

**COMPARATIVE STUDY ON USE OF SWADESHI MATERIAL VERSUS
POLYPROPYLENE MESH FOR LICHTENSTEIN'S HERNIOPLASTY IN**

GRH, MADURAI

DISSERTATION SUBMITTED FOR

**M.S. DEGREE EXAMINATION
BRANCH I – GENERAL
SURGERY**



THE TAMILNADU
DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI

CERTIFICATE

BY THE GUIDE

This is to certify that the dissertation entitled “**COMPARATIVE STUDY ON USE OF SWADESHI MATERIAL VERSUS POLYPROPYLENE MESH FOR LICHTENSTEIN’S HERNIOPLASTY IN GRH, MADURAI**” submitted by **Dr. AKSHAR.A** to Tamil Nadu Dr. M.G.R Medical University, Chennai , done in partial fulfillment of the requirement of the award of MS Degree Branch – I (General Surgery) is a bonafide research work carried out by him under direct supervision and guidance from January 2018 to January 2019 in the Department of General Surgery, Madurai Medical College.

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CONTENTS

| S. NO. | PARTICULARS | PAGE NO. |
|---------------|----------------------------------|-----------------|
| 1. | INTRODUCTION | 9 |
| 2. | AIM OF THE STUDY | 11 |
| 3. | REVIEW OF LITERATURE | 12 |
| 4. | SWADESHI MATERIAL | 65 |
| 5. | SUBJECTS & METHODS | 71 |
| 6. | RESULTS | 74 |
| 7. | DISCUSSION | 87 |
| 8. | CONCLUSION | 89 |
| 9. | APPENDIX | |
| | i. BIBLIOGRAPHY | 90 |
| | ii. PROFORMA | 93 |
| | iii. MASTER CHART | 95 |
| | iv. ETHICAL CERTIFICATE | 102 |
| | v. PLAGIARISM CERTIFICATE | 103 |

INTRODUCTION

A Hernia means 'To bud' or 'To protrude'[Greek] or 'Rupture'[Latin]. Hernia is defined as " an abnormal protrusion of the whole or a part of a viscera through a normal or abnormal opening with the sac covering it ".

Inguinal Hernia is the most common type of hernia (73%) because the muscular anatomy in the inguinal region is weak and also due to the presence of natural weaknesses like deep ring and cord structures. Indirect hernia is more common than direct type.

Other types of hernias are Femoral, Umbilical, Epigastric, Obturator, Spigelian, Lumbar etc.

It has been said that the history of groin hernias is the history of surgery itself^[1]. Hernia repair is one of the most commonly performed general surgical procedures worldwide^[2]. Mesh based techniques particularly the Lichtenstein's tension free hernioplasty and Laparoscopic repairs were advocated

for the treatment of symptomatic inguinal hernias in adults by the European Hernia Society^[3]. Lichtenstein's technique is currently the most popular and accepted technique among open mesh based techniques. It has minimal perioperative morbidity and is considered the standard of care.

Today, the gold standard of hernia repair in western countries is represented by the use of polypropylene meshes as prosthesis. A Lichtenstein type of operation has now become the method of choice in most developed nations of the world especially in the USA.

In the developing world, the traditional Bassini operation is still being performed in most centers due largely to the scarcity and expensive nature of the commercial prosthetic mesh

AIM AND OBJECTIVE

- This study refers to the advantage of using swadeshi material in the treatment of inguinal hernia with similar efficacy compared to polypropylene mesh in terms of cost effectiveness in Inguinal Hernia patients who are admitted to GRH Madurai.

REVIEW OF LITERATURE

ANATOMY OF INGUINAL CANAL :

The anterior abdominal wall consists of nine layers^[6](Fig 1); from outwards to in

- 1) Skin
- 2) Camper's Fascia
- 3) Scarpa's Fascia
- 4) External Oblique muscle
- 5) Internal Oblique muscle
- 6) Transversus abdominis muscle
- 7) Fascia Transversalis
- 8) Pre- peritoneal fat
- 9) Peritoneum

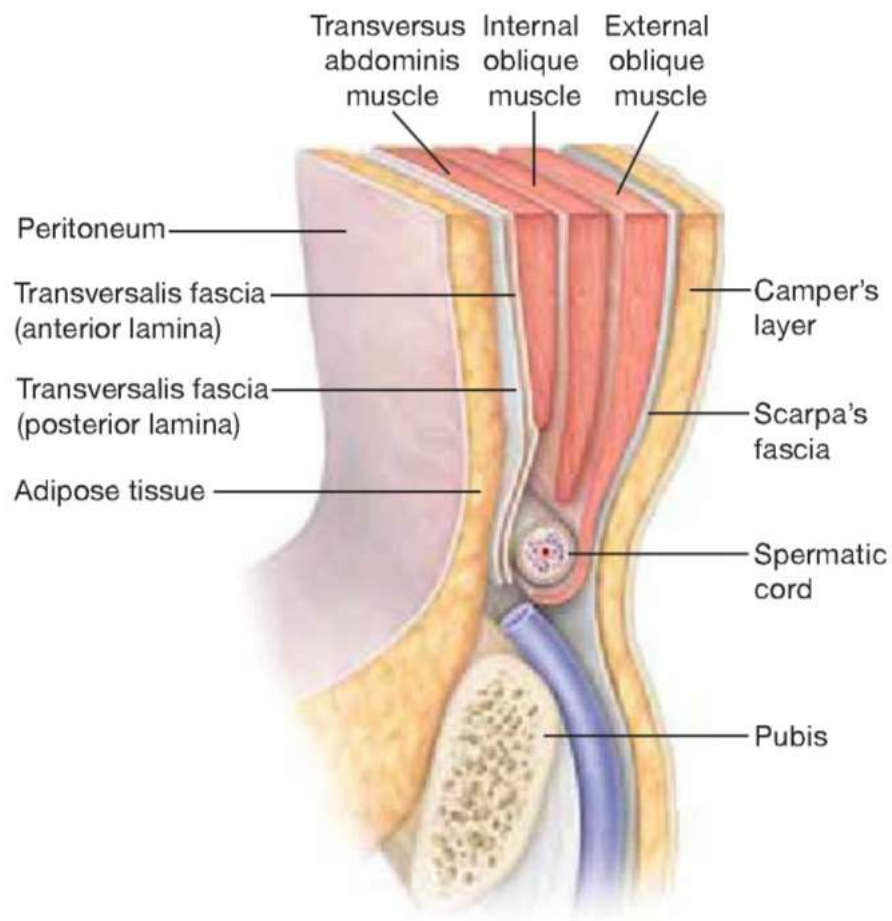
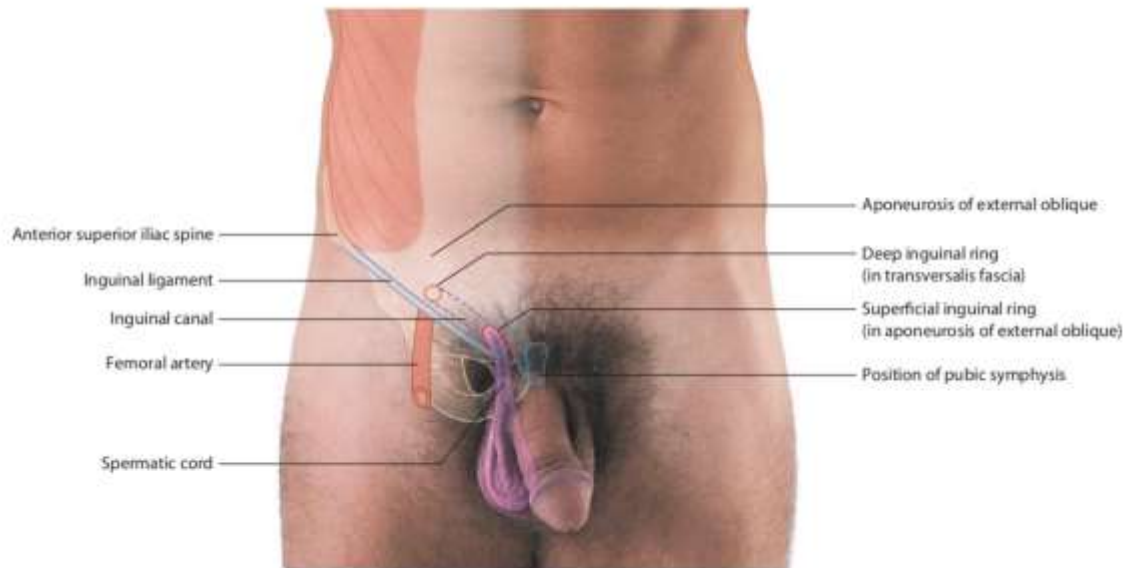


Fig 1 – Layers of Anterior Abdominal Wall

The inguinal canal is an oblique intermuscular passage in the lower part of the anterior abdominal wall, situated just above the medial half of the inguinal ligament. It is about 4 cm(1.5 inches) long and is directed downwards, forwards and medially. It extends from the deep inguinal ring to the superficial inguinal ring^[7].(Fig 2)



Inguinal region in a man



Inguinal region in a woman

Fig 2- Inguinal Canal In males and Females

The deep inguinal ring is an oval opening in the Fascia Transversalis, situated 1.2 cm above the mid inguinal point, and immediately lateral to the stem of the inferior epigastric artery. In males, prolongation of the connective tissue occurs from the margins of the ring to the cord structures and is called the internal spermatic fascia^[8]. The superficial inguinal ring is a triangular gap in the external oblique aponeurosis. The base is formed by the pubic crest. The two sides are formed by the lateral and medial margins. They are called the crura^[7]. The lower border or the inferior crus of the ring is the cord like medial end of the inguinal ligament which is attached to the pubic tubercle. The medial border or the superior crus is flat and is attached to the front of the pubic symphysis where it decussates with its fellow of the opposite side^[9].(Fig 3).

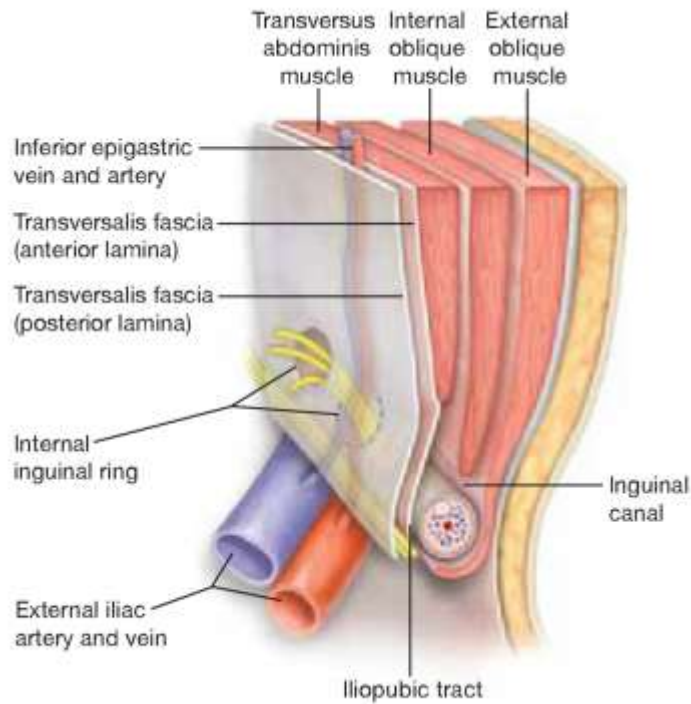


Fig 3 – Extent of Inguinal Canal

The size of the superficial inguinal ring is larger in males than in females. It admits the tip of the little finger^[9].

The spermatic cord with the ilioinguinal nerve in males or the round ligament with the ilioinguinal nerve in females emerge out of the superficial ring.^[9](Fig 4).

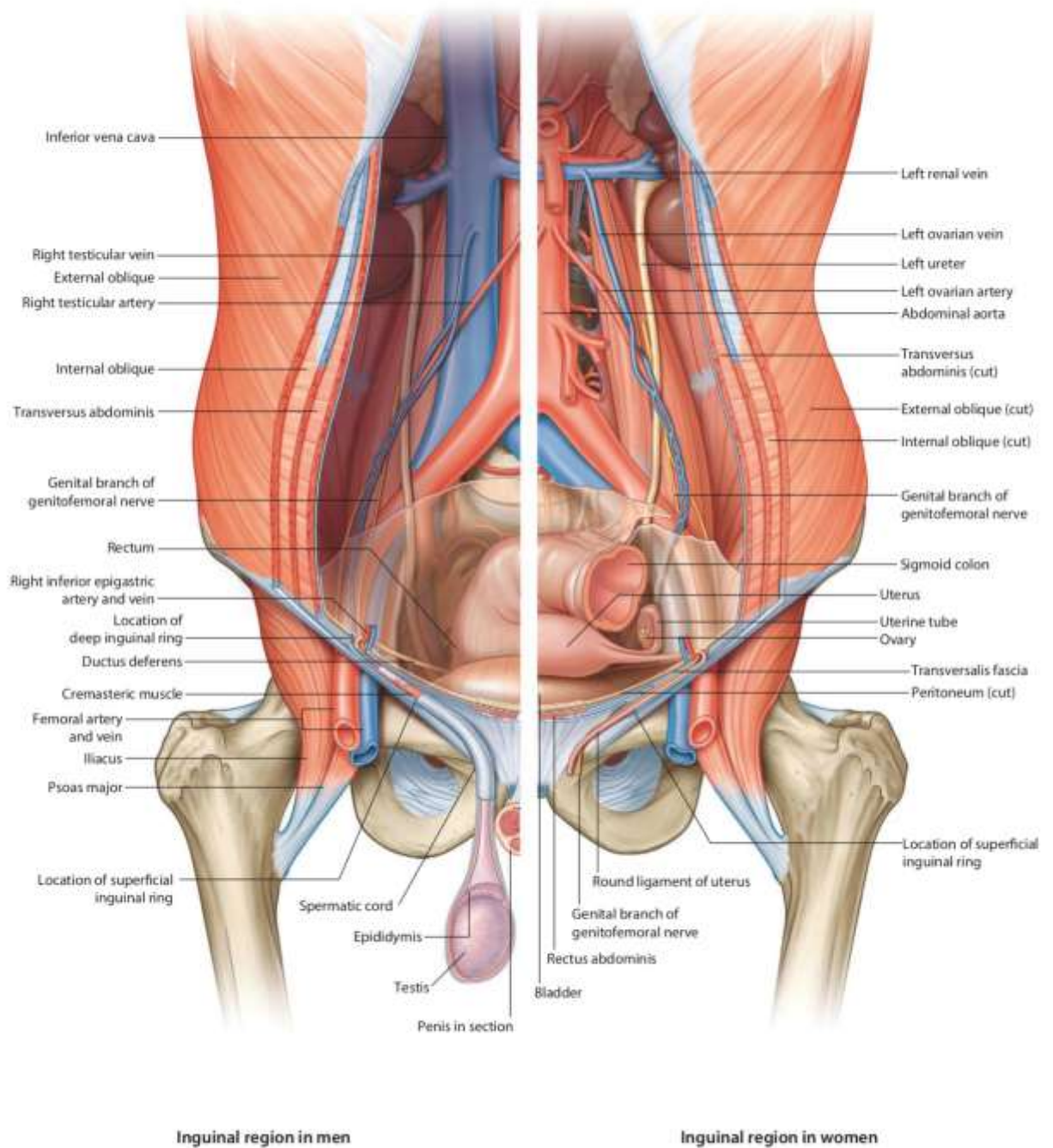


Fig 4- Structures emerging out of Superficial Ring

In males, a fascial prolongation of the margins of the ring called the external spermatic fascia passes down over the

spermatic cord into the scrotum^[9].

BOUNDARIES OF INGUINAL CANAL^[7] :

The Anterior Wall:

In its whole Extent:

Skin, Superficial Fascia and External
Oblique Aponeurosis.

In its lateral one – third :

The fleshy fibres of the internal oblique
muscle.

The Posterior Wall:

In its whole Extent :

The Fascia transversalis, The Extraperitoneal
tissue and the Parietal Peritoneum.

In its Medial Two-third :

The conjoint tendon and the reflected part of the
inguinal ligament.

Roof :

It is formed by the arched fibres of the
internal oblique and transversus abdominis muscles.

Floor:

It is formed by the grooved upper surface of the inguinal ligament and at the medial end by the lacunar ligament.(Fig 5).

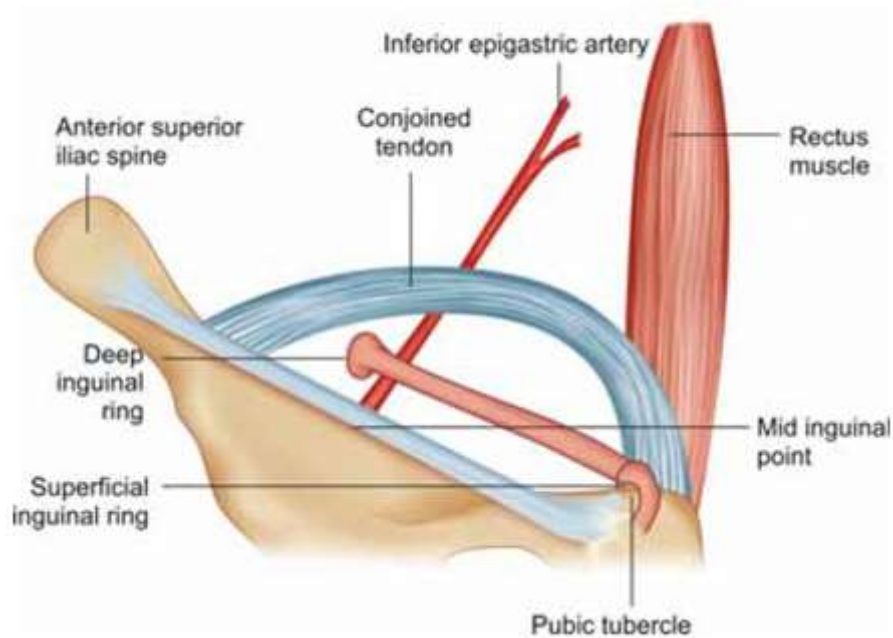


Fig 5- Boundaries Of Inguinal Canal

The inguinal canal is larger in the male than in the female.

STRUCTURES PASSING THROUGH THE CANAL^[7] :

- The Spermatic Cords in males
- The Round ligament of the uterus in the females.

CONSTITUENTS OF THE SPERMATIC CORD^[7]: (Fig 6,7).

- The ductus deferens
- The testicular and cremasteric arteries, artery to vas deferens
- The pampiniform plexus of veins
- Lymph vessels from the testis
- The genital branch of the genitofemoral nerve
- Remains of the processus vaginalis.

The ilioinguinal nerve lies inferolateral to the cord.

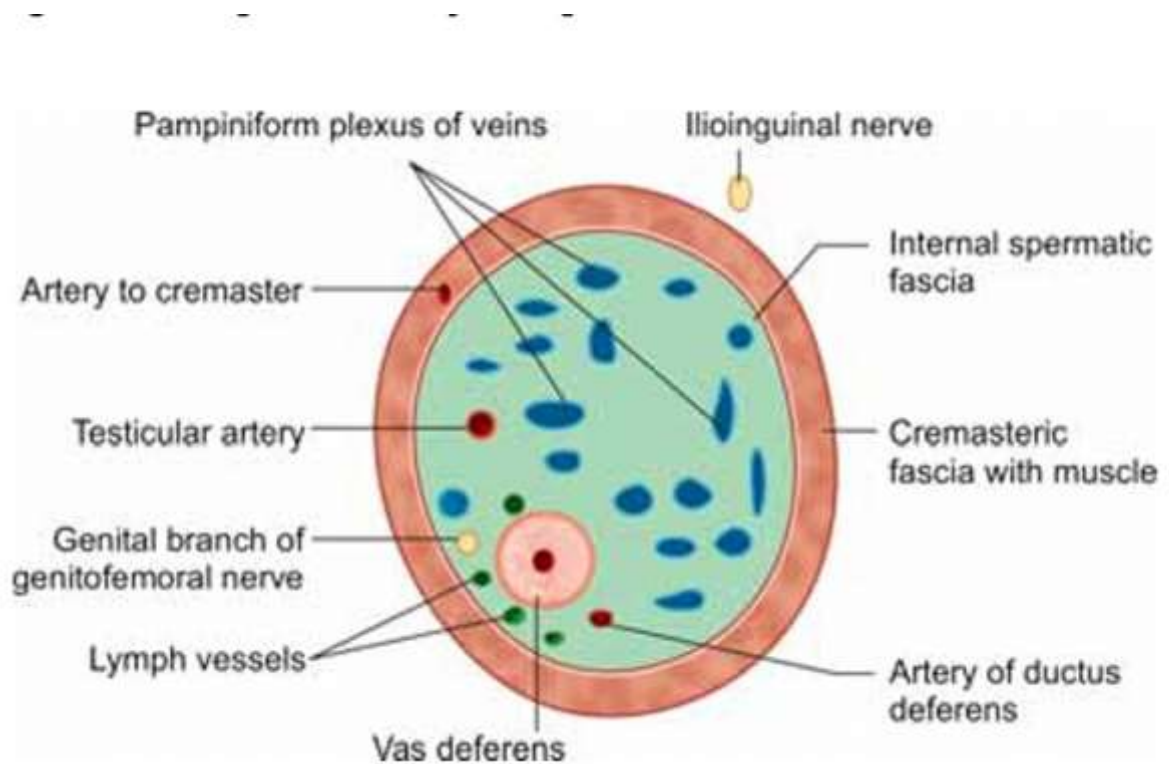


Fig 6 – Constituents Of Spermatic Cord

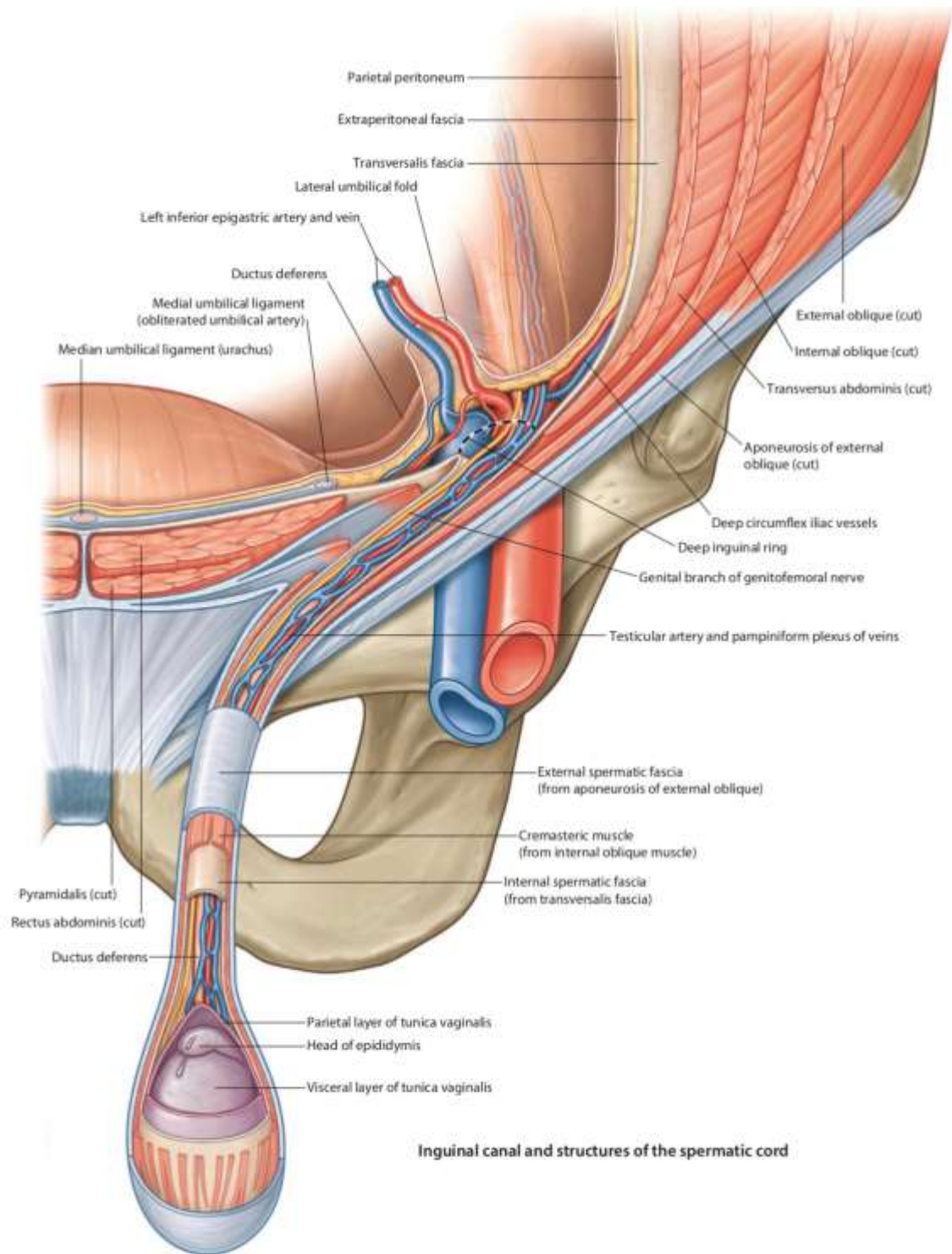


Fig 7 – Constituents Of Spermatic Cord

COVERINGS OF SPERMATIC CORD^[7] :

From within outwards, these are as follows;

1)The Internal Spermatic Fascia, derived from the fascia transversalis

2)The Cremasteric Fascia, derived from the Internal oblique and Transversus abdominis muscles

3)The External Spermatic Fascia, derived from the External oblique aponeurosis.

The integrity of the inguinal canal depends upon the strength of the anterior wall in the lateral part and the posterior wall in the medial part, provided the abdominal muscles are of good tone and their aponeuroses unyielding^[8].

The conjoint tendon lies posterior to the superficial inguinal ring and helps to strengthen this region.

The aponeurosis of the transversus abdominis muscle extends downwards from the arched muscle to become inserted into a variable length of Cooper's ligament between the pubic tubercle and the femoral vein. It is intimately adherent to the underlying fascia transversalis.

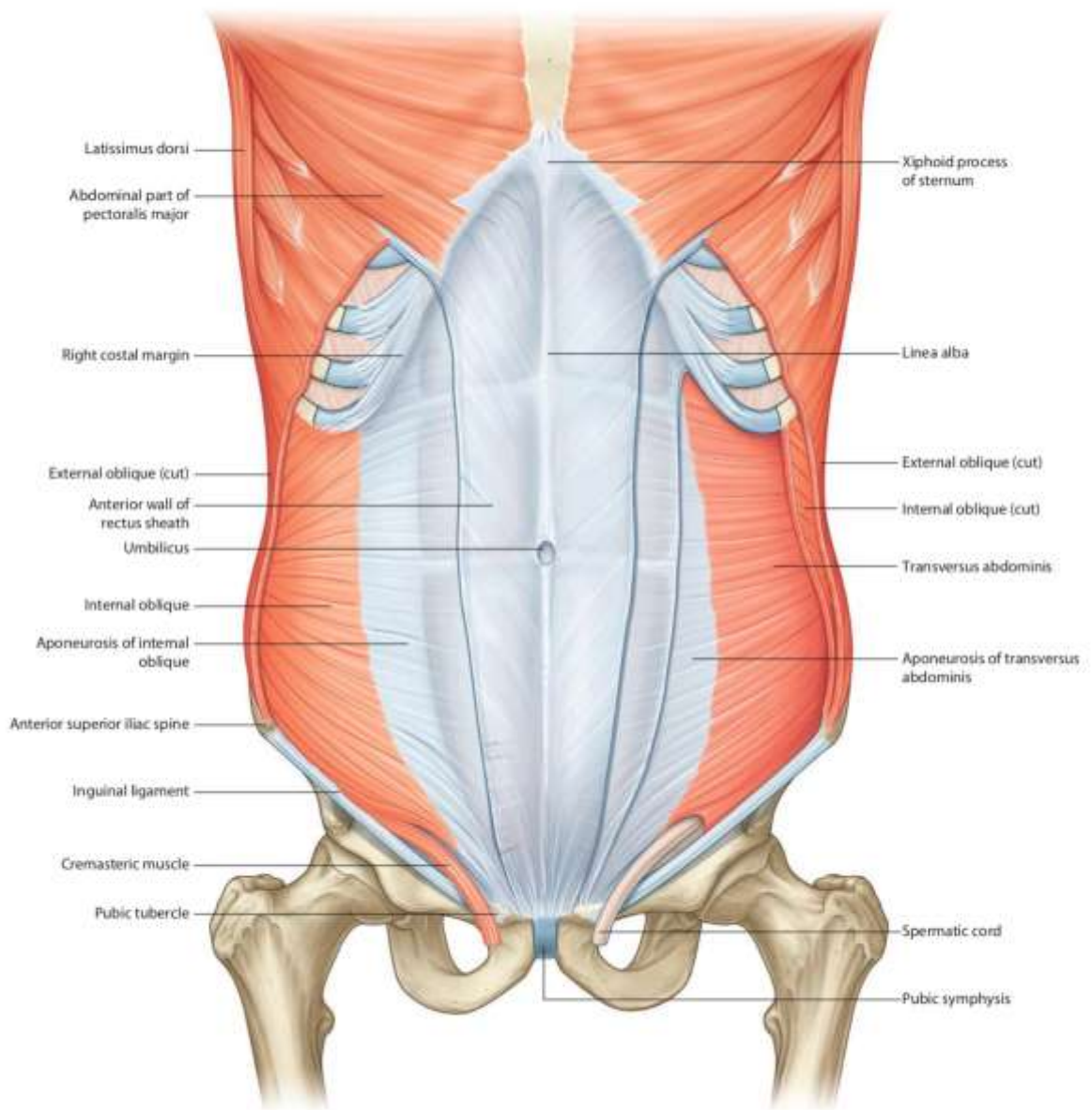
The strength of the posterior wall of the inguinal canal will

vary with the extent of this aponeurosis^[8].

Laterally, the transversalis fascia is strengthened by the presence in front of it of tendinous and sometimes muscular fibres of the transverses abdominis muscle.

These fibres constitute the **Interfoveolar ligament**. They arch down from the lower border of transversus around the vas to the inguinal ligament and constitute the functional medial edge of the deep ring^[8].

The fascia transversalis binds together the muscle and aponeurotic fascicles into a continuous layer and reinforces the weak areas where aponeurotic areas are sparse. This layer is responsible for the structural integrity of the abdominal wall and by definition, a hernia results from a defect in the transversalis fascia.(Fig 8,9).



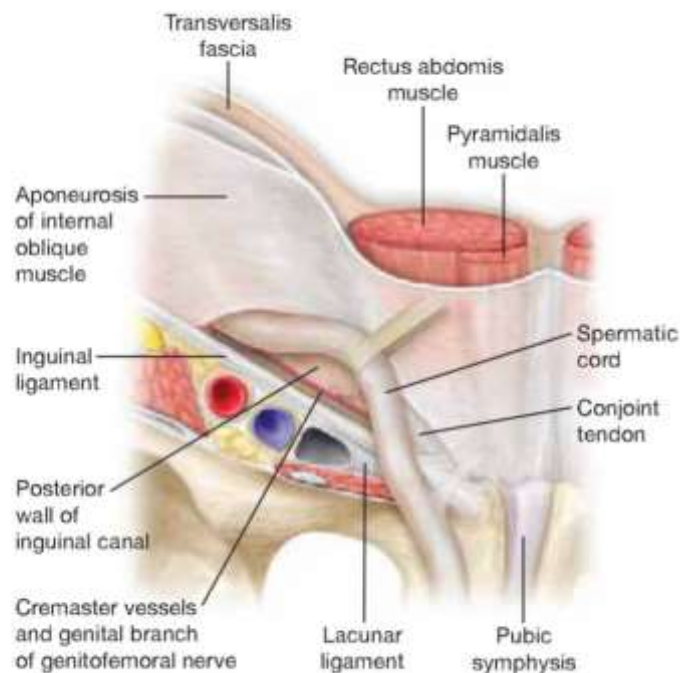


Fig 8,9 – Importance of Fascia Transversalis

MECHANISM OF INGUINAL CANAL^[7]:

1)Obliquity of the Inguinal Canal:

The two inguinal rings do not lie opposite each other. Therefore, when the intraabdominal pressure rises, the anterior and posterior walls of the canal are approximated, thus obliterating the passage. This is the Flap Valve Mechanism.

2)The Superficial inguinal ring is guarded from behind by the conjoint tendon and by the reflected part of the inguinal ligament.

3)The Deep inguinal ring is guarded from the front by the fleshy fibres of the Internal oblique.

4)Shutter Mechanism of the Internal Oblique :

When the internal oblique contracts, the roof of the inguinal canal is approximated to the floor, like a shutter.

The arching fibres of the Transversus Abdominis also take part in this mechanism.

5)Ball – Valve Mechanism:

Contraction of the cremaster helps the spermatic cord to plug the superficial inguinal ring.

6)Slit – Valve Mechanism:

Contraction of the External Oblique helps in Approximation of the two crura of the superficial inguinal ring. This greatly increases the Integrity of the superficial inguinal ring.

7)Hormones may play a role in maintaining the tone of the inguinal musculature.

DEVELOPMENT OF INGUINAL CANAL^[7]:

Inguinal Canal represents the passage of Gubernaculum through the abdominal wall. It extends

from the caudal end of the developing gonad(in the lumbar region) to the labioscrotal swelling.

In early life, the canal is very short. As the pelvis increases in width, the deep inguinal ring is shifted laterally, and the adult dimensions of the canal are attained.

The predisposition of man to inguinal hernia is due to the evolutionary changes that have taken place in the inguinal region as a result of his upright posture. These evolutionary changes are;

1)The iliac crest has grown forwards into the lower digitations of the external oblique muscle, so that the inguinal ligament can no more be operated by fleshy fibres of muscle which now help in balancing the body. In all other mammals, external oblique has no attachment to the iliac crest.

2)The internal oblique and transverses initially originated from the anterior border of ilium and the sheath of iliopsoas, and act as a powerful sphincter of the inguinal canal. The shift of their origin to the inguinal ligament

and iliac crest has minimized their role.

3) Due to peculiar growth of hip bones and pelvis, the crural passage (between hip bone and inguinal ligament) in man has become much wider than any other mammal. This predisposes to Femoral hernia.

EXTERNAL OBLIQUE MUSCLE: (Fig 10,11).

Origin:

The muscle arises from eight fleshy slips from the outer surfaces of the middle of the shaft of the lower eight ribs. The fibres run downwards, forwards and medially^[7].

Insertion:

1) Most of the fibres end in a Broad Aponeurosis, through which they are inserted from above downwards into the Xiphoid process, Linea Alba, Pubic Symphysis, Pubic Crest and the Pectineal line of the Pubis.

2) The lower fibres of the muscle are inserted directly into the anterior two thirds of the outer lip of the iliac crest^[7].

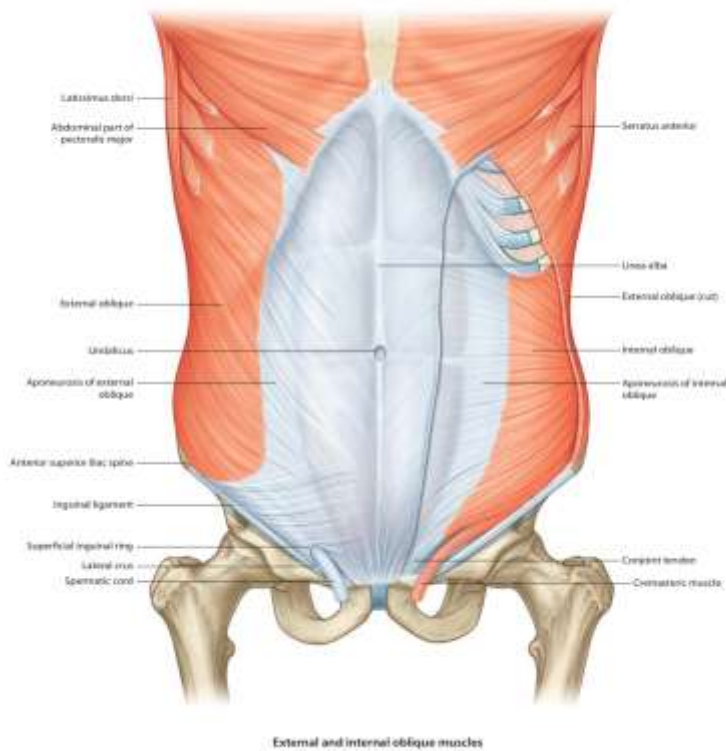
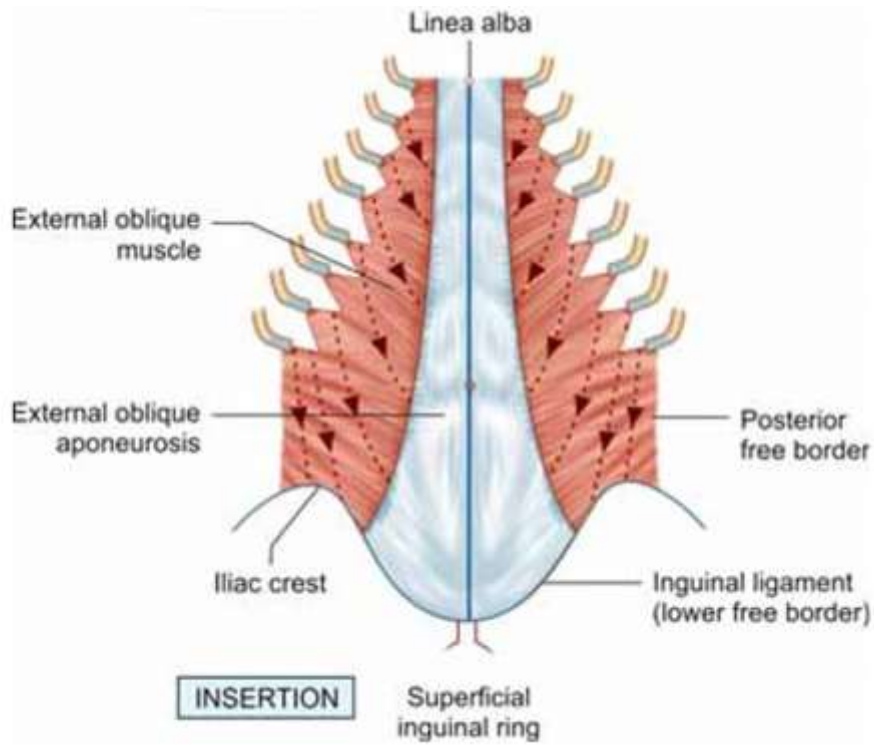


Fig 10, 11 – External Oblique Muscle

Nerve Supply :

By the lower Six Thoracic nerves^[7].

Points of Interest:

- 1)The upper four slips of the muscle interdigitate with the origin of the Serratus anterior and the lower four slips with the origin of the Lattisimus Dorsi.
- 2)The junction of the muscle fibres with the aponeurosis lies; a) medial to a vertical line drawn from the ninth costal cartilage in the upper part.b)Below a line joining the anterior Superior iliac spine and Umbilicus. Above the ninth costal cartilage, this line curves upwards and medially.
- 3) Between the Anterior superior iliac spine and the Pubic tubercle, the aponeurosis has a free inferior border that is folded on itself to form the inguinal ligament.
- 4) Between the Linea Semilunaris and the Linea Alba, the aponeurosis helps in forming the anterior wall of rectus sheath.
- 5) Just above the Pubic crest, the aponeurosis of the External oblique, presents a triangular aperture

- called the superficial inguinal ring.
- 6) The muscle has free posterior and upper borders.
 - 7) The intercrural fibres are seen in the lower part of the aponeurosis. They arise from the anterior superior iliac spine and lateral part of the inguinal ligament and run upwards and medially – in a direction opposite to the direction of the external oblique fibres. These help prevent the separation of the crura of the superficial inguinal ring^[9].
 - 8) The aponeurosis is supposed to have a superficial and deep parts – the fibres of the superficial part running obliquely upwards and those of the deep part running at right angle downwards^[8].
 - 9) The fibres continue across the midline after decussation.
 - 10) The fibres from the deep layer pass to the superficial layer on the contralateral side of the abdominal wall and vice versa^[8].
 - 11) The free horizontal border of this aponeurosis extends from the fifth rib to the xiphisternum. It is the only

structure in the anterior rectus sheath above the costal margin^[8].

- 12) The free posterior border of the muscle forms the anterior boundary of the Lumbar triangle of Petit that is floored in by the internal oblique and bounded behind by the anterior border of the latissimus dorsi and below by the iliac crest^[8].

INGUINAL LIGAMENT^[7]:

- a) It is also known as the Poupart's ligament.
- b) It is formed by the lower border of the external oblique aponeurosis which is thickened and folded back on itself.
- c) It extends from the anterior superior iliac spine to the Pubic tubercle.(Fig 12).
- d) It's lateral half is rounded and oblique. It's medial half is grooved upwards and is more horizontal.
- e) The Fascia Lata is attached to the lower border. Traction of this fascia makes the ligament convex downwards.
- f) The upper surface of the ligament gives origin to the

Internal Oblique from its lateral two-thirds, to the Transverses abdominis from the lateral one-third and to the Cremaster muscle from its middle part.

g) The upper grooved surface of the medial half of the inguinal ligament forms the floor of the inguinal canal and lodges the spermatic cord or round ligament of the uterus.

h) The Pectineal part of the inguinal ligament or the Lacunar Ligament(Fig 12) is triangular. Anteriorly, it is attached to the medial end of the inguinal ligament. Posteriorly, it is attached to the pectin pubis. It is horizontal in position and supports the spermatic cord. The apex is attached to the pubic tubercle. The base is directed laterally. It forms the medial boundary of the femoral ring. It is reinforced by the pectineal fascia. It has two surfaces – abdominal or upper surface forming the floor of the medial part of the inguinal canal and a Femoral or lower surface^[7,9].

i) The pectineal ligament or the Ligament of Astley –

Cooper(Fig 12) is a condensation of the transversalis fascia and periosteum of the superior pubic ramus lateral to the pubic tubercle. It is an extension from the posterior part of the base of the lacunar ligament. It is attached to the pecten pubis. It joins the iliopubic tract and lacunar ligaments at their medial insertions. It is considered the posterior margin of the femoral canal. It can be used as a mooring point for sutures while repairing the posterior wall of the inguinal canal in hernias^[7,9].

j) The reflected part of the inguinal ligament is also called the Ligamentum Colles. It consists of fibres that run upwards and medially from the lateral crus of the superficial inguinal ring. It lies behind the superficial inguinal ring and in front of the conjoint tendon. It's fibres interlace with those of the opposite side at the linea alba^[7].

k) Intercrural fibres arise from middle of inguinal ligament, and arch over the superficial ring to keep its crura together^[7].

l) The Iliopubic tract of Thompson is derived from the fascia transversalis. It stretches from the anterior superior iliac spine to the pubis.

m) It lies posterior to and adjacent to the inguinal ligament laterally. As it trajectories medially, it gets separated from the inguinal ligament and forms the inferior border of the internal ring. It bridges across the femoral vessels, and reinforces the anterior margin of the femoral sheath^[6].

n) The iliopubic tract if well developed (as in majority of cases) can be used for hernia repair.

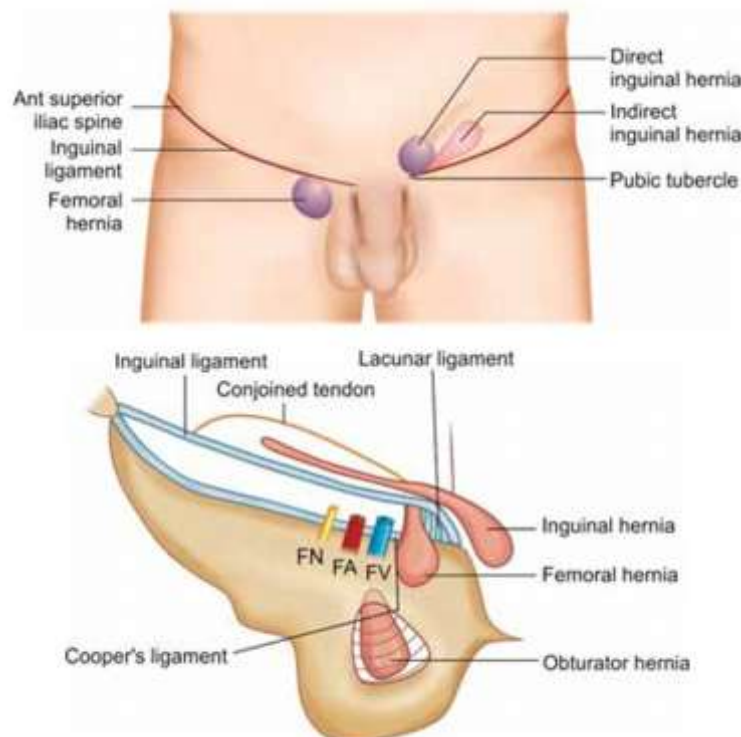


Fig 12 – Inguinal Ligament, Lacunar Ligament and
Cooper’s Ligament

MYOPECTINEAL ORIFICE OF FRUCHAUD: (Fig 13).

In 1956, H.Fruchaud, a French surgeon, described an oval shaped area in the groin protected only by the combined lamina of the aponeurosis of the transversus abdominis and the fascia transversalis where all groin hernias occur and is called the Myopectineal orifice.

It is bounded;

Superiorly – by the arching fibres of the internal oblique and the transversus abdominis muscles

Medially –by the lateral border of the rectus muscle

Inferiorly – by Cooper’s ligament

Laterally – by Iliopsoas muscle.

The inguinal ligament and the iliopubic tract divide the MPO into two;

a)Superior compartment containing the inguinal canal. It can be divided into medial and lateral compartments.

b)Inferior compartment containing the femoral canal^[6].

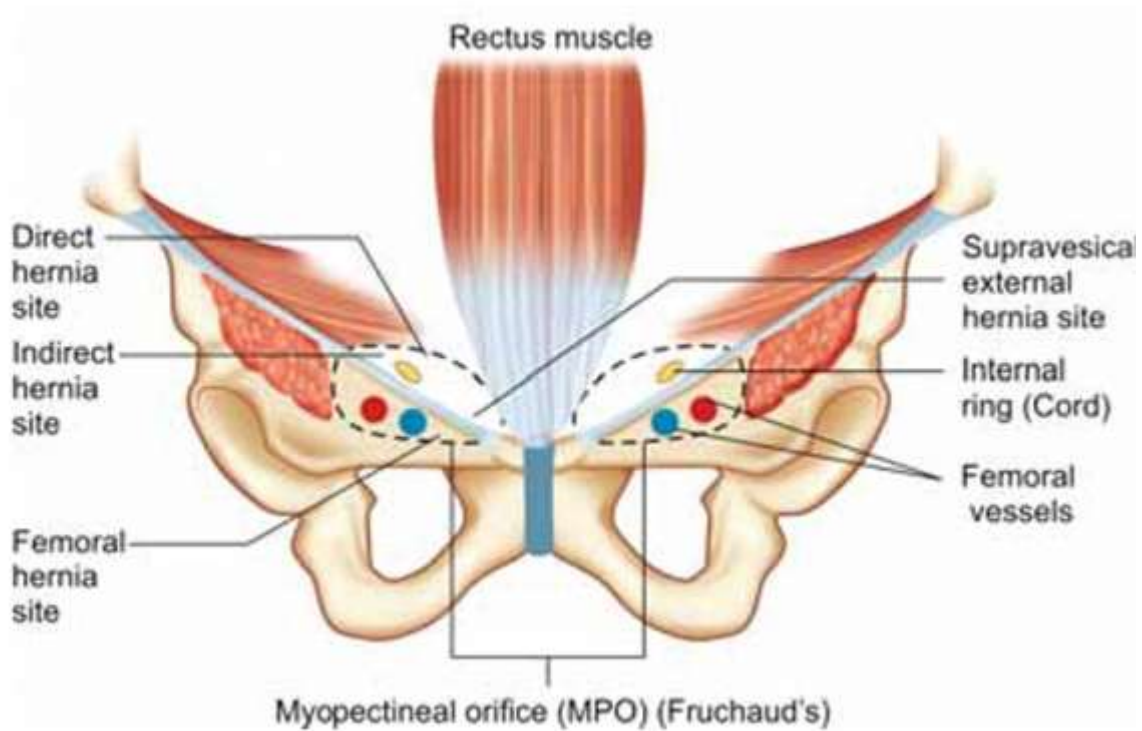


Fig 13- Myopectineal Orifice Of Fruchaud

NERVE SUPPLY OF ANTERIOR ABDOMINAL WALL:

ROOT VALUE: T7 TO L1.(Fig 14).

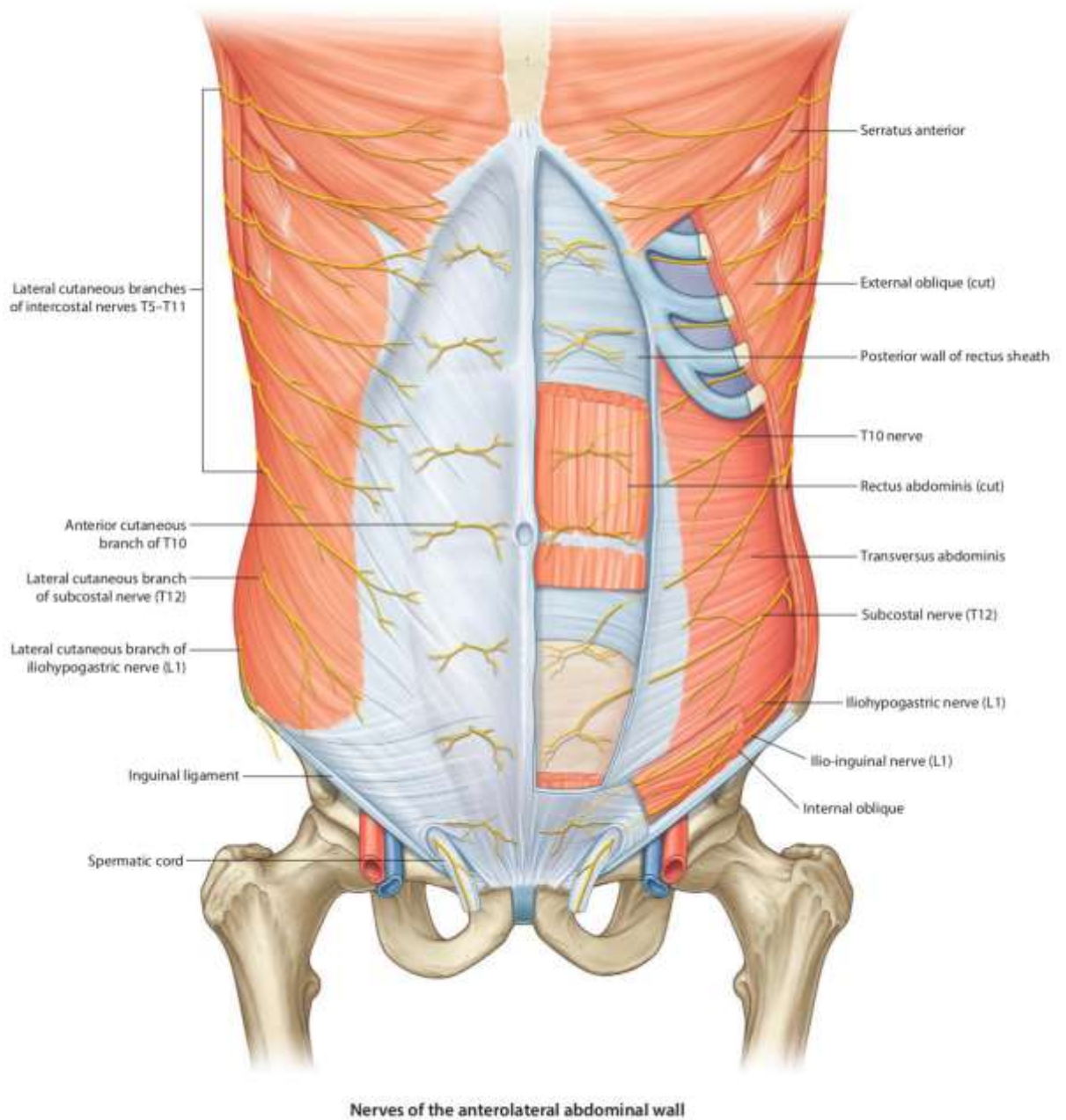


Fig 14 – Nerves Of the Anterior Abdominal Wall

NERVES:

- 1) The anterior cutaneous nerves are seven in number.

- They are derived from the lower five intercostal nerves , the subcostal nerve and the iliohypogastric nerve.
- 2) Intercostal nerves run between the Internal Oblique and Transversus abdominis.
 - 3) Then they pierce the posterior lamina of the internal oblique aponeurosis to enter the rectus sheath.
 - 4) Within the sheath ,they pass behind the rectus abdominis , then pierce the rectus muscle and the anterior wall of the rectus sheath close to the median plane , divide into medial and lateral branches and supply the skin of the front of the abdomen^[7].(Fig 15).

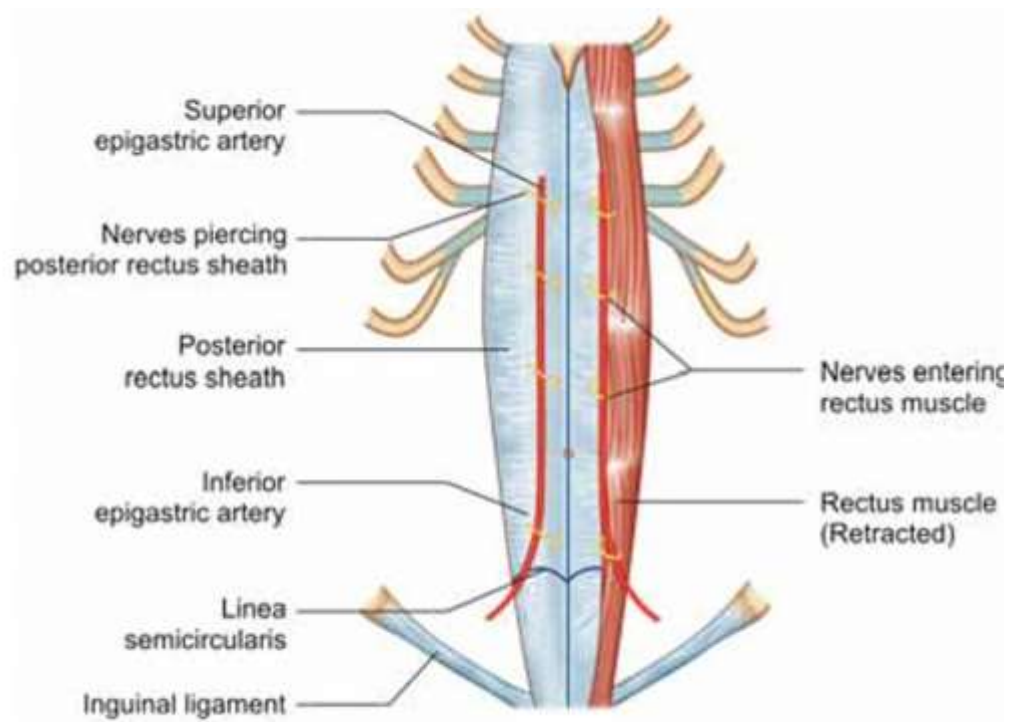


Fig 15 – Anterior Cutaneous Nerves

- 5) They are arranged in serial order. T7 near the xiphoid process , T10 at the level of the umbilicus and the Iliohypogastric nerve 2.5 cm above the superficial inguinal ring, and others at proportionate distances between them^[7].
- 6) Subcostal Nerve supplies the Pyramidalis muscle.
- 7) Iliohypogastric nerve emerges from the lateral edge of the psoas muscle and becomes cutaneous 2.5 cm above the superficial inguinal ring^[7].(Fig 16).
- 8) It supplies the skin in the suprapubic region with sensory fibres^[6].

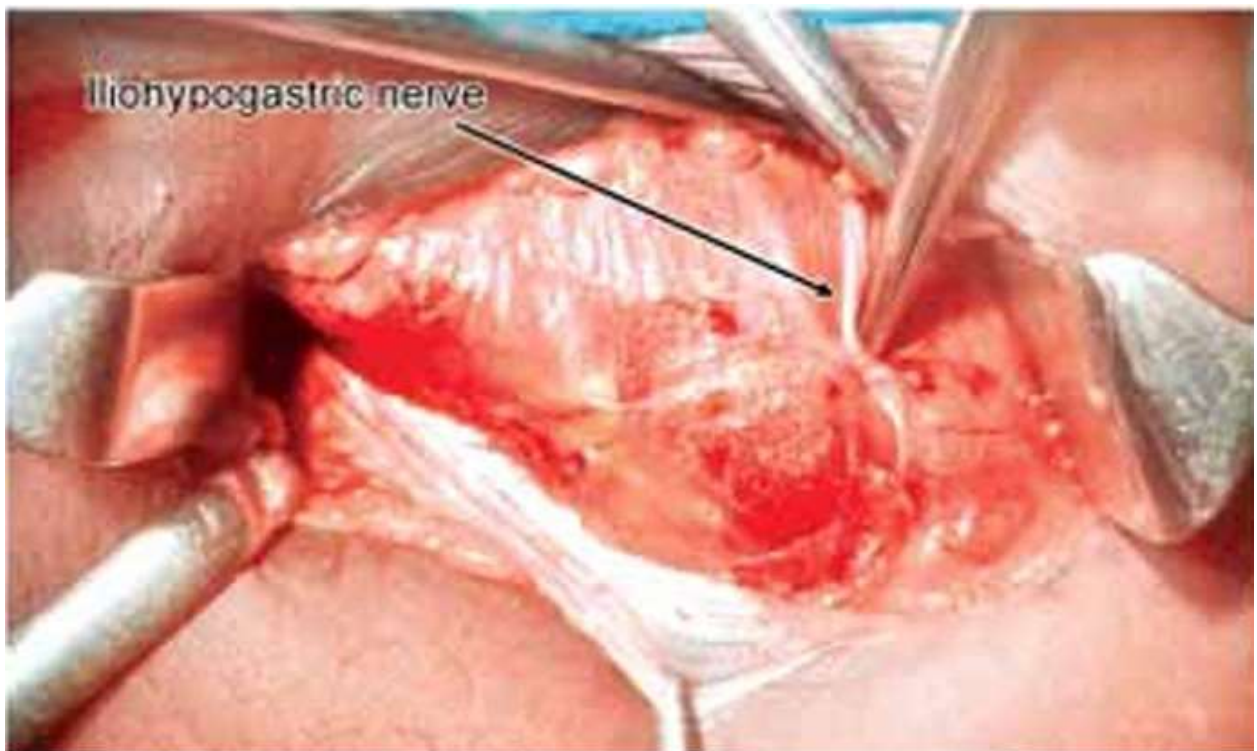
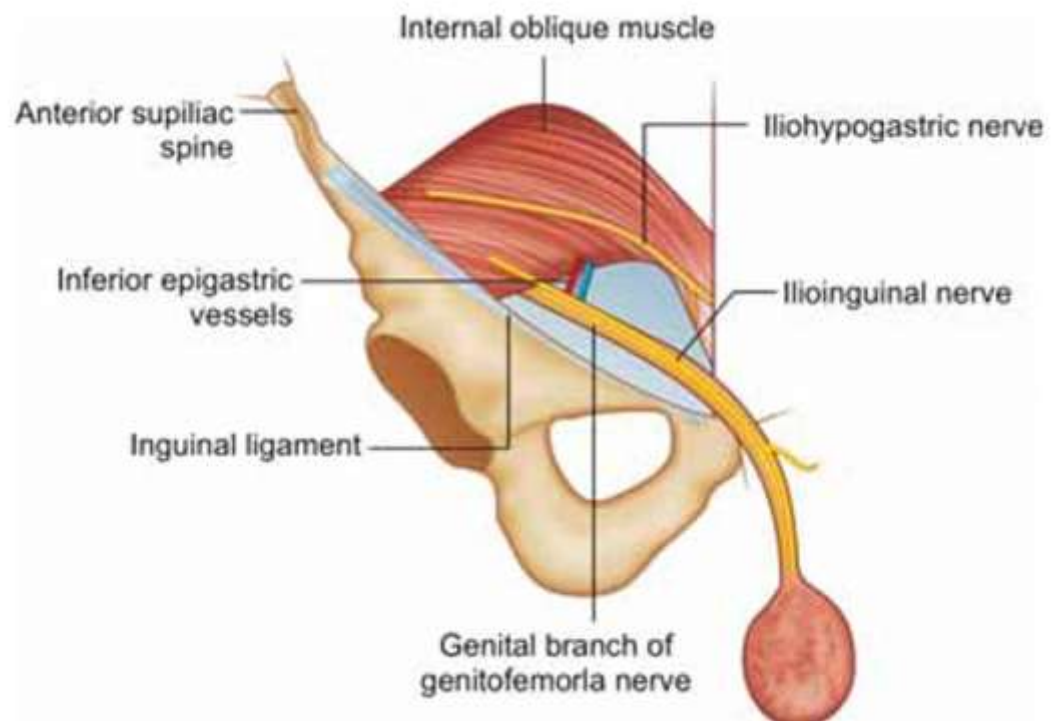


Fig 16 – IlioHypogastric Nerve

- 9) The ilioinguinal nerve, although a content of the canal, does not enter the canal through the deep ring.
- 10) It pierces the internal oblique muscle, i.e it slips into the canal from the side, not from the back.
- 11) The terminal part of the Ilioinguinal nerve emerges through the superficial inguinal ring, pierces the external spermatic fascia and descends to supply the skin of the external genitalia and the upper part of the medial side of the thigh^[6,7]. (Fig 17, 18).



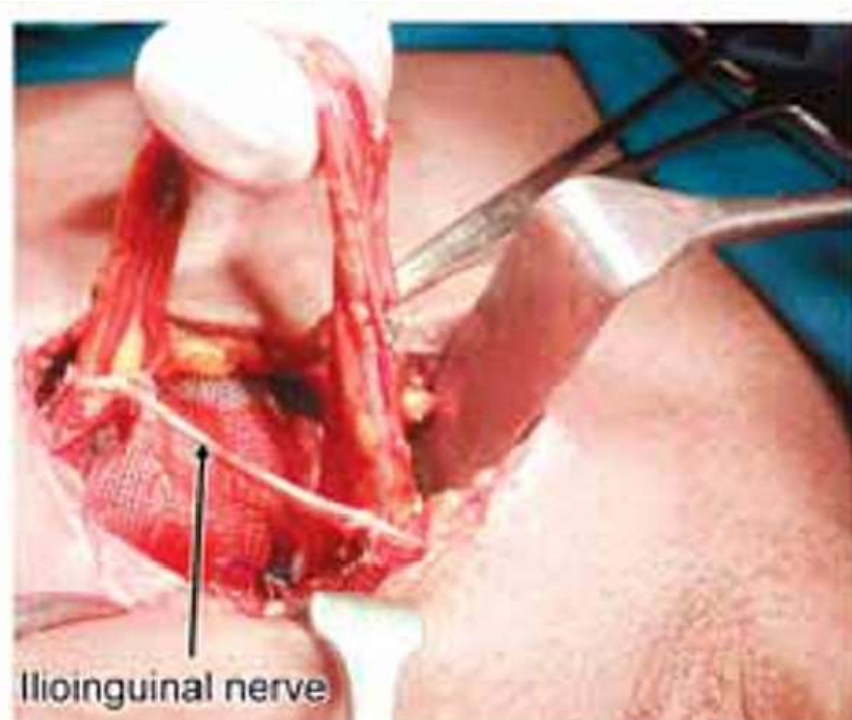


Fig 17, 18 – IlioInguinal Nerve

- 12) A common variant is for the ilioinguinal and iliohypogastric nerves to exit around the superficial inguinal ring as a single entity.
- 13) The Genitofemoral nerve (L1,L2) runs along the anterior aspect of the psoas muscle and divide before reaching the internal ring. The genital branch penetrates the iliopubic tract lateral to the deep ring and then enters the ring to join the cord. It supplies the anterior scrotum with sensory fibres, the cremaster muscle with motor fibres and is the efferent limb for the cremasteric reflex. The femoral branch courses beneath the inguinal

ligament to provide sensation to the anteromedial thigh and is the afferent limb for the cremasteric reflex^[6].(Fig 19,20).

- 14) The lateral cutaneous nerves are derived from the lower two intercostal nerves. Each nerve has a large anterior and small posterior branch , both of which emerge between the lower digitations of the external oblique muscle and supply the skin of the side of the abdomen. The larger anterior branches also supply the external oblique muscle^[7].
- 15) The lateral cutaneous branches of the subcostal and the iliohypogastric nerves descend over the iliac crest and supply the skin of the anterosuperior part of the gluteal region^[7].
- 16) The lateral femoral cutaneous nerve arises from L2-L3, emerges lateral to the psoas muscle at L4, and crosses the iliacus muscle obliquely toward the anterior superior iliac spine. It then passes inferior to the inguinal ligament where it divides to supply the lateral thigh^[6].

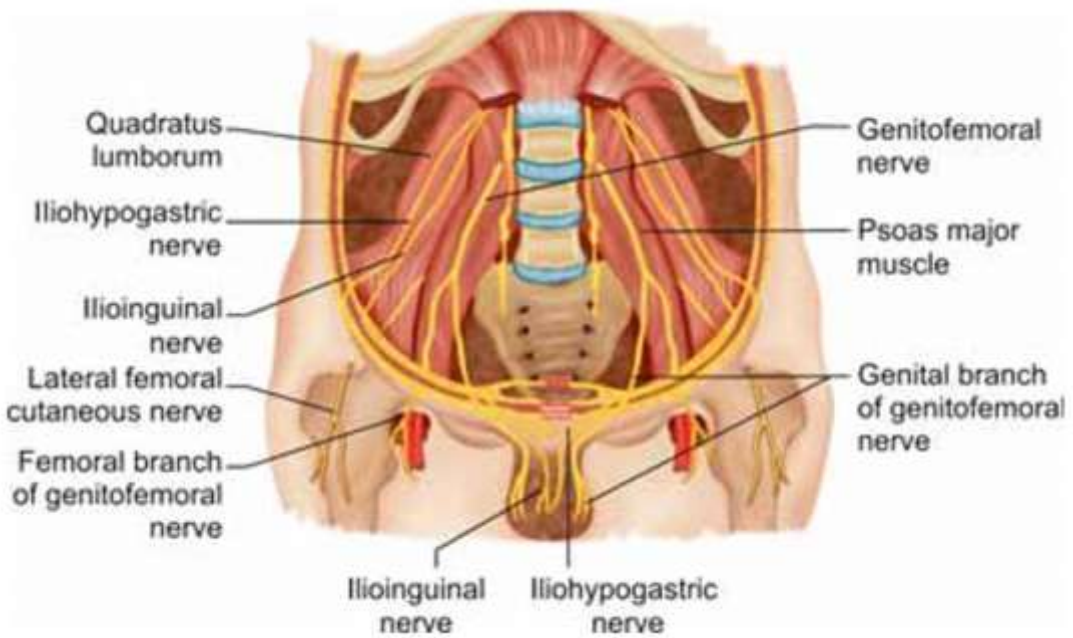
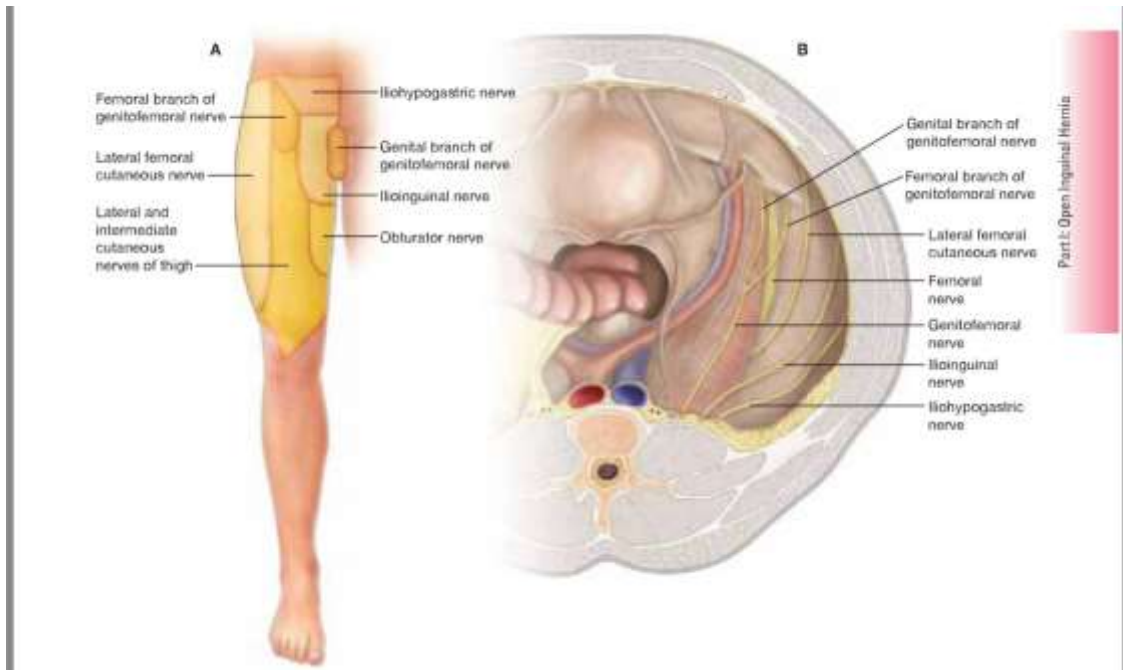
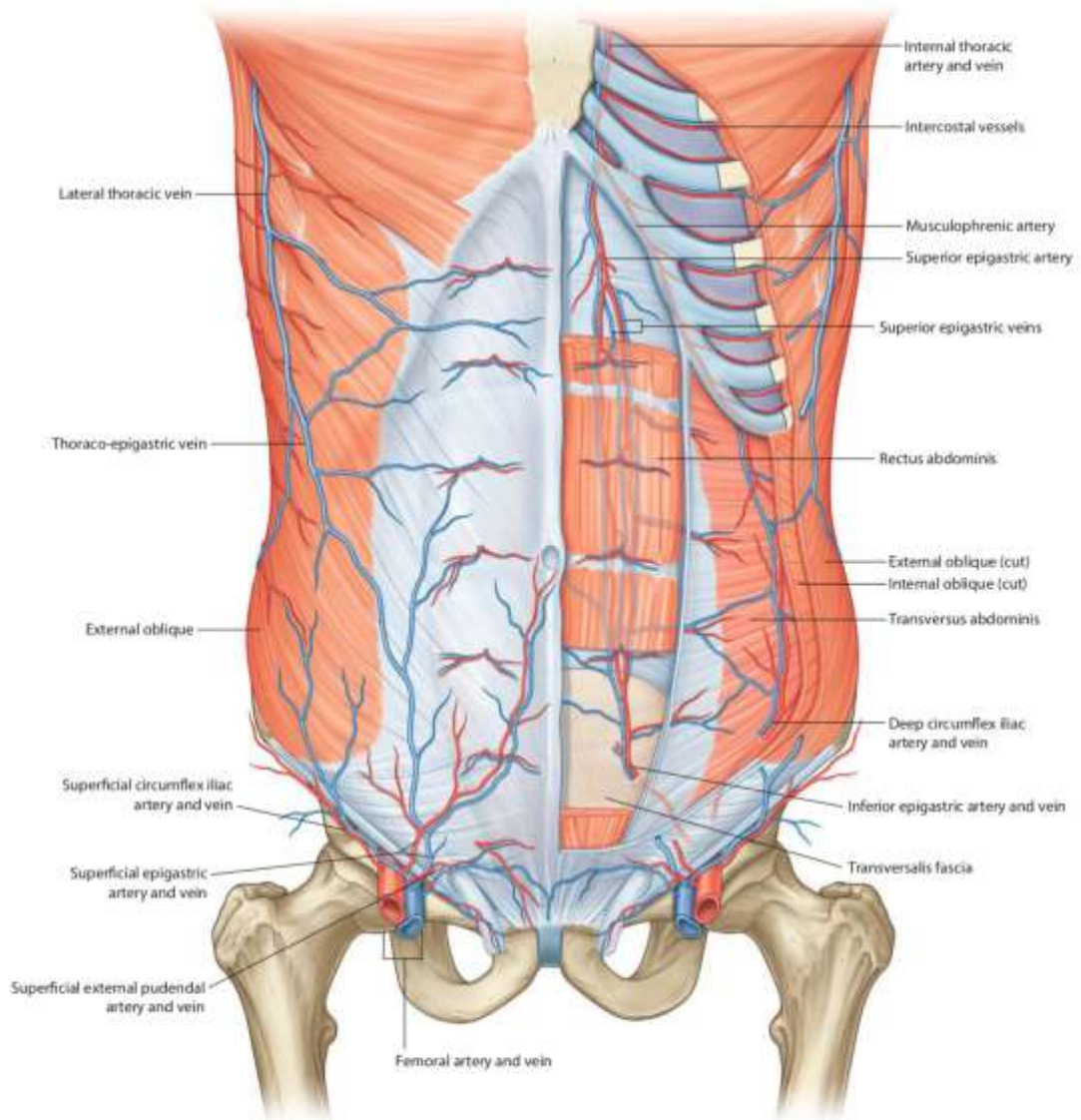


Fig 19, 20 – Nerves Of the Anterolateral Abdominal Wall –
Internal View

ARTERIES: (Fig 21,22).

- 1) The anterior cutaneous arteries are the branches of the superior and inferior epigastric arteries , and accompany the anterior cutaneous nerves.
- 2) The lateral cutaneous arteries are branches of the lower intercostal arteries and accompany the lateral cutaneous nerves.
- 3) The superficial inguinal arteries arise from the femoral artery and supply the skin over the lower part of the abdomen. They are the superficial epigastric artery, the superficial external pudental artery and the superficial circumflex iliac artery^[7].



Vasculature of the anterior abdominal wall

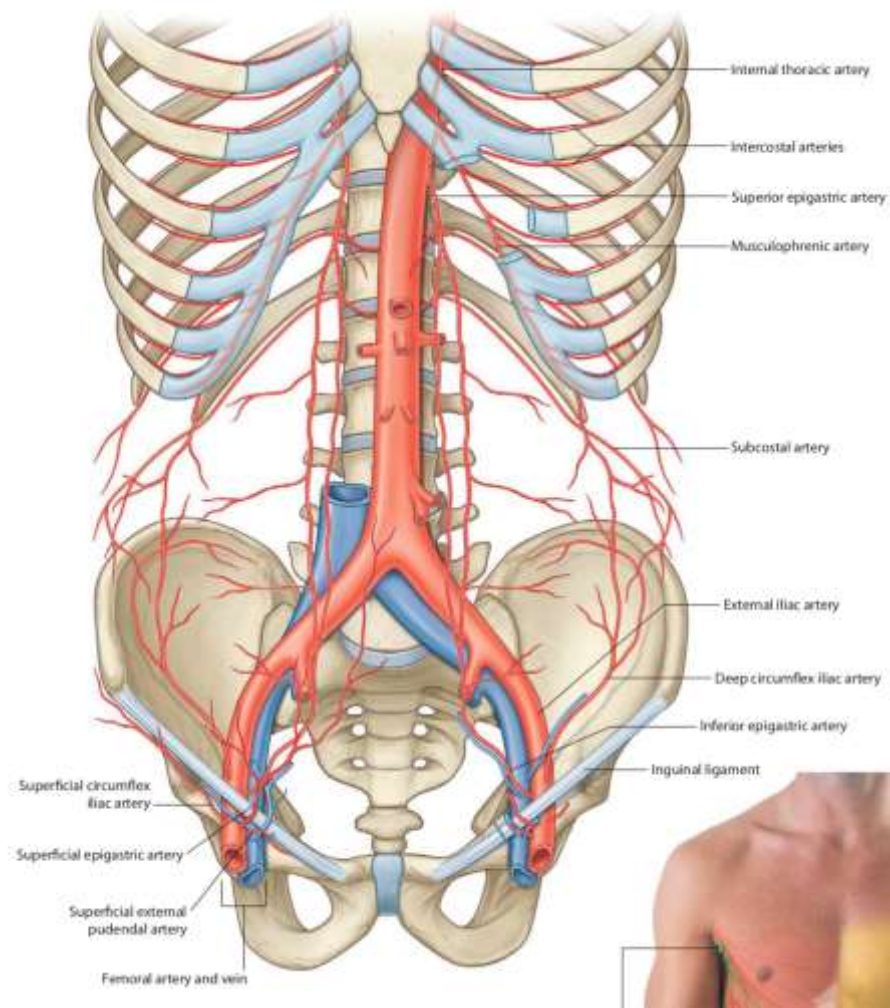


Fig 21, 22- Arteries of the Anterolateral Abdominal Wall

INFERIOR EPIGASTRIC ARTERY : (Fig 23).

The inferior epigastric artery along with the vein cross over the iliopubic tract along the medial aspect of the internal ring and ascend along the posterior surface of the rectus muscles , invested in a fold of peritoneum called lateral umbilical ligament.

Near its takeoff, it gives two branches – the cremasteric and pubic.

The cremasteric branch penetrates the transversalis fascia and joins the spermatic cord.

The pubic branch courses in a vertical fashion inferiorly, crossing Cooper's ligament, and anastomoses with the Obturator artery forming a circle – the CORONA MORTIS - before entering the obturator foramen. Injury to this circle, usually sustained while working in the area of Cooper's ligament, may cause copious bleeding^[6].

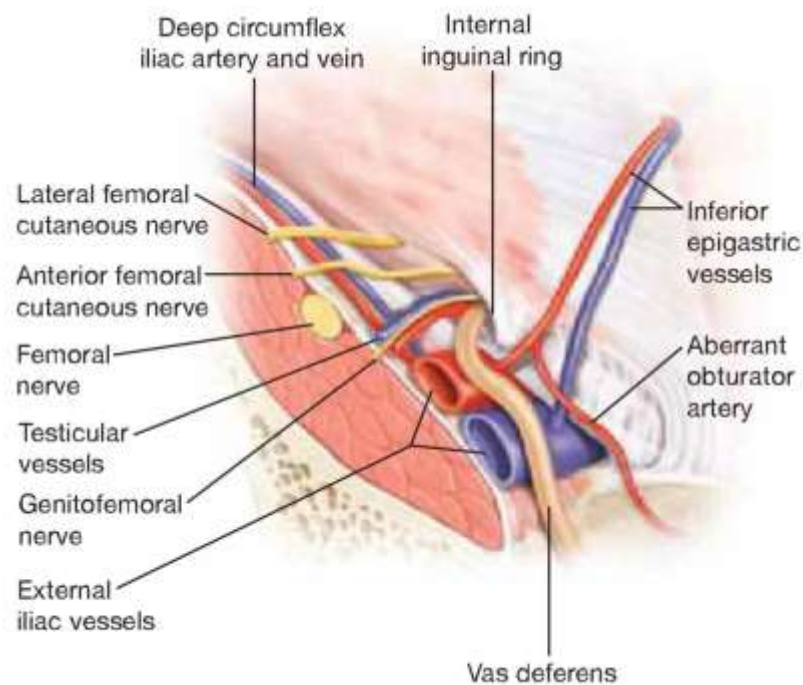


Fig 23 – Inferior Epigastric Artery

VEINS :

- 1)The veins also accompany the arteries.
- 2)The superficial inguinal veins drain into the GSV^[6].

LYMPHATICS:

Above the level of the umbilicus , the lymphatics drain into the axillary lymph nodes, while below the level of the umbilicus, the lymphatics drain into the superficial inguinal nodes^[7].

ACTIONS OF THE MAIN MUSCLES OF THE ANTERIOR

ABDOMINAL WALL ^[6,7,8,9]:

- 1) The muscles provide a firm but elastic support for the abdominal viscera against gravity . This is chiefly due to the tone of the muscles.
- 2) They can compress the abdominal viscera and help in forceful acts of expulsion like micturition, defaecation, parturition, vomiting etc.
- 3) They can compress the lower part of the thorax and help in forceful acts of expiration like, coughing, sneezing, blowing, shouting etc.
- 4) Lateral flexion of the trunk on one side is brought about by contraction of one side abdominal muscles.
- 5) Rotation of the trunk is brought about by a combined action of one side external oblique with opposite internal oblique.

The area on and deep to the posterior wall that is bounded by the inferior epigastric artery laterally, the lateral border of the rectus abdominis medially and below by the inguinal ligament is the Inguinal triangle of Hasselbach^[8]. (Fig 24).

Hasselbach's triangle is divided into medial and lateral halves by the obliterated umbilical artery.

By definition, a hernial sac passing lateral to the artery i.e through the deep ring is an indirect inguinal hernia and one which passes medially is a direct inguinal hernia. The direct hernia can be medial or lateral^[8]. (Fig 25, 26, 27).

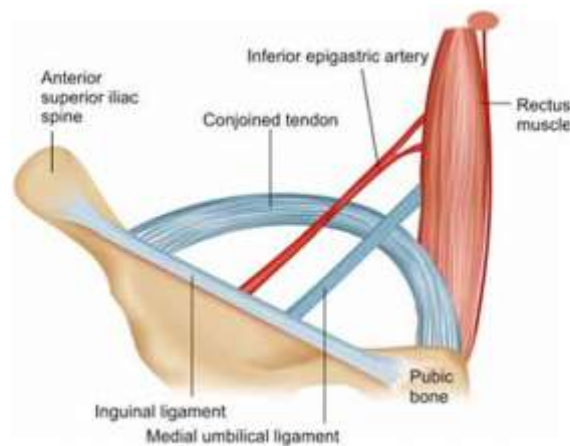


Fig 24 – Hasselbach's Triangle

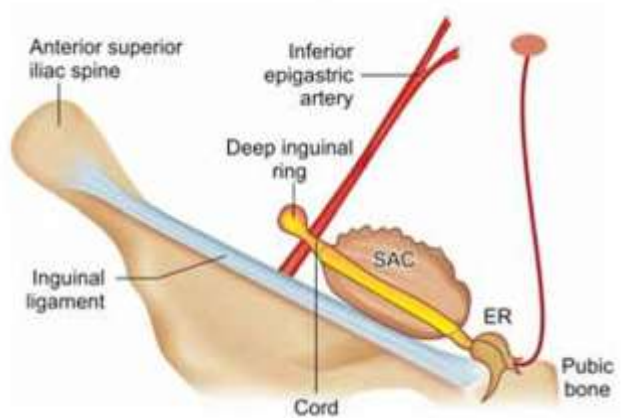
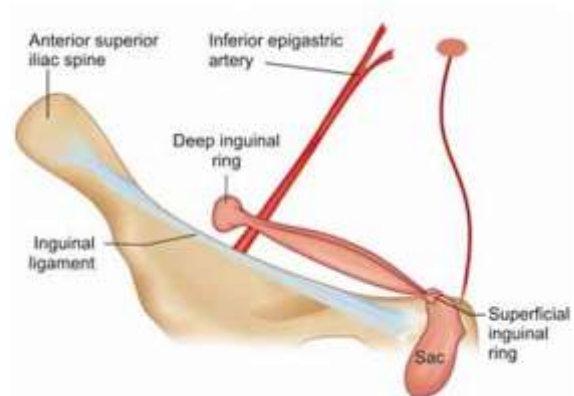
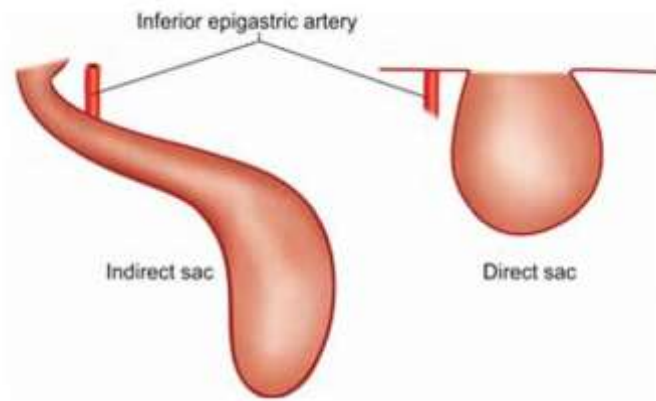


Fig 25, 26, 27 – Indirect and Direct Hernia

COVERINGS OF INDIRECT SAC^[7]: (Fig 28).

- 1) Extra peritoneal tissue
- 2) Internal spermatic fascia

- 3) Cremasteric fascia
- 4) External spermatic fascia
- 5) Skin.

COVERINGS OF LATERAL DIRECT SAC^[7]: (Fig 28).

- 1) Extra peritoneal tissue
- 2) Fascia transversalis
- 3) Cremasteric Fascia
- 4) External spermatic fascia
- 5) Skin

COVERINGS OF MEDIAL DIRECT SAC^[7]: (Fig 28).

- 1) Extraperitoneal tissue
- 2) Fascia transversalis
- 3) Conjoint tendon
- 4) External spermatic fascia
- 5) Skin.

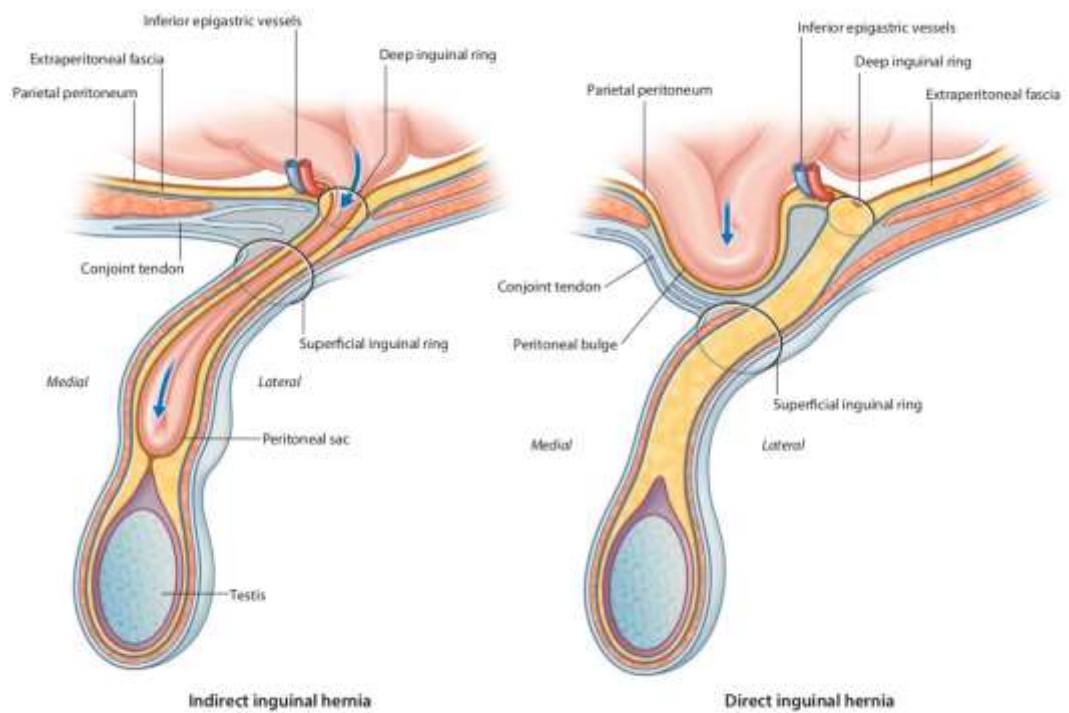


Fig 28 – Coverings OF Various Hernia Sacs

AETIOLOGY OF HERNIA:

- 1) Straining
- 2) Lifting of Heavy weight
- 3) Chronic cough
- 4) Chronic constipation
- 5) Urinary causes like BPH, Carcinoma prostate, Stricture,
Phimosi s etc
- 6) Obesity
- 7) Repeated pregnancy
- 8) Smoking

- 9) Ascites
- 10) Post – appendectomy
- 11) Familial Collagen disorder – Prune Belly Syndrome
- 12) Collagen deficiency causing acquired hernias –
Metastatic Emphysema of REED.

PARTS OF HERNIA:

- 1) Sac
- 2) Covering
- 3) Content

Sac is a diverticulum of peritoneum. It contains mouth, neck , body and fundus.

CLINICAL CLASSIFICATION OF HERNIA:

- 1) Reducible hernia
- 2) Irreducible hernia
- 3) Obstructed hernia
- 4) Inflamed hernia
- 5) Strangulated hernia.

REPAIR OF HERNIA:

Evidence of surgical repair of inguinal hernias date back to the ancient Egyptian and Greek Civilizations. Early

management often involved a conservative approach, with operations being reserved only for complications.

Surgery often involved routine excision of the testicles, and wounds were closed with cauterization or left to granulate on their own. Both mortality and recurrence rates were high.

From the 1700s to 1800s ,many physicians including Hesselbach, Cooper, Camper, Scarpa, Richter and Gimbernat identified vital components of the inguinal region. These combined with aseptic techniques led many surgeons to perform sac dissection, high ligation and closure of the internal ring^[10].

The first prosthetic material used was Marlex mesh by Usher in 1958^[10]. The posterior wall was opened and Marlex mesh was sutured to the undersurface of the medial margin defect and to the shelving edge of the inguinal ligaments. Some tails were created in the mesh that went around the spermatic cord and were secured to the inguinal ligament.

In the early 1980s, Lichtenstein popularized the tension free repair, supplanting previous tissue based repairs with the widespread acceptance of prosthetic materials for

inguinal floor reconstruction. This technique was superior because prosthetic materials could restore the strength of the transversalis fascia, thereby avoiding tension in the defect closure. Superior results were reproducible regardless of the hernia size and type, and they were achievable among expert and non-expert surgeons alike^[10].

Currently, repair of hernia may be open or laparoscopic.

Open repairs may be;

1) Pure tissue repairs :

Shouldice, Modified Bassini's, Mcvay repair etc

2) Prosthetic repairs:

Lichtenstein, Rives, Gilbert, Stoppa etc.

Laparoscopic repairs may be Transabdominal Preperitoneal repair (TAPP) or Totally Extraperitoneal repair (TEP).

LICHTENSTEIN TENSION FREE HERNIOPLASTY:

The need for a prosthetic repair was first proposed by Billroth who stated that “ If only the proper material could be created to artificially produce tissue of density and toughness of fascia and tendon, the secret of the radical cure for hernia

could be discovered”^[10].

The Lichtenstein group popularized the routine use of mesh in 1984 and coined the term , “Tension free Hernioplasty”. The previous generation’s fear of infection and rejection of prosthesis was removed by Nyhus, who stated in 1989 that , “ My concerns relative to the potentially increased incidents of infection or rejection of polypropylene mesh have not been warranted till date”^[10].

In the tension free hernioplasty, instead of suturing anatomic structures that are not in apposition, the entire inguinal floor is reinforced by insertion of a sheet of mesh. The prosthesis that is placed between the transversalis fascia and the external oblique aponeurosis extends well beyond the Hasselbach’s triangle in order to provide sufficient mesh-tissue interface.

On increased intra-abdominal pressure, the external oblique aponeurosis contracts against the mesh, thus protecting the inguinal canal. Thus the procedure addresses both the hazardous suture – line tension and the metabolic causes of hernia. The operation is therefore therapeutic as well as prophylactic. It protects the entire groin from all future

mechanical and metabolic adverse effects.[10]

Position : Supine

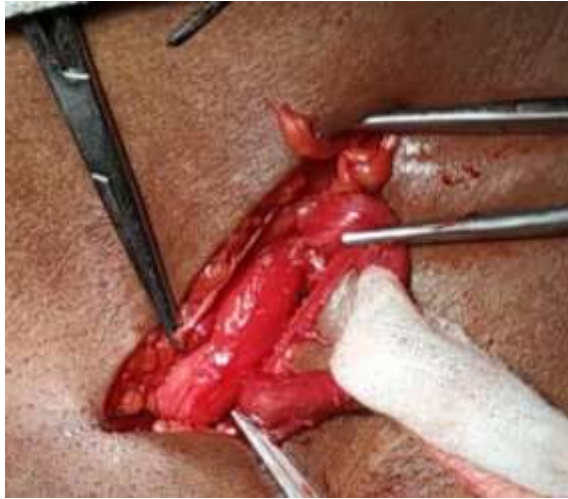
Anaesthesia : Regional or Local.

Technique^[6,10,11] :

- 1) A 5-6 cm skin incision which starts from the pubic tubercle and extends laterally within the longer line, gives an excellent exposure of the pubic tubercle and the internal ring.
- 2) The external Oblique aponeurosis is opened and it is separated from the cord structures and the internal oblique muscle.



- 3) The cord with its cremaster covering is separated from the floor of the inguinal canal and the pubic bone for a distance of approximately 2 cm beyond the pubic tubercle.



- 4) The internal ring is explored for indirect hernial sacs by incising the cremasteric sheath at the level of the deep ring.
- 5) Indirect sacs are freed from the cord to a point beyond the neck of the sac and are inverted into the preperitoneal space with or without ligation depending on the surgeons preference.
- 6) The wall of the excess distal sac is excised.
- 7) Findings are confirmed in case of indirect / direct sac.
- 8) A sheet of 8*16 cm mesh is used. Monofilament polypropylene meshes in the control group (swadeshi monofilament polyethylene mesh in the study group) are preferred because their surface texture promotes fibroplasias and their monofilament structure do not perpetuate or harbor infection.
- 9) The mesh is cut in the shape of a footprint, with a lower,

sharp angle to fit into the angle between the inguinal ligament and the rectus sheath and an upper, wide angle to spread over the rectus sheath.

- 10) With the cord retracted, the sharper corner is sutured with a non- absorbable suture material to the insertion of the rectus sheath to the pubic bone and overlapping the bone by 1-2 cm. (The periosteum is avoided). The overlapping mesh is sutured to the rectus.
- 11) This suture is continued as a continuous suture attaching the mesh to the inguinal ligament upto a point just lateral to the internal ring. Suturing the mesh beyond this point is unnecessary and may injure the femoral nerve.
- 12) A slit is made in the lateral end of the mesh, creating two tails, a wide one (two-thirds above) and a narrower one(one-thirds below).



- 13) The wider upper one is crossed and placed over the narrower one and sutured.
- 14) The mesh is further fixed to the internal oblique and the rectus sheath.



- 15) A suction drain is kept below the external oblique muscle. The wound is closed in layers.



TECHNICAL ASPECTS OF LICHTENSTEIN'S REPAIR^[10] :

- 1) Use a large sheet of mesh that extends medial to the pubic tubercle, above the Hasselbach's triangle and lateral to the internal ring.
- 2) Cross the tails of the mesh behind the spermatic cord.
- 3) Secure the upper edge of the mesh to the rectus sheath and internal oblique aponeurosis.
- 4) Keep the mesh in a relaxed, tented or sagittal position.
- 5) Visualize and protect the Ilioinguinal, Iliohypogastric and genitofemoral nerves during the operation.

Based on RCTs, tension free hernioplasty with mesh is superior to Bassini's and Shouldice repairs.

CHARACTERISTICS OF AN IDEAL MESH

- High tensile strength
- Suture maintenance
- Ideal porosity to aid rapid fibroblast colonisation
- Minimum shrink tendency
- Ideal rigidity
- No loss of mesh filaments or fraying when shaping
- The indigenous mosquito net material has the above qualities to be utilised as a mesh prosthesis

PROPERTIES OF POLYPROPYLENE MESH

| Product | Material | Absorbable | Pore size | Weight | Filament | Tensile strength |
|--------------------------------|---------------|------------|-----------|--------|---------------|------------------|
| Vicryl | polyglactin | yes | 0.4 | 56 | multifilament | 13.5 N/cm |
| Prolene | polypropylene | no | 0.8 | 80-100 | monofilament | 156.5 N/cm |
| mosquito net/swadeshi material | polyethylene | no | 0.33 | 37.5 | monofilament | 16.94 N/cm |

| Product | Material | Absorbable | Pore size | Weight | Filament | Tensile strength |
|--------------------------------|---------------|------------|-----------|--------|---------------|------------------|
| Vicryl | polyglactin | yes | 0.4 | 56 | multifilament | 13.5 N/cm |
| Prolene | polypropylene | no | 0.8 | 80-100 | monofilament | 156.5 N/cm |
| mosquito net/swadeshi material | polyethylene | no | 0.33 | 37.5 | monofilament | 16.94 N/cm |

SWADESHI MATERIAL (MOSQUITO NET/POLYETHYLENE MESH)



The swadeshi material used in the study is the indigenously manufactured mosquito net made of polyethylene material. The mosquito net material was subjected to analysis for both physical and chemical properties at the SOUTH INDIA TEXTILE RESEARCH ASSOCIATION (SITRA), COIMBATORE. Before using the swadeshi material in surgery, they were sterilized with ethylene oxide (EtO). The swadeshi material obtained from indigenously prepared mosquito net is a macroporous, monofilament, non absorbable polyethylene mesh.

| | |
|---|--------|
| Mean Filament yarn diameter mm | 0.1153 |
| Mean mesh thickness mm | 0.4 |
| Mean Pore area (pore part only)in sq.mm | |
| Maximum | 0.1237 |
| Minimum | 0.1038 |
| Average | 0.1153 |
| Mean mesh GSM | 37.6 |
| Average Yarn Count (Denier) | 91 |
| Porosity % (Overall) | 69.35 |
| Thickness in mm. | 0.39 |
| Fabric Weight g/sq.mtr | 37.53 |
| Bursting Strength (Kgs/sq.cm) | 4.9 |
| Tensile Strength (Strip Method)-ISO | |
| Warp Strength (kg) | 16.94 |
| Warp Elongation (%) | 53.26 |
| Weft Strength (kg) | 14.59 |
| Weft Elongation (%) | 59.71 |

CHEMICAL PARAMETERS

- No hazardous dye in the material used
- No insecticide in the material used
- The material used is polyethylene



**THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
SITRA CHEMICAL LABORATORY**

13/37 Avanasli Road, Aerodrome Post, Coimbatore - 641 014, INDIA
Ph : (0422) 2574367-9, 4215334, 4215328 Fax : (0422) 2571898, 4215300
Email: chem@sitra.org.in, info@sitra.org.in Website: http:// www.sitra.org.in
Address all correspondence to the Director ISO/IEC 17025 : 2005 NABL ACCREDITED Cert. Number T-358



Dr.Akshar.A

Ref : Mail - Dt.20.03.18

| | |
|--|---|
| Identification of Textile Fibres <i>As per AATCC TM 10 - 2011</i> | N1800034-1 Mosquito Net - Mesh |
| Identification of Fibres | Polyethylene |
| Melting Point, deg C | 139.0 |

- End of Report -



THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

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Email: info@sitra.org.in

Website: [http:// www.sitra.org.in](http://www.sitra.org.in)

Address all correspondence to the Director

Dr.Akshar.A

K1800025

TEST RESULTS

The given Mosquito net sample was tested and the results are given below:

| Test | Results |
|--|---------|
| Mean Filament yarn diameter mm | 0.1153 |
| Mean mesh thickness mm | 0.40 |
| Mean Pore area (pore part only) in sq.mm | 0.12366 |
| Maximum | 0.10377 |
| Minimum | 0.11533 |
| Average | |
| Mean mesh GSM | 37.6 |
| Average Yarn Count (Denier) | 91.0 |
| Porosity % (Overall) | 69.35 |

- End of Report -



THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

SITRA PHYSICAL LABORATORY

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Ph: (0422) 2574367-9, 6544188, 4215333 Fax: (0422) 2571896, 4215300
E-mail: physics@sitra.org.in, info@sitra.org.in Website: http://www.sitra.org.in
Address all correspondence to the Director ISO/IEC 17025 : 2005 NABL ACCREDITED



| | |
|----------------------------------|---------------------------------|
| Test Report No : C1800005 | Report Date : 07-04-2018 |
| Dr.Akshar.A | Reference : 26.03.2018 |

Samples Tested at : R.H. 65% ± 2% and Temp. 21 Degree C ± 1 Degree C

| | |
|---|--|
| Fabric - Thickness (ASTM D 1777-96) (Reapproved 2015) | C1800005-1 FABRIC SAMPLE SAMPLE - C MOSQUITO NET |
| Thickness in mm. | 0.39 |

| | |
|--|--|
| Fabric - Weight (ASTM) (As per ASTM D 3776/D 3776 M-09a (2017)-Option C) | C1800005-1 FABRIC SAMPLE SAMPLE - C MOSQUITO NET |
| Fabric Weight g/sq.mtr | 37.53 |

| | |
|---|--|
| Fabric - Bursting Strength (ISO) (ISO 13938-1:1999) | C1800005-1 FABRIC SAMPLE SAMPLE - C MOSQUITO NET |
| Bursting Strength (Kgs/sq.cm) | 4.9 |

| | |
|--|--|
| Fabric - Tensile Strength (Strip Method)-ISO (ISO 13934:1-1999 (2013)) | C1800005-1 FABRIC SAMPLE SAMPLE - C MOSQUITO NET |
| Warp Strength (kg) | 16.94 |
| Warp Elongation (%) | 53.26 |
| Weft Strength (kg) | 14.59 |
| Weft Elongation (%) | 59.71 |



M. Kumaran

Note: Denier- Yarn denier test could not be done as the yarn could not be unravelled from the mosquito net material. Tensile Strength: Gauge Length- 200mm x 50mm, Rate of Traverse- 100mm/min. Thickness: Weights- 4.14 Kpa.

- End of Report -



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Dr.Akshar.A

Ref : LT DT-29.03.2018

Cleavable Aryl Amines

| # | Name of the substance | A1800122-1 Swadeshi (Poly thelene) Material |
|----|--|--|
| | Identification GC-MSD/HPTLC/HPLC | HPTLC |
| | Quantification HPLC | HPLC |
| | Method | In House |
| 1 | 4-Aminobiphenyl | ND |
| 2 | 4-Chloro-o-toluidine | ND |
| 3 | Benzidine | ND |
| 4 | 2-Naphthylamine | ND |
| 5 | O-Aminotoluene | ND |
| 6 | 2-Amino-4-Nitrotoluene | ND |
| 7 | P-Chloraniline | ND |
| 8 | 2,4-Diaminotoluene | ND |
| 9 | 4,4'-Diaminodiphenylmethane | ND |
| 10 | 3,3'-Dimethylbenzidine | ND |
| 11 | 3,3'-Dimethylbenzidine | ND |
| 12 | 3,3'-Dimethyl-4,4'-Diamino diphenylmethane | ND |
| 13 | 2-Methoxy-5-Methyl aniline | ND |
| 14 | 4,4'-Methylenbis(2-Chloroaniline) | ND |
| 15 | 4,4'-Oxydianiline | ND |
| 16 | 4,4'-Thiodianiline | ND |
| 17 | O-Toluidine | ND |
| 18 | 2,4-Diaminotoluene | ND |
| 19 | 2,4,5-Trimethyl aniline | ND |
| 20 | O-Aniline | ND |
| 21 | P-Aminocobenzene | ND |
| 22 | 2,4-Xyldine | ND |
| 23 | 2,6-Xyldine | ND |
| 24 | 3,3'-Dichloro Benzidine | ND |

Pesticides (20 Nos.)

| # | | A1800122-1 Swadeshi (Poly thelene) Material |
|---|-------------------------------------|--|
| | Extraction : Acetonitrile,P.Benzene | Acetonitrile |
| | Clean up : n-hexane, Florisil, DEE | n-hexane |
| | Identification : | GC-MS |
| 1 | Quantification | GC-MS |
| | Aldrin | ND |
| 2 | Captafol | ND |
| 3 | Chlordane | ND |



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Dr.Akshar.A

Ref : LT DT-20.03.2018

| | | |
|----|-------------------------------------|----|
| 4 | DDT | ND |
| 5 | Dieldrin | ND |
| 6 | Endrin | ND |
| 7 | Heptachlor | ND |
| 8 | Hexachlorobenzene | ND |
| 9 | Hexachlorocyclohexane-Total isomers | ND |
| 10 | 2,4,5-T | ND |
| 11 | Chloroform | ND |
| 12 | Chlorobenzilate | ND |
| 13 | Dinoseb and its salts | ND |
| 14 | Monochlorophos | ND |
| 15 | Pentachlorophenol | ND |
| 16 | Toxaphene | ND |
| 17 | Methamidophos | ND |
| 18 | Methyl ipanthion | ND |
| 19 | Parathion | ND |
| 20 | Phosphamidon | ND |

Amines - ND-Not Detected upto 20 ppm,ND-Not Detected upto 0.5 ppm

Authorized By

- End of Report -

MATERIALS AND METHODS

Primary Objectives

- To derive conclusions about post – operative results and rate of recurrences in Lichtensteins repair with polypropylene versus a swadeshi material (polyethylene mesh) in the management of inguinal hernias.

Eligibility criteria

A.Inclusion criteria:

- Age > 18 years & < 65 years.
- Those presenting with uncomplicated inguinal/inguinoscrotal hernia.
- Patients who consented for inclusion in the study according to designated proforma .

B.Exclusion criteria:

- Age < 18 years and > 65 years.
- Patients with complicated hernias.
- Patients with Bilateral hernias.
- Patients with femoral hernias.

- Patients having hernia with hydrocele.
- Comorbid conditions.
- Immunocompromised states.
- Coagulopathy.
- Patients who did not consent to the procedure.

Methodology

- From January 2018 to January 2019, patients presenting with inguinal hernias in GRH Madurai will be recruited in this study.
- The patients were seen in surgical speciality OP in emergency and routine hours and were diagnosed on the basis of history & clinical examination.
- After obtaining consent, patients would be required to fill in a proforma (which is given below). After that patients would be randomly divided into two groups. In the first group Lichtenstein's hernia repair will be performed by polypropylene mesh. In the second group, Lichtenstein's hernia repair will be done with

swadeshi material (polyethylene mesh).

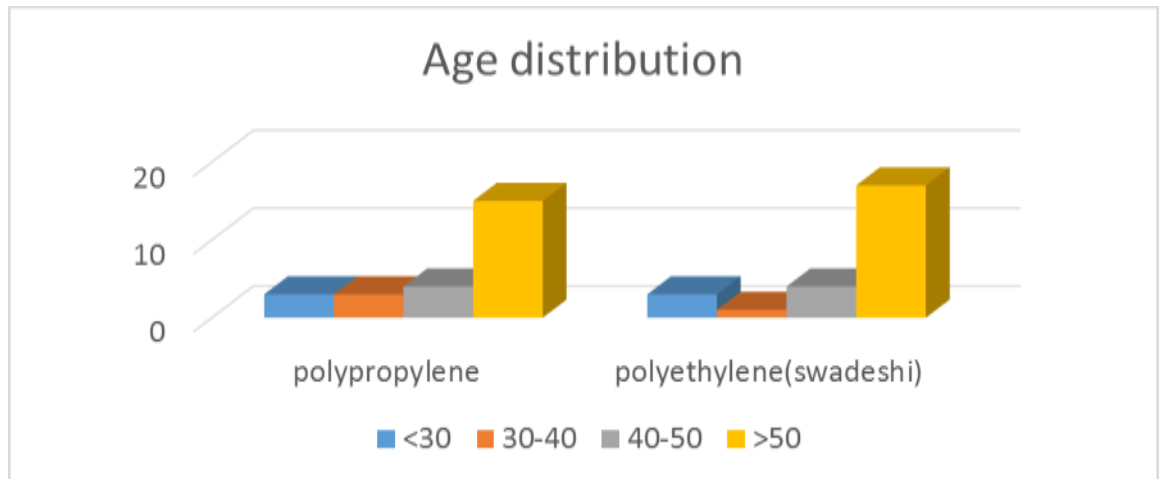
Both groups will be analyzed for,

- **POST-OPERATIVE COMPLICATIONS:**

- Pain
- Hematoma formation
- Seroma formation
- Superficial/deep wound/mesh infection
- Scrotal edema
- Loss or change in sensation in the operated groin
- Return to daily activities
- Foreign body sensation
- 2. RECURRENCE – It is a palpable hernia on examination on the same side of the repair.

RESULTS

1. AGE DISTRIBUTION:

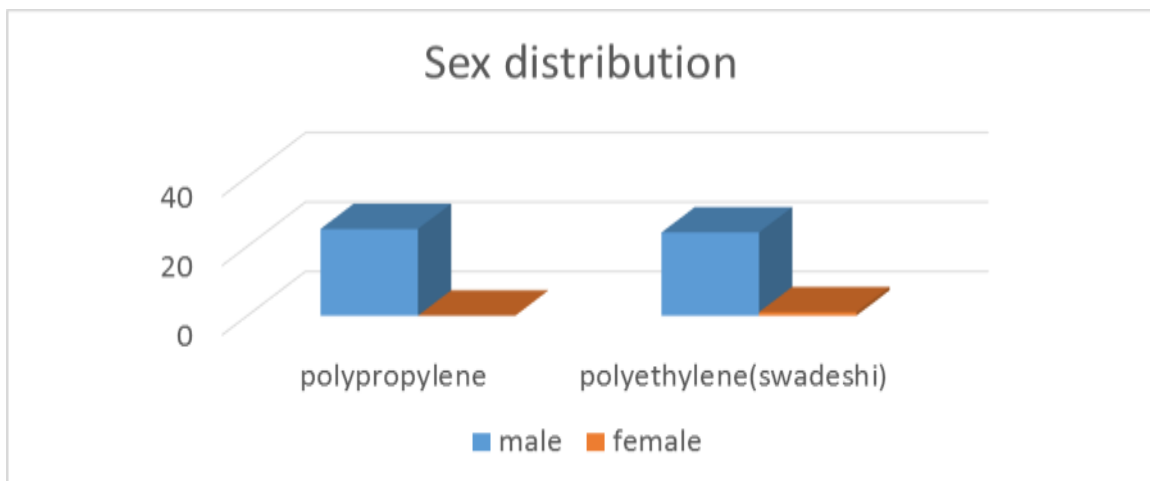


| Age | <30 | 30-40 | 40-50 | >50 | total | mean | S.D |
|------------------------|-----|-------|-------|-----|-------|-------|----------|
| Polypropylene | 3 | 3 | 4 | 15 | 25 | 48.04 | 11.77738 |
| polyethylene(swadeshi) | 3 | 1 | 4 | 17 | 25 | 48.8 | 11.14301 |

The mean age in the study group(PE mesh) and control(PP mesh) group were both 48.

2. SEX DISTRIBUTION:

Among the study and control groups, only one of the patient was a female who was in the study group(PE mesh)



| Sex | Male | female |
|-------------------------|------|--------|
| polypropylene | 25 | 0 |
| polyethylene (swadeshi) | 24 | 1 |

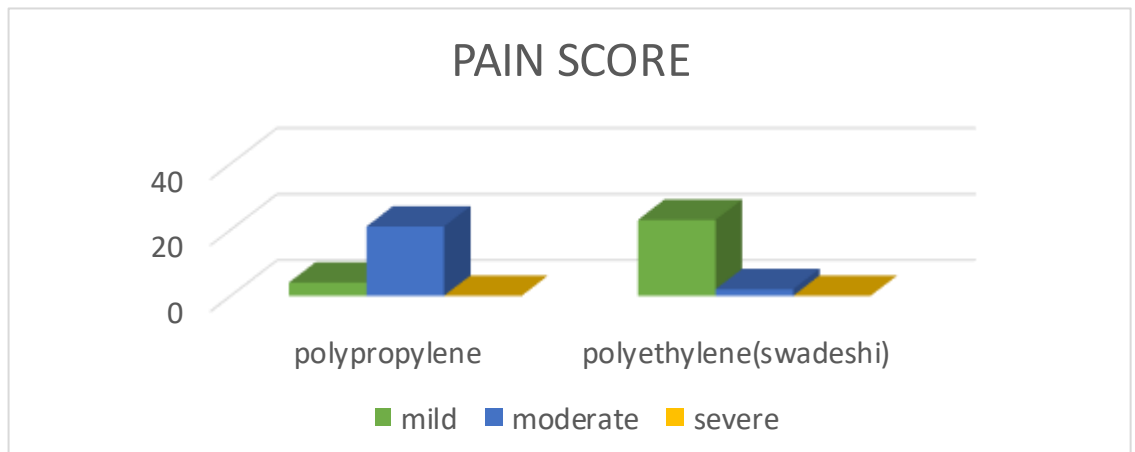
3. POSTOPERATIVE PAIN COMPARED USING VISUAL

ANALOG SCORE:

VISUAL ANALOG SCORE USED FOR POSTOPERATIVE PAIN ASSESSMENT

COMPARATIVE PAIN SCALE CHART (Pain Assessment Tool)

| | | | | | | | | | | |
|---|---|---|---|---|---|--|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |  |
| 0 Pain Free | 1 Very Mild | 2 Discomforting | 3 Tolerable | 4 Distressing | 5 Very Distressing | 6 Intense | 7 Very Intense | 8 Utterly Horrible | 9 Estruciating Unbearable | 10 Unimaginable Unspeakable |
| No Pain | Minor Pain | | | Moderate Pain | | | Severe Pain | | | |

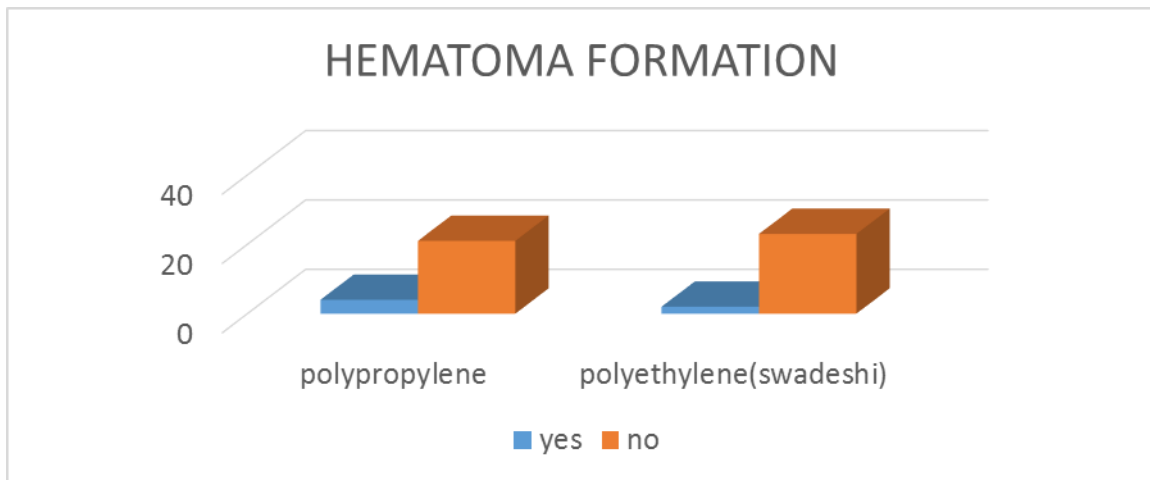


| pain score | mild | Moderate | severe | Total | mean | S.D | P' |
|------------------------|------|----------|--------|-------|------|----------|-------------|
| Polypropylene | 4 | 21 | 0 | 25 | 4.72 | 1.061446 | Significant |
| polyethylene(swadeshi) | 23 | 2 | 0 | 25 | 2.6 | 0.763763 | |

Postoperative pain was evaluated by visual analog score on the first 3 post operative days. The results are shown in the table. Patients in the study group experienced less pain compared to the control group. The difference was significant.

4. HAEMATOMA FORMATION :

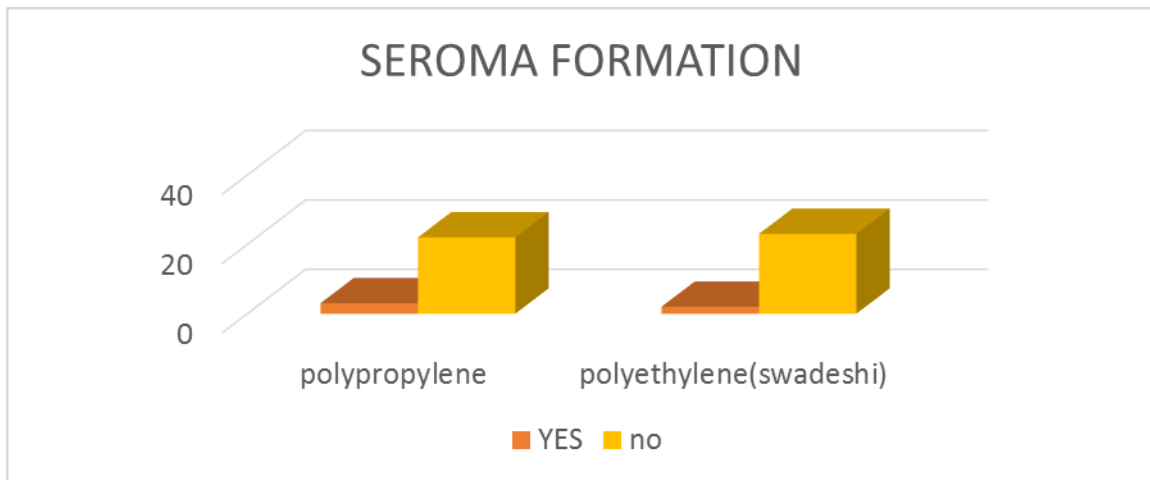
Hematoma is defined as a collection of clotted blood within tissues following surgery. Patients were followed for about 30 days postoperatively. In the control group where polypropylene (PP) mesh was used 4 patients developed hematoma whereas only 2 patients in the study group with swadeshi mesh (polyethylene PE mesh) developed hematoma



| hematoma formation | yes | No | total | percentage |
|------------------------|-----|----|-------|------------|
| Polypropylene | 4 | 21 | 25 | 16% |
| polyethylene(swadeshi) | 2 | 23 | 25 | 8% |

5. SEROMA FORMATION :

Seroma is defined as a collection of serous fluid within tissues following surgery. In the control group (PP mesh) seroma formation was noted in 3 patients whereas in the study group (PE mesh) seroma formation was noted in 2 patients



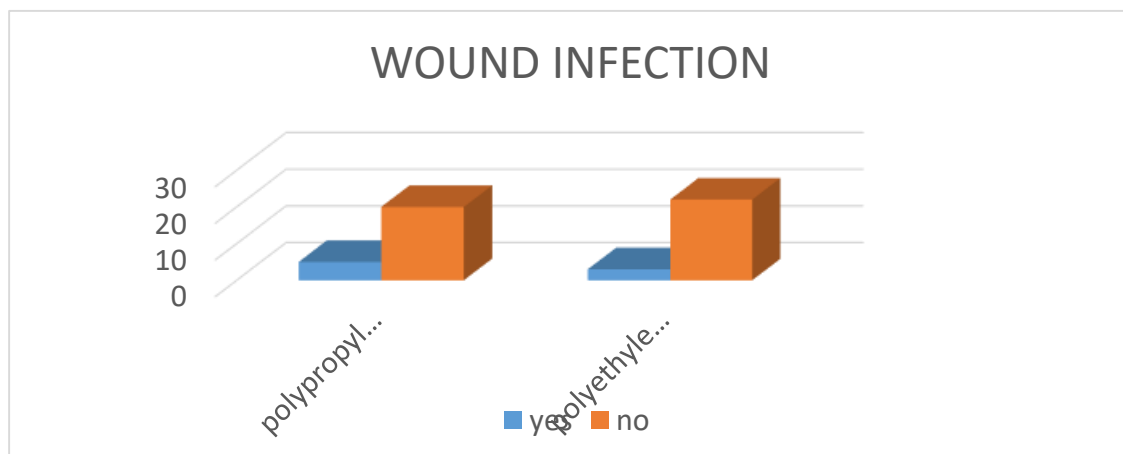
| seroma formation | yes | no | total | percentage |
|-------------------------|-----|----|-------|------------|
| Polypropylene | 3 | 22 | 25 | 12% |
| polyethylene (swadeshi) | 2 | 23 | 25 | 8% |

6. WOUND INFECTION:

Wound infection can be superficial involving the subcutaneous tissue or it may be deep involving the underlying mesh. Patients were observed for signs of tenderness and purulent discharge for upto 6 months.

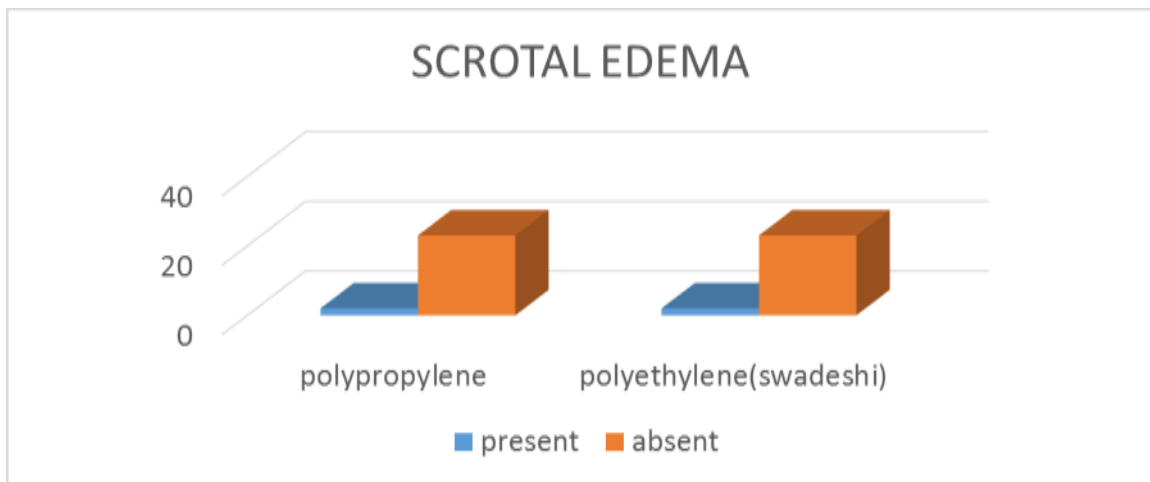
There was no case of infection involving the mesh. Superficial infection of skin and subcutaneous skin with seropurulent discharge was noted in 5 cases in the control group (PP mesh) and 3 cases in the study group (PE mesh). All patients were treated successfully with antibiotics and regular cleaning and dressing.

| wound infection | yes | no | total | percentage |
|------------------------|-----|----|-------|------------|
| Polypropylene | 5 | 20 | 25 | 20% |
| polyethylene(swadeshi) | 3 | 22 | 25 | 12% |



7. SCROTAL EDEMA:

Patients were observed for scrotal edema till 3rd post operative day. There was no difference in the incidence of scrotal edema in both the study (PP mesh) and control (PE mesh) group with each group having 2 patients with scrotal edema.

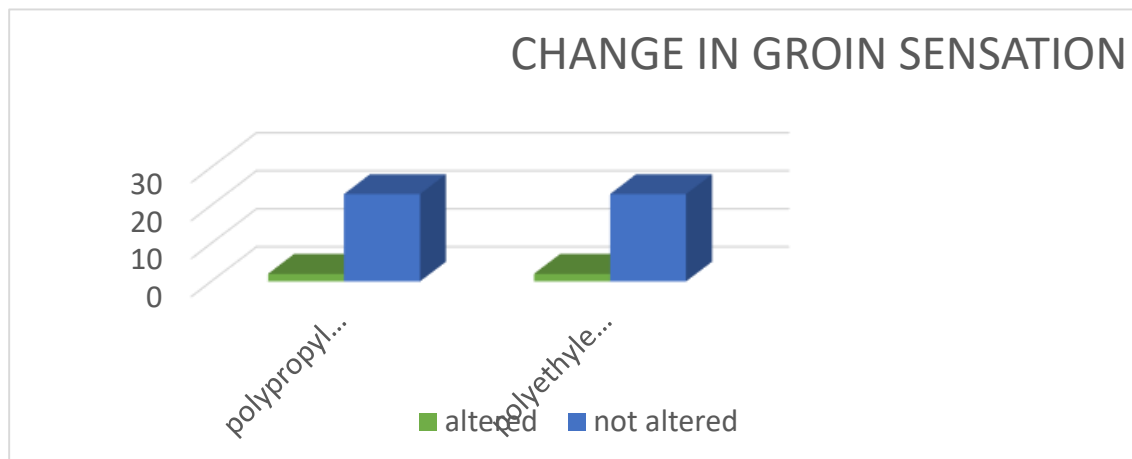


| scrotal edema | present | absent | total | percentage |
|-------------------------|---------|--------|-------|------------|
| Polypropylene | 2 | 23 | 25 | 8% |
| polyethylene (swadeshi) | 2 | 23 | 25 | 8% |

8. LOSS OR CHANGE IN SENSATION IN THE AFFECTED

GROIN :

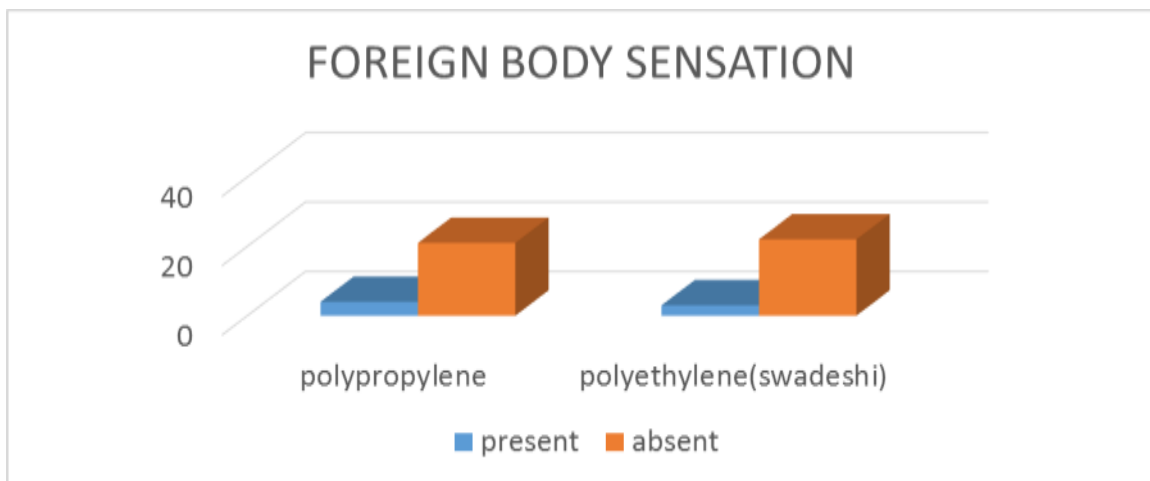
Patients were observed for any change in sensation in the operated groin such as hyperaesthesia till 3rd post operative day. Both the control and study group had 2 patients each with altered groin sensation.



| groin sensation | altered | not altered | total | Percentage |
|------------------------|---------|-------------|-------|------------|
| Polypropylene | 2 | 23 | 25 | 8% |
| polyethylene(swadeshi) | 2 | 23 | 25 | 8% |

9. FOREIGN BODY SENSATION:

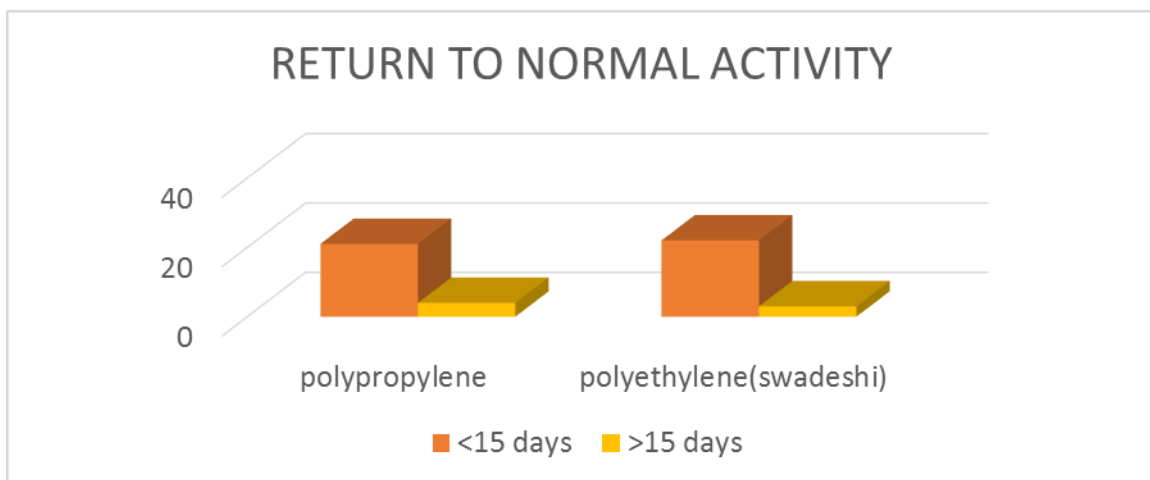
Foreign body sensation is a common symptom among patients treated with mesh repair. Patients were followed for 3 months for symptoms of foreign body sensation. It was seen in 4 patients in control group and 3 patients in study group.



| foreign body sensation | present | absent | total | percentage |
|------------------------|---------|--------|-------|------------|
| Polypropylene | 4 | 21 | 25 | 16% |
| polyethylene(swadeshi) | 3 | 22 | 25 | 12% |

10. RETURN TO NORMAL ACTIVITIES:

Following surgery, sutures were removed from the 10th to 14th post operative day and patients were discharged to carry out normal day to day activities. Patients were asked to restrict themselves from straining and lifting heavy weights. If the patient had any of the wound complications mentioned above, there was a delay in the patient returning to normal day to day activities.

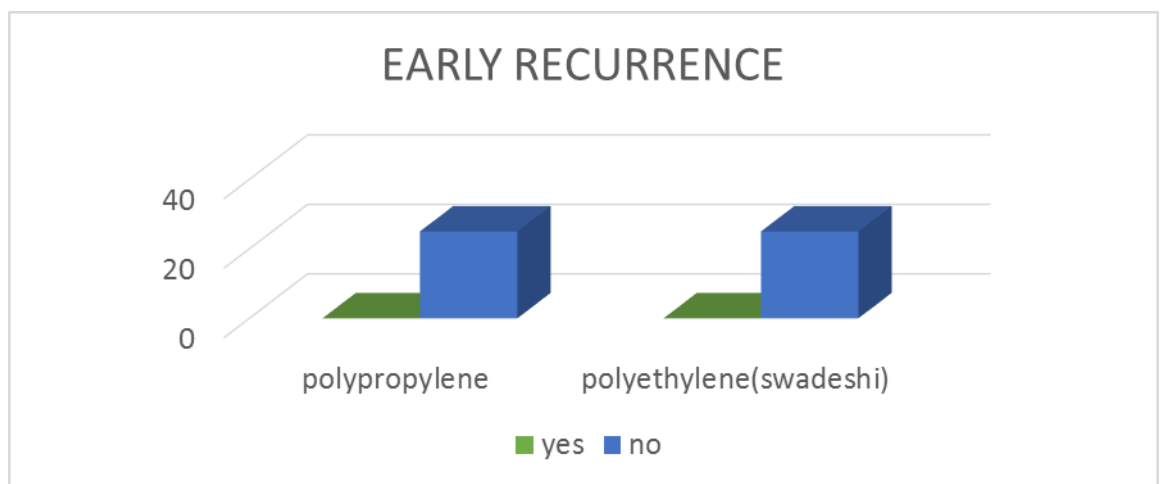


| return to normal | <15 days | >15 days | Total | mean | S.D | P' value |
|-------------------------|----------|----------|-------|-------|----------|-------------|
| Polypropylene | 21 | 4 | 25 | 15.96 | 3.611094 | Significant |
| polyethylene (swadeshi) | 22 | 3 | 25 | 13 | 1.290994 | |

21 of 25 patients in the control group (PP mesh) and 22 of 25 patients in the study group (PE mesh) returned to normal activity within 15 days. Patients in the study group returned to daily activities earlier than the control group and the difference was significant.

11. EARLY RECURRENCE:

Recurrence can be identified by an expansile cough impulse or a visible bulge in the operates site in the immediate post operative period or after 6 months. There was no case of early recurrence in both the groups.



| early recuurence | yes | No | total | percentage |
|------------------------|-----|----|-------|------------|
| Polypropylene | 0 | 25 | 25 | 0% |
| polyethylene(swadeshi) | 0 | 25 | 25 | 0% |

DISCUSSION

- In our study the majority of patients were male with only one case of female inguinal hernia in the study group. The mean age group of the patients in the study and control group was 48 with majority of patients above the age of 50
- The incidence of post operative pain was calculated using visual analog score. Patients in the study group (PE mesh) had less postoperative pain compared to the control group (PP mesh). The difference was significant.
- The incidence of seroma formation, hematoma formation, wound infection are similar in both the study and control group. Thus use of swadeshi material (PE mesh) instead of PP mesh in Lichtenstein mesh repair does not alter the incidence of post operative pain, seroma formation, hematoma formation and wound infection.
- Foreign body sensation in the operated site is a common symptom following mesh repair. The prosthetic mesh introduced induces a fibrosis that

strengthens the inguinal defect. This causes foreign body sensation in the inguinal region. There was no difference in the incidence of foreign body sensation between swadeshi material (polyethylene) and polypropylene mesh observed during this study.

- Following suture removal on the 12th to 15th post operative day, patients were discharged and advised to do daily activities without straining and lifting heavy weights. Majority of the patients returned to daily activities within 15 days. Patients in the study group (PE mesh) returned to daily activities earlier than the control group (PP mesh) and the difference was significant.
- Patients were followed for 1 year for incidence of recurrence in the operated side of inguinal region in the form of visible bulge or expansile cough impulse. None of the cases in the PP mesh and swadeshi material (PE mesh) groups had recurrence.

CONCLUSION

The use of a swadeshi material such as polyethylene in lichtensteins mesh repair has similar efficacy compared to routine polypropylene mesh in terms of seroma formation, hematoma formation, wound infection and early recurrence. However patients in the control group (PE mesh) had lower incidence of post operative pain and early return to daily activities than the study group (PP mesh). The cost of a polypropylene mesh though is 20 times expensive than a swadeshi material such as polyethylene. Thus in a developing country like india the use of swadeshi material (polyethylene) in mesh repair can be cost effective and thus be widely available to the underpreviledged. This study needs further evaluation as patients above 65 years of age, significant comorbid conditions and patients with hernia and hydrocele were not included in the study.

Lichtenstein mesh repair being the most commonly performed inguinal hernia surgery in developing countries. The use of a cost effective swadeshi material (polyethylene) can be as efficacious as polypropylene and thus be widely available to the population at a cheaper cost.

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PROFORMA

| | |
|--------------|----------|
| Name :- | I. P. No |
| Age :- | Unit |
| Sex :- | D.O.A |
| Occupation:- | D.O.D |
| Address:- | |
| Phone no: | |

DIAGNOSIS:

PRESENTING COMPLAINTS

Swelling

Pain

Co existing co morbidities

Treatment history

GENERAL PHYSICAL EXAMINATION

1. General survey
2. Body build and nourishment
3. Appearance
4. Dehydration: Mild/ Moderate/ Severe/ Nil
5. Anaemia/ Jaundice/ Clubbing/ Cyanosis/
Lymphadenopathy/ Pedal edema
6. Pulse

7. Temperature

8. Respiratory rate

9. Blood pressure

LOCAL EXAMINATION - groin.

1. INSPECTION

2. PALPATION

SYSTEMIC EXAMINATION

Cardiovascular system

Respiratory system

Central nervous system

Abdomen

Genito-urinary system

Per/rectal examination

MASTER CHART

CONTROL GROUP (POLYPROPYLENE MESH)

| Name | Age | Sex | IP No | Diagnosis | foreign body sensation | rejection of mesh | pain score | hematoma formation | seroma formation |
|-----------------|-----|------|-------|---------------------------|------------------------|-------------------|------------|--------------------|------------------|
| sonai | 55 | male | 467 | Left inguinal hernia | no | no | 1 | no | no |
| balakrishnan | 60 | male | 56128 | right inguinal hernia | no | no | 2 | no | no |
| thirumalairajan | 20 | male | 218 | right inguinal hernia | no | no | 4 | no | no |
| subramani | 55 | male | 5960 | Left inguinal hernia | yes | no | 3 | no | no |
| ramu | 56 | male | 7420 | bilateral inguinal hernia | no | no | 2 | yes | no |
| irulandi | 47 | male | 825 | right inguinal hernia | no | no | 3 | no | no |
| thiruselvam | 53 | male | 13181 | Left inguinal hernia | no | no | 5 | no | yes |
| vasudevan | 54 | male | 13389 | bilateral inguinal hernia | no | no | 4 | no | no |
| kubendiran | 55 | male | 14689 | bilateral inguinal hernia | yes | no | 3 | yes | no |
| kaalai | 60 | male | 1014 | bilateral inguinal hernia | no | no | 4 | no | no |
| ramasamy | 56 | male | 1231 | right inguinal hernia | no | no | 6 | no | no |
| duraisengam | 60 | male | 18750 | right inguinal hernia | no | no | 5 | no | yes |
| kumar | 51 | male | 30250 | right inguinal hernia | no | no | 4 | no | no |
| kannan | 38 | male | 1484 | right inguinal hernia | yes | no | 5 | yes | no |
| marees | 33 | male | 33984 | Left inguinal hernia | no | no | 2 | no | no |
| vellakutti | 60 | male | 34236 | right inguinal hernia | no | no | 1 | no | no |
| selvaraj | 60 | male | 33909 | Left inguinal hernia | no | no | 1 | no | no |
| pachaiyappan | 28 | male | 2031 | Left inguinal hernia | no | no | 2 | yes | No |
| raju | 57 | male | 35366 | Left inguinal hernia | yes | no | 4 | no | no |

| | | | | | | | | | |
|------------|----|------|-------|---------------------------|----|----|---|----|-----|
| manikandan | 42 | male | 2632 | right inguinal hernia | no | no | 3 | no | no |
| palanisamy | 42 | male | 2598 | Left inguinal hernia | no | no | 2 | no | no |
| arumugam | 50 | male | 39765 | right inguinal hernia | no | no | 3 | no | yes |
| murugan | 47 | male | 2596 | bilateral inguinal hernia | no | no | 5 | no | no |
| periyasamy | 28 | male | 39220 | bilateral inguinal hernia | no | no | 4 | no | no |
| murugan | 34 | male | 36895 | right inguinal hernia | no | no | 2 | no | no |

| Name | Age | Sex | IP No | Diagnosis | early recurrence | wound infection | return to normal activity <15days | groin sensation | scrotal edema |
|-----------------|-----|------|-------|---------------------------|------------------|-----------------|-----------------------------------|-----------------|---------------|
| sonai | 55 | male | 467 | Left inguinal hernia | no | no | yes | no | no |
| balakrishnan | 60 | male | | right inguinal hernia | no | no | yes | no | no |
| thirumalairajan | 20 | male | 218 | right inguinal hernia | no | no | yes | no | no |
| subramani | 55 | male | 5960 | Left inguinal hernia | no | no | yes | no | no |
| ramu | 56 | male | 7420 | bilateral inguinal hernia | no | yes | no | no | no |
| irulandi | 47 | male | 11825 | right inguinal hernia | no | no | yes | no | no |
| thiruselvam | 53 | male | 13181 | Left inguinal hernia | no | no | yes | no | yes |
| vasudevan | 54 | male | 13389 | bilateral inguinal hernia | no | no | yes | no | no |
| kubendiran | 55 | male | 14689 | bilateral inguinal hernia | no | yes | no | no | no |
| kaalai | 60 | male | 1014 | bilateral inguinal | no | no | yes | no | no |

| | | | | | | | | | |
|--------------|----|------|-------|---------------------------|----|-----|-----|-----|-----|
| | | | | hernia | | | | | |
| ramasamy | 56 | male | 1231 | right inguinal hernia | no | no | yes | no | no |
| duraisengam | 60 | male | 18750 | right inguinal hernia | no | no | yes | no | no |
| kumar | 51 | male | 30250 | right inguinal hernia | no | no | yes | no | yes |
| kannan | 38 | male | 1484 | right inguinal hernia | no | yes | no | no | no |
| marees | 33 | male | 33984 | Left inguinal hernia | no | no | yes | no | no |
| vellakutti | 60 | male | 34236 | right inguinal hernia | no | no | yes | no | no |
| selvaraj | 60 | male | 33909 | Left inguinal hernia | no | no | yes | no | no |
| pachaiyappan | 28 | male | 2031 | Left inguinal hernia | no | yes | no | no | no |
| raju | 57 | male | 35366 | Left inguinal hernia | no | no | yes | no | no |
| manikandan | 42 | male | 2632 | right inguinal hernia | no | no | yes | yes | no |
| palanisamy | 42 | male | 2598 | Left inguinal hernia | no | no | yes | no | no |
| arumugam | 50 | male | 39765 | right inguinal hernia | no | yes | no | no | no |
| murugan | 47 | male | 2596 | bilateral inguinal hernia | no | no | yes | yes | no |
| periyasamy | 28 | male | 39220 | bilateral inguinal hernia | no | no | yes | no | no |
| murugan | 34 | male | 36895 | right inguinal hernia | no | no | yes | no | no |

STUDY GROUP (SWADESHI MATERIAL)

| Name | Age | Sex | IP No | Diagnosis | foreign body sensation | rejection of mesh | pain score | hematoma formation | seroma formation |
|---------------------|-----|------|-------|---------------------------|------------------------|-------------------|------------|--------------------|------------------|
| raju | 54 | male | 6507 | bilateral inguinal hernia | no | no | 3 | no | no |
| ramu | 57 | male | 8912 | right inguinal hernia | no | no | 4 | no | no |
| karthik | 22 | male | 282 | right inguinal hernia | no | no | 6 | no | no |
| pitchai | 46 | male | 336 | left inguinal hernia | yes | no | 5 | no | no |
| mahendran | 56 | male | 8692 | right inguinal hernia | no | no | 2 | no | no |
| narayanan | 60 | male | 945 | right inguinal hernia | no | no | 3 | yes | no |
| xavier | 60 | male | 17240 | left inguinal hernia | no | no | 5 | no | no |
| veeran | 50 | male | 17454 | bilateral inguinal hernia | no | no | 4 | no | no |
| balasubramani | 51 | male | 994 | left inguinal hernia | yes | no | 3 | no | no |
| pandi | 52 | male | 1450 | left inguinal hernia | no | no | 4 | no | no |
| parameshwaran | 40 | male | 1449 | bilateral inguinal hernia | no | no | 3 | yes | no |
| johnson sandhanaraj | 42 | male | 1659 | left inguinal hernia | no | no | 5 | no | no |
| babu | 55 | male | 1484 | left inguinal hernia | no | no | 4 | no | no |
| krishnan | 57 | male | 33986 | left inguinal hernia | no | no | 5 | no | no |

| | | | | | | | | | |
|---------------|----|--------|-------|---------------------------|-----|----|---|----|-----|
| mani | 53 | male | 35343 | left inguinal hernia | no | no | 3 | no | no |
| sathis kumar | 27 | male | 2316 | right inguinal hernia | yes | no | 1 | no | yes |
| thoongan | 59 | male | 37698 | bilateral inguinal hernia | no | no | 1 | no | no |
| balasubramani | 55 | male | 37160 | left inguinal hernia | no | no | 2 | no | no |
| marimuthu | 35 | male | 37714 | right inguinal hernia | no | no | 4 | no | no |
| arumugam | 52 | male | 2383 | right inguinal hernia | no | no | 3 | no | yes |
| subramani | 60 | male | 2832 | left inguinal hernia | no | no | 2 | no | no |
| ponraj | 25 | male | 42856 | bilateral inguinal hernia | no | no | 3 | no | no |
| azhagan | 57 | male | 41784 | left inguinal hernia | no | no | 5 | no | no |
| raja | 50 | male | 3155 | right inguinal hernia | no | no | 4 | no | no |
| thayammal | 45 | female | 36745 | left inguinal hernia | no | no | 2 | no | no |

| Name | Age | Sex | IP No | Diagnosis | early recurrence | wound infection | return to normal activity <15days | groin sensation | scrotal edema |
|-----------|-----|------|-------|---------------------------|------------------|-----------------|-----------------------------------|-----------------|---------------|
| raju | 54 | male | 6507 | bilateral inguinal hernia | no | no | yes | no | no |
| ramu | 57 | male | 8912 | right inguinal hernia | no | no | yes | no | no |
| karthik | 22 | male | 282 | right inguinal hernia | no | no | yes | no | no |
| pitchai | 46 | male | 336 | left inguinal hernia | no | no | yes | no | no |
| mahendran | 56 | male | 8692 | right inguinal | no | no | yes | no | no |

| | | | | | | | | | |
|---------------------|----|--------|------|---------------------------|----|-----|-----|-----|-----|
| | | | | hernia | | | | | |
| narayanan | 60 | male | 945 | right inguinal hernia | no | yes | no | no | no |
| xavier | 60 | male | 7240 | left inguinal hernia | no | no | yes | no | no |
| veeran | 50 | male | 7454 | bilateral inguinal hernia | no | no | yes | no | no |
| balasubramani | 51 | male | 994 | left inguinal hernia | no | no | yes | no | yes |
| pandi | 52 | male | 1450 | left inguinal hernia | no | no | yes | no | no |
| parameshwaran | 40 | male | 1449 | bilateral inguinal hernia | no | yes | no | no | no |
| johnson sandhanaraj | 42 | male | 1659 | left inguinal hernia | no | no | yes | yes | no |
| babu | 55 | male | 1484 | left inguinal hernia | no | no | yes | no | no |
| krishnan | 57 | male | 3986 | left inguinal hernia | no | no | yes | no | no |
| mani | 53 | male | 5343 | left inguinal hernia | no | no | yes | no | no |
| sathis kumar | 27 | male | 2316 | right inguinal hernia | no | yes | no | no | no |
| thoongan | 59 | male | 7698 | bilateral inguinal hernia | no | no | yes | no | yes |
| balasubramani | 55 | male | 7160 | left inguinal hernia | no | no | yes | no | no |
| marimuthu | 35 | male | 7714 | right inguinal hernia | no | no | yes | no | no |
| arumugam | 52 | male | 2383 | right inguinal hernia | no | no | yes | no | no |
| subramani | 60 | male | 2832 | left inguinal hernia | no | no | yes | no | no |
| ponraj | 25 | male | 2856 | bilateral inguinal hernia | no | no | yes | yes | no |
| azhagan | 57 | male | 1784 | left inguinal hernia | no | no | yes | no | no |
| raja | 50 | male | 3155 | right inguinal hernia | no | no | yes | no | no |
| thayammal | 45 | female | 6745 | left inguinal hernia | no | no | yes | no | no |

ஆராய்ச்சிதகவல்அறிக்கை

மதுரைஅரசு இராசாசி மருத்துவமனையில் வரும் நோயாளிக்கு
அடிவயிற்றில் குடல்இறக்கம்

ஒரு ஆராய்ச்சி இங்கு நடைபெற்று வருகிறது. நீங்களும் இந்த
ஆராய்ச்சியில் பங்கேற்க விரும்புகிறோம்.

உங்களை சிலசிறப்பு பரிசோதனைக்கு உட்படுத்தி அதன் தகவல்களை
ஆராய்வோம். அதனால் தங்களது நோயின் ஆய்வரிகையோ அல்லது
சிகிச்சையோ பாதிப்பு ஏற்படாது என்பதை தெரிவித்துக்கொள்கிறேன்.

முடிவுகளைவெளியிடும்போது அல்லது ஆராய்ச்சியின் போதோ
தங்களது பெயர் அல்லது அடையாளங்களோ வெளியிடமாட்டோம்
என்பதை தெரிவித்து கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில்
தான் நடக்கும். மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியில் இருந்து
பின் வாங்கலாம் என்பதையும் தெரிவித்து கொள்கிறோம்.

இந்த சிறப்பு பரிசோதனை முடிவுகளை ஆராய்ச்சியின் போது அல்லது
ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிப்போம் என்பதையும்
தெரிவித்து கொள்கிறோம்.

ETHICAL COMMITTEE CERTIFICATE



MADURAI MEDICAL COLLEGE
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(Affiliated to The Tamilnadu Dr.MGR Medical University,
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ETHICS COMMITTEE CERTIFICATE

Name of the Candidate : Dr.Akshar. A
Course : PG in MS., General Surgery
Period of Study : 2017-2020
College : MADURAI MEDICAL COLLEGE
Research Topic : Comparative study on use of
swadeshi material versus
polypropylene mesh for
Lichtenstein's hernioplasty in
GRH, Madurai
Ethical Committee as on : 23.01.2018

The Ethics Committee, Madurai Medical College has decided to inform
that your Research proposal is accepted.

M. Shanthi
Member Secretary

Prof Dr V Nagaraajan
Chairman

Dean/Convener
Dean/Convener

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (Hon)
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DEAN
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Urkund Analysis Result

Analysed Document: akshar THESIS WORD FINAL copy.doc (D57275895)
Submitted: 19/10/2019 09:10:00
Submitted By: gowaraaks@gmail.com
Significance: 3 %

Sources included in the report:

THESIS WORD FINAL copy.doc (D42276834)
https://www.researchgate.net/publication/240116702_Assessment_of_inguinal_hernia_treatment_results_in_patients_operated_on_with_mesh_using_Lichtenstein_PHS_and_Robbins-Rutkow_techniques

Instances where selected sources appear:

3