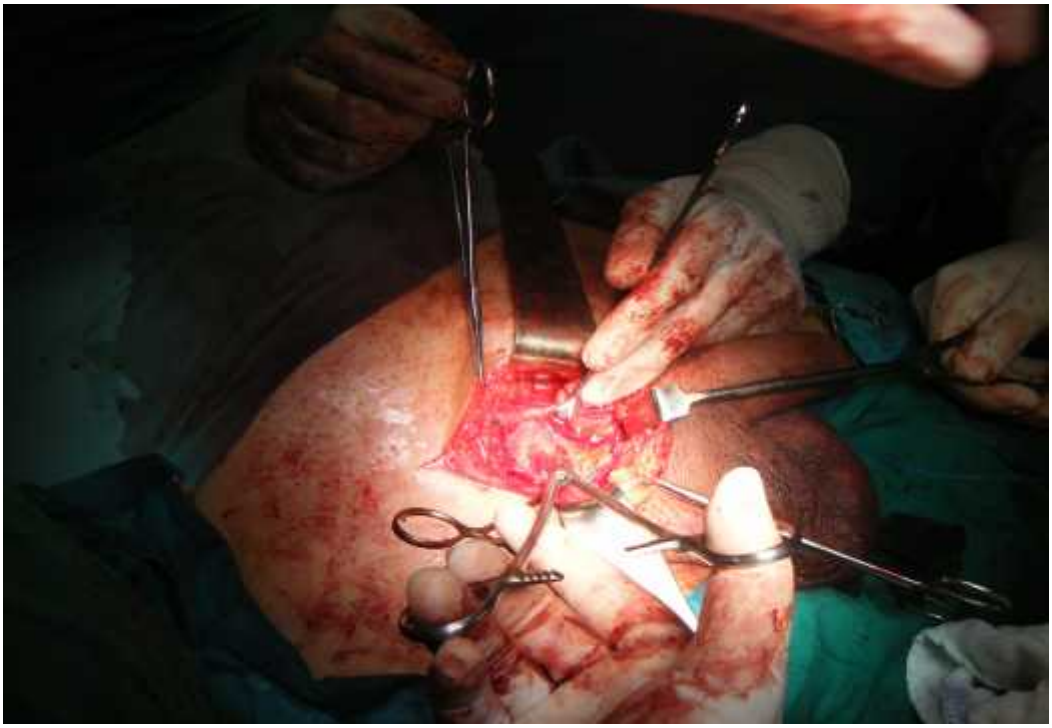


***MESH ENDING MEDIALLY TO DEEP INGUINAL RING***

***T***

***INTERMITTENT SUTURES SUPERIORLY TO CONJOINT***

***TENDON***



***PLACING OF MESH IN PROPERITONEAL SPACE***

# DISCUSSION

The current methods of repair of direct inguinal hernias have the disadvantage of inguinodynia[2]. Number of causes for inguinodynia put forward are:

- Tissue handling,
- Placement of mesh at deep inguinal ring,
- Sutures for fixing the mesh

In the present conventional mesh repair, the postoperative pain is attributed to entrapment of ilioinguinal nerve, because of the placement of mesh lateral to deep inguinal ring. The placement of mesh in our technique ends medial to deep inguinal ring, so that that the ilioinguinal nerve is not entrapped causing less postoperative pain[1].

The use of mesh has become well established in hernia surgery. The stability of the mesh must match the physiological forces that are exerted on the abdominal wall[3].

The ideal mesh is selected on certain important characteristics like:

- Minimal foreign body response
- Tensile strength
- Pore size
- Biocompatibility
- No degradation

- Tissue integration
- No adhesion / fistula formation

The aim of the present randomized trial was to determine the minimal postoperative pain using properitoneal nontension sutured mesh repair compared to conventional mesh repairs in the repair of direct inguinal hernias.

The groin pain is assessed by Visual Analogue Scale at rest and following exercise (regular flexion of the hip joint), showed that the pain is less following properitoneal nontension sutured mesh repair compared to conventional mesh repairs. No patients reported severe chronic pain during follow up[4].

All the patients presented with groin swelling in both groups. In our study all the patients are male in group A, but in group B one female. The mean age and standard deviation in group A and group B is 52.5±15.26 and 45.4±16.21 respectively. In group A, pain score at 2week is 5.7 and from 9week onwards it is 0,where as in group B at 2week it is 8.1 and at 11week it is 0.3 by Mann Whitney U test. Combined pain score by Mann Whitney U test is 2.5 upto 9weeks, at 10week its 0, 11week its 1.625, 12week its 0. P value is significant. Analysis showed statistical difference present between the two groups.

In our study in properitoneal nontension sutured mesh repair group out of 25 patients, no patients experienced severe pain at 2weeks, they only experienced mild and moderate pain on VAS and only one patient at 7week experienced mild pain, and no patients experienced any pain after 8weeks on VAS. In conventional mesh repair out of 25 patients,20 patients experienced severe pain at 2weeks and patients experiencing no pain are from 10week onwards with 13 patients experienced no pain

and 12 patients experienced mild pain at 11week and all patients experienced no pain on VAS from 12week.

In one study, out of 52 patients who underwent properitoneal nontension sutured mesh repair in three years follow-up, postoperative pain on VAS(0 to 10) at 2 months(mean+SD; 1.39+0.58), 1 year (0.37+0.27), 3 years(0.58+0.40). More than one third of patients had returned to work 1week after surgery(37.8%) with 62.2% returning by 2weeks and 100% by 6weeks. Most significantly 90.9% of patients had resumed full recreational activities by 8weeks[i].

In our study most significantly 100% of patients in group A had resumed full recreational activities by 8weeks.

# CONCLUSION

This study showed that with the use of Properitoneal nontension sutured mesh repair, there is :

- Less groin pain

In a conclusion, there is apparent advantage in the use of Properitoneal nontension sutured mesh repair over other conventional mesh repairs in the reduction of postoperative pain. The short term follow up of the study did not allow any conclusion regarding r ecurrence of hernia, thus larger cohorts with longer follow up are needed.

# SUMMARY

This study "***COMPARISION OF PROPERITONEAL NON TENSION SUTURED MESH REPAIR VERSUS CONVENTIONAL MESH REPAIR FOR REDUCING POSTOPERATIVE PAIN IN DIRECT INGUINAL HERNIA - A RANDOMISED CONTROL TRIAL***".

In this study out of 50 patients who underwent mesh repair 25 underwent properitoneal non tension sutured mesh repair *and* 25 underwent conventional mesh repair. With Standard inclusion and exclusion criteria all patients were given spinal anesthesia

Mean age group in properitoneal non tension sutured mesh repair group was 52.5 while in conventional mesh repair group was 45.4. Most of the patients had symptoms of inguinal swelling from within 20 months in both the groups. In properitoneal non tension sutured mesh repair group left sided hernias were in 6 patients, Right sided hernias were in 11 patients, bilateral in 8 patients. In conventional mesh repair group left sided hernias in 5 patients, right sided hernias in 14 patients, bilateral in 6 patients. In properitoneal non tension sutured mesh repair group all are male patients,in conventional mesh repair group 1 female patient.

In both the groups postoperative pain was observed by VAS from 2week to 12 week daily. It was found out that in both groups all the patients were followed.

Postoperative pain measured by visual analogue score (VAS) pain was assessed both at rest and after exercise. In this study in group A mean pain score at 2week is 5.7 and from 9week onwards is 0,where as in group B at 2week is 8.1 and at 11week is 0.3 by Fischer test. Analysis showed statistical difference present between the two groups (p=0.000). Most significantly 100% of patients in group A had resumed full recreational activities by 8weeks.

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# TABLES

**SEX**

| Group | Male | Female | Total |
|---|---|---|---|
| A | 25 | 0 | 25 |
| B | 24 | 1 | 25 |

Fisher Exact Test

P = 1

**AGE (MEAN ï SD)**

| Group | Male |
|---|---|
| A | 52.5±15.26 |
| B | 45.4±16.21 |

t = 1.590

DF = 48

P = 0.118

**PAIN SCORE**

| Group | 2nd week | 3rd week | 4th week | 5th week | 6th week | 7th week | 8th week | 9th week | 10th week | 11th week | 12th week |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 5.7±0.52 | 4.7±0.52 | 3.7±0.52 | 2.7±0.52 | 1.7±0.54 | 0.7±0.54 | .04±0.2 | 0±0 | 0±0 | 0±0 | 0+0 |
| B | 8.1±0.74 | 7.1±0.74 | 6.1±0.74 | 5.1±0.74 | 4.2±0.81 | 3.1±0.74 | 2.1±0.74 | 1.3±0.49 | 0.9±0.33 | 0.5±0.51 | 0.O |
| Mann whitney U test | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 2.5 P = 0.000 | U = 0 P = 0.000 | U = 1.625 P = 0.000 | U = 0 P=0.000 |

## MEAN SCORE

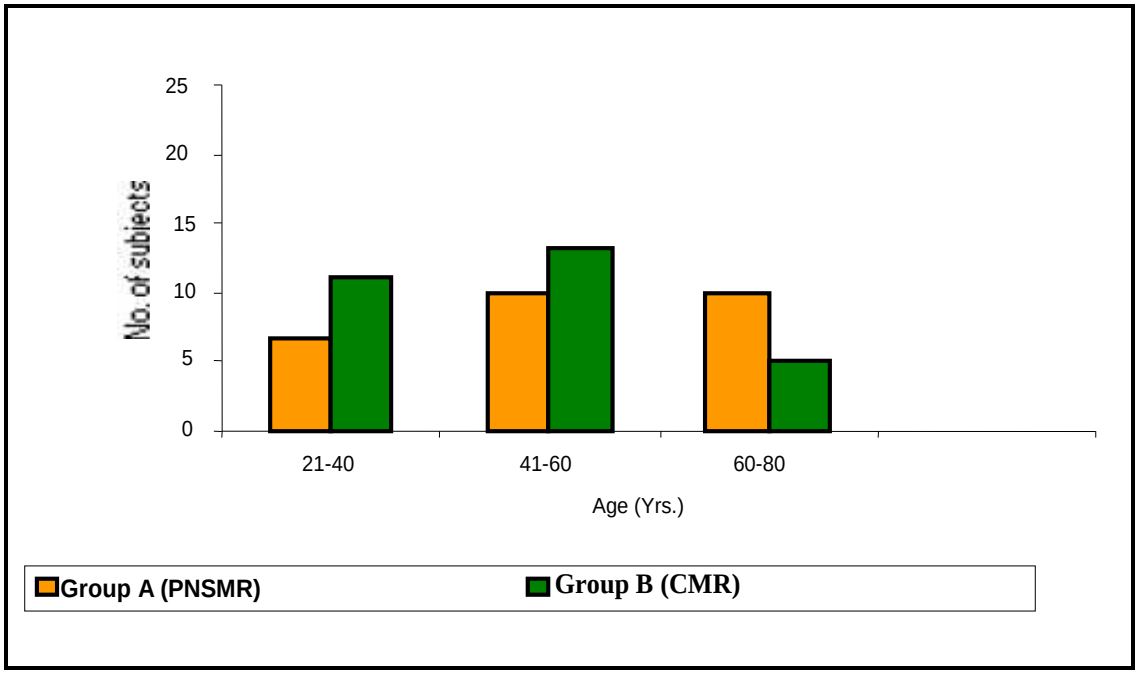
| Group | 2WEEK | | 3WEEK | | 4WEEK | | 5WEEK | | 6WEEK | | 7WEEK | | | | 8WEEK | | 9WEEK | | 10WEEK | | 11WEEK | | 12WEEK | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mod** | **Sev** | **Mod** | **Sev** | **Mild** | **Mod** | **Mild** | **Mod** | **Mild** | **Mod** | **No pain** | **Mild** | **Mod** | **No pain** | **No pain** | **Mild** | **No pain** | **Mild** | **No pain** | **Mild** | **No pain** | **Mild** | **No Pain** | **Mild** |
| A | 25 | 0 | 25 | 0 | 7 | 18 | 25 | 0 | 25 | 0 | 8 | 17 | 0 | Pain F test P = 0.004 | 24 | 1 | 25 | 0 | 25 | 0 | 25 | 0 | 25 | 0 |
| B | 5 | 20 | 15 | 10 | 0 | 25 | 0 | 25 | 5 | 20 | 0 | 9 | 16 | | 0 | 25 | 0 | 25 | 2 | 23 | 13 | 12 | 25 | 0 |
| | F test P = 0.000 | | F test P = 0.000 | | F test P = 0.010 | | F test P = 0.010 | | F test P = 0.010 | | $X^2$ = 26.462, DF= 2 P = 0.000 | | | | F test P = 0.000 | | F test P = 0.000 | | F test P = 0.000 | | F test P = 0.000 | | F Test P = 0.000 | |

# AIM OF THE STUDY

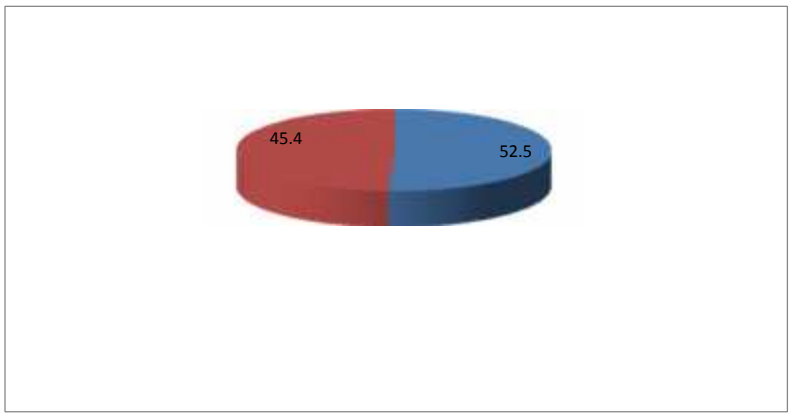
The aim of the study was to determine, minimal postoperative pain using Properitoneal non tension sutured mesh repair than conventional mesh repair in repair of direct inguinal hernias in KLES DR PRABAKAR KORE HOSPITAL, BELGAUM. This interpretation is based on assessment of the factors of:

1. Groin pain

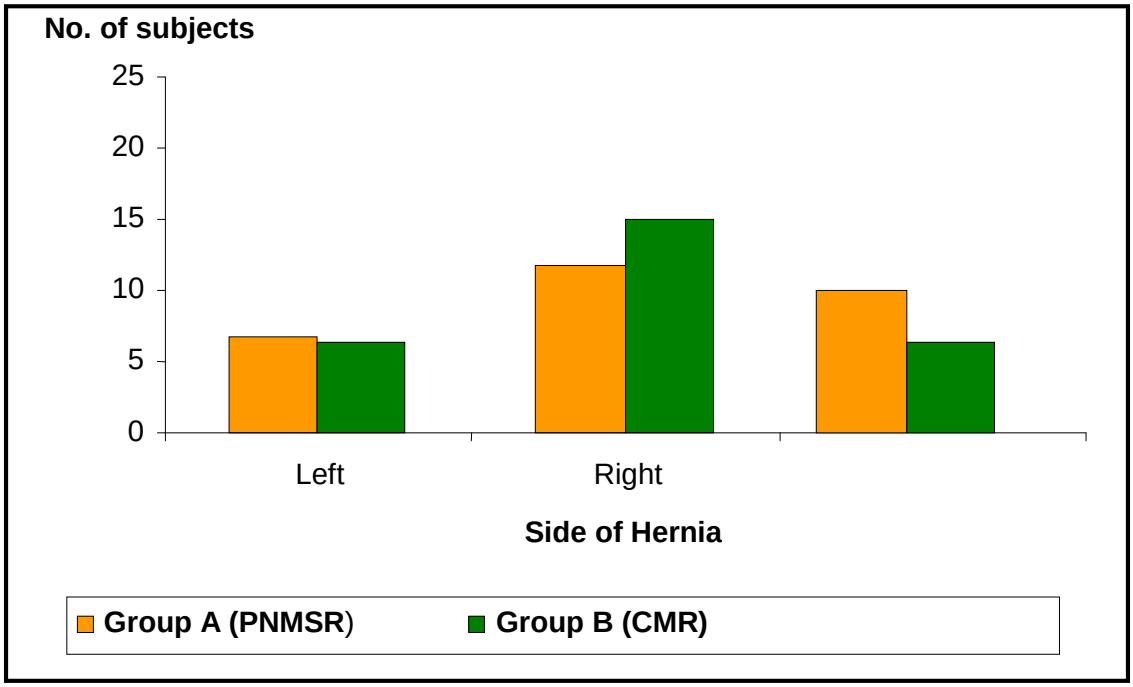
## GRAPH 1: COMPARISON OF AGE DISTRIBUTION



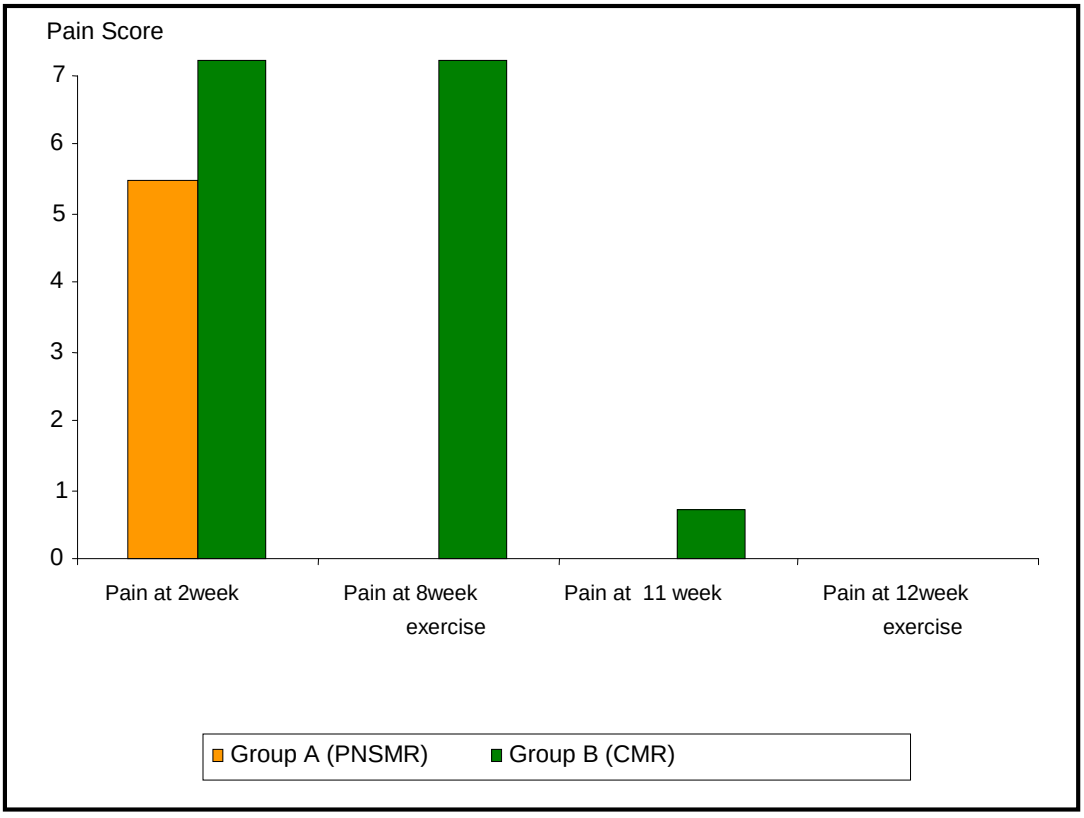

## GRAPH 2: COMPARISON OF MEAN AGE GROUP



## GRAPH 3: COMPARISON OF SIDE OF HERNIA




## GRAPH :4 COMPARISON OF GROIN PAIN



# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| RDH | ; | Right direct inguinal hernia |
| LDH | ; | Left direct inguinal hernia |
| BDH | ; | Bilateral direct inguinal hernia |
| VAS | ; | Visual analogue score |
| NO FO UP | ; | No follow up |
| DIAGNO | ; | Diagnosis |
| PROCED | ; | Procedure |
| MO | ; | Moderate |
| MI | ; | Mild |
| SE | ; | Severe |

**PROFORMA OF CLINICAL EXAMINATION OF INDIVIDUAL PATIENT**

**Serial no**

**Name of the patient**

**Age**

**Sex**

**Address**

**Occupation**

**Socioeconomic**

**IP.No**

**Date of admission**

**Clinical diagnosis**

**Clinical details**

**HISTORY**

1) Pain
2) Lump
3) Systemic symptoms
4) Other complaints
5) Past history of operation
6) Personal history

GENERAL PHYSICAL EXAMINATION

1) Vitals
2) Appearance
3) Attitude

**LOCAL EXAMINATION**

**At** **6**

Position of patient

1) Standing
2) Supine

**Local examination**

**Inspection**

1) Swelling
2) Skin over the swelling
3) Impulse on coughing
4) Position of penis

**Palpation**

1) Impulse on coughing
2) Reducing

Percussion

Auscultation

Tone of muscle

R.S.Examination

CVS Examination

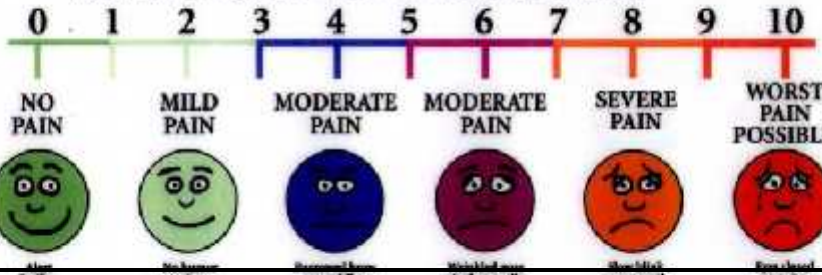
**INVESTIGATION**

1) CBC
2) Urine routine
3) Minirenal

MODERATE

# UNIVERSAL PAIN ASSESSMENT TOOL

This pain assessment tool is intended to help patient care providers assess pain according to individual patient needs. Explain and use 0-10 Scale for patient self-assessment. Use the faces or behavioral observations to interpret expressed pain when patient cannot communicate his/her pain intensity.




| | | | | | | |
|---|---|---|---|---|---|---|
| Verbal Descriptor Scale | NO PAIN | MILD PAIN | MODERATE PAIN | MODERATE PAIN | SEVERE PAIN | WORST PAIN POSSIBLE |
| WONG-BAKER FACIAL GRIMACE SCALE | Alert Smiling | No tension serious flat | Grimaced brow pursed lips breath holding | Wrinkled nose raised upper lips rapid breathing | Shouldn't open mouth | Eyes closed moaning crying |
| ACTIVITY TOLERANCE SCALE | NO PAIN | CAN BE IGNORED | INTERFERES WITH TASKS | INTERFERES WITH CONCENTRATION | INTERFERES WITH BASIC NEEDS | BEDREST REQUIRED |
| SPANISH | NADA DE DOLOR | UNPOQUITO DE DOLOR | UN DOLOR LEVE | DOLOR FUERTE | DOLOR DEMASIADO FUERTE | UN DOLOR INSOPORTABLE |
| TAGALOG | Walang Sakit | Konting Sakit | Katamtamang Sakit | Matinding Sakit | Pinaka-Matinding Sakit | Pinaka-Malalang Sakit |
| CHINESE | 不痛 | 輕微 | 中度 | 嚴重 | 非常嚴重 | 最嚴重 |
| KOREAN | 통증 없음 | 약한 통증 | 보통 통증 | 심한 통증 | 아주 심한 통증 | 극악의 통증 |
| PERSIAN (FARSI) | بدون درد | درد ملایم | درد معتدل | درد شدید | درد بسیار شدید | بدترین درد ممکن |
| VIETNAMESE | Không Đau | Đau Nhẹ | Đau Vừa Phải | Đau Nặng | Đau Thật Nặng | Đau Đến Tận Cùng |
| JAPANESE | 痛みがない | 少し痛い | いくらか痛い | かなり痛い | ひどく痛い | ものすごく痛い |

# POST OPERATIVE PERIOD

## GROUP A : PROPERITONEAL NON TENSION SUTURED MESH REPAIR

| **POST OPERATIVE PAIN** | **2 WEEKS** | **3 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **4 WEEKS** | **5 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **6 WEEKS** | **7 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **8 WEEKS** | **9 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **10 WEEKS** | **11 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **12 WEEKS** | |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

**GROUP B: CONVENTIONAL MESH REPAIR**

| **POST OPERATIVE PAIN** | **2 WEEKS** | **3 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **4 WEEKS** | **5 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **6 WEEKS** | **7 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **8 WEEKS** | **9 WEEKS** |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **10 WEEKS** | **11 WEEKS** |
|---|---|---|

| | | |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

| **POST OPERATIVE PAIN** | **12 WEEKS** | |
|---|---|---|
| VISUAL ANALOGUE SCORE | | |

MASTER CHART (PROPERITONEAL NONTENSION SUTURED MESH REPAIR)

| SL NO | IP NO | NAME | AGE/SEX | DIAGNOS | PROCED | PAIN SCORE AT DIFFERENT WEEKS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2 WEEK | 3 WEEK | 4 WEEK | 5 WEEK | 6/WEEK | 7/WEEK | 8/WEEK | 9/WEEK | 10/WEEK | 11WEEK | 12/WEEK |
| 1 | 216089 | KM | 28/M | BDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 1/MI | | | | | | |
| 2 | 217333 | IS | 60/M | RDH | PMR | 6/MO | 6/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 3 | 223539 | RU | 86/M | BDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 4 | 226789 | DU | 40/M | LDH | PMR | 7/MO | 6/MO | 5/MO | 4/MI | 3/MI | 2/MI | 1/MI | | | | |
| 5 | 223521 | VB | 65/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 6 | 224885 | BK | 68/M | LDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 7 | 250983 | VE | 45/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 8 | 228717 | SR | 40/M | RDH | PMR | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | | |
| 9 | 239801 | BA | 36/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 10 | 232793 | SK | 27/M | LDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 11 | 232323 | SG | 48/M | BDH | PMR | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | | |
| 12 | 232261 | SR | 60/M | LDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 13 | 232001 | IM | 65/M | RDH | PMR | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | | |
| 14 | 240843 | BP | 31/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 15 | 242007 | SO | 66/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 16 | 241669 | BG | 28/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 17 | 245801 | BK | 62/M | BDH | PMR | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | | |
| 18 | 242861 | NA | 58/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 19 | 214689 | MV | 60/M | LDH | PMR | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | | | | |
| 20 | 243223 | BK | 62/M | BDH | PMR | 5/MO | 4/MO | 3/MI | 3/MI | 1/MI | | | | | | |
| 21 | 295801 | BA | 62/M | BDH | PMR | 5/MO | 4/MO | 3/MI | 3/MI | 1/MI | | | | | | |
| 22 | 254121 | CK | 48/M | BDH | PMR | 5/MO | 4/MO | 3/MI | 3/MI | 1/MI | | | | | | |
| 23 | 256141 | DN | 56/M | RDH | PMR | 6/MO | 5/MO | 4/MO | 4/MO | 2/MI | 1/MI | | | | | |
| 24 | 254051 | AA | 58/M | BDH | PMR | 6/MO | 5/MO | 4/MO | 4/MO | 2/MI | 1/MI | | | | | |
| 25 | 218883 | SM | 56/M | LDH | PMR | 6/MO | 5/MO | 4/MO | 4/MO | 2/MI | 1/MI | | | | | |

MASTER CHART (CONVENTIONAL MESH REPAIR)

| SL NO | IP NO | NAME | AGE/SEX | DIAGNOS | PROCED | PAIN SCORE AT DIFFERENT WEEKS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 211994 | DJ | 65/M | LDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2//MI | 1/MI | |
| 2 | 213752 | SP | 18/M | LDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | |
| 3 | 213894 | RS | 45/M | RDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI |
| 4 | 214688 | MY | 60/M | BDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI |
| 5 | 214222 | KA | 38/M | BDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI |
| 6 | 213624 | MU | 45/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MO | 2/MI | 1/MI | 1/MI | |
| 7 | 224010 | SA | 25/M | RDH | CMR | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | | 1/MI |
| 8 | 224232 | SO | 55/M | RDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | |
| 9 | 224564 | KM | 26/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | |
| 10 | 230358 | SK | 11/F | RDH | CMR | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI | |
| 11 | 229476 | KA | 43/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI |
| 12 | 235164 | AN | 23/M | RDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI |
| 13 | 236184 | GA | 34/M | LDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI |
| 14 | 241068 | MK | 55/M | LDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | |
| 15 | 239162 | BK | 54/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | |
| 16 | 242668 | BH | 55/M | BDH | CMR | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI | 1/MI |
| 17 | 239112 | MA | 38/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI |
| 18 | 246014 | SH | 60/M | LDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI |
| 19 | 245180 | SP | 40/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | |
| 20 | 246812 | AS | 55/M | RDH | CMR | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | | |
| 21 | 248136 | KA | 64/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI |
| 22 | 248142 | MA | 71/M | BDH | CMR | 9/SE | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | |
| 23 | 250036 | SH | 36/M | RDH | CMR | 8/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | | 1/MI |
| 24 | 256120 | RM | 56/M | BDH | CMR | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | 1/MI | 1/MI | 1/MI | |
| 25 | 254068 | MA | 64/M | RDH | CMR | 9/SE | 9/SE | 7/MO | 6/MO | 5/MO | 4/MO | 3/MI | 2/MI | | |