

**COMPARATIVE STUDY OF PRESERVATION VERSUS  
ELECTIVE DIVISION OF ILIOINGUINAL NERVE IN OPEN  
MESH REPAIR OF INGUINAL HERNIA**

**DISSERTATION SUBMITTED FOR  
BRANCH-I M.S (GENERAL SURGERY)**

**APRIL 2015**



**THE TAMILNADU DR.M.G.R.MEDICALUNIVERSITY  
CHENNAI**

### COMPARATIVE STUDY OF PRESERVATION VERSUS ELECTIVE DIVISION OF

BY ZZZT1114.MS(GENERAL SURGERY) SMITHA NAIR

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CHENNAI

## **DECLARATION**

I, **Dr.Smitha Nair**, do hereby declare that I carried out this work on “**comparative study of preservation versus elective division of ilioinguinal nerve in open mesh repair of inguinal hernia** ” at the Department of Surgery, Govt. Rajaji Hospital, Madurai, under the guidance of **Prof. Dr.A.M.Syed Ibrahim M.S.**, Professor of Surgery, during the period of August 2013 to August 2014.

I also declare that this bonafide work has not been submitted in part or full by me or any others for any award, degree or diploma to any other University or Board either in India or abroad.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the M.S degree examination in General Surgery (Branch I) to be held in April 2015.

Place :

Date :

Dr.Smitha Nair

## **ACKNOWLEDGEMENT**

At the outset, I would like to thank our Dean for permitting me to use the facilities in Madurai Medical College and Government Rajaji Hospital for conducting my study.

I sincerely thank Prof. Dr.S.Sankaramahalingam M.S., Professor and Head of the Department, Department of General Surgery for his constant support, advice and co-operation in completing this study.

My Unit Chief Prof. Dr.A. M. Syed Ibrahim M.S. has always guided me, by example and valuable words of advice and has given me his moral support. I will be ever grateful to him.

I offer my heartfelt thanks to my unit Assistant Professors Dr.J.Amuthan M.S.,D.L.O., Dr.M. Lakshminarayanan M. S., and Dr.D. Geetha M.S.,D.G.O. for their constant encouragement, timely help and critical suggestions throughout the study and also for making my stay in the unit both informative and pleasurable.

Place: Madurai.

Date :

Dr.Smitha Nair  
Post Graduate in General Surgery  
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Madurai

## LIST OF ABBREVIATIONS USED

AD	Anna domino :After Christ
BC	Before Christ
Cms	Centimeter
ECG	Electrocardiogram
Gms	Grams
H/O	History of
Hb%	Hemoglobin percentage
HBsAg	Hepatitis B surface antigen
HIV	Human immuno deficiency virus
Inj IM	Injection , Intramuscular
ie,	That is
IP No	In patient number
Lt	Left
N	Total number
P	Probability (Significance of difference)
RBS	Random blood sugar
Rt	Right
RCT	Randomized Controlled trial
S/o	Suggestive of
USG	Ultrasonogram
Vs	Versus
Yrs	Years

## **ABSTRACT**

**Background and Objectives:** Chronic post herniorrhaphy groin pain is defined as pain lasting for more than 3 months after surgery. It is one of the most important complications occurring after inguinal hernia repair and it occurs with greater frequency than previously thought .Majority of chronic pain has been attributed to Ilioinguinal nerve entrapment.

Routine excision of the ilioinguinal nerve is an attempt to decrease the incidence of chronic groin pain caused by nerve entrapment, inflammation and fibrotic reactions around the nerve.

The purpose of the current study is to evaluate the effect of routine ilioinguinal nerve excision compared to nerve preservation on chronic groin pain and other sensory symptoms when performing Lichtenstein tension free inguinal hernia repair.

**Method:** A total of 60 patients admitted for inguinal hernia at Government Rajaji Hospital Madurai who met with the inclusion criteria underwent open mesh repair of inguinal hernia over the study period from August 2013 to August 2014.The ilioinguinal nerve was identified and preserved in 30 patients(group A) and elective division of the ilioinguinal nerve was done in 30 patients(group-B).Patients were evaluated for pain and other sensory symptoms at PoD-1, at one month, at three months, and at six months after surgery by using 4 point verbal scale.

**Results:** 50 of 60 patients completed the study protocol fully, 26 patients ( 25 men and 1 women ) with mean age  $31 \pm 20$  belonged to group A, and 24 patients (all men) with mean age of  $39 \pm 14$  belonged to group B.

The results of the follow up visits are 24 Vs 19 (  $p>0.05$  ) at POD-1 ; 13 Vs 10 (  $p>0.05$  ) at 1 month ; 10 Vs 2 (  $p>0.05$  ) at 3 months ; and 8 Vs 1 (  $p<0.05$  ) at 6 months in group A and group B respectively. The mean severity score was  $1.65\pm 0.79$  vs  $1.37\pm 0.92$  at POD-1 ;  $0.81\pm 0.94$  vs  $0.42\pm 0.50$  at 1 month ;  $0.58\pm 0.81$  vs  $0.08\pm 0.28$  at 3 months ; and  $0.39\pm 0.09$  vs  $0.05\pm 0.20$  at 6 months in group A and group B respectively. There was significant difference ( $p<0.05$ ) at 3 and 6 months.

The results showed no significant difference in the neurosensory disturbances in either Groups, that is, the incidence of hypoesthesia was 57.6% vs 62.% ; 26.9% vs 37.5% ; 19.2% vs 20.8% ; and 11.5% vs 16.6% at POD-1, 1, 3, and 6 months in group A and B respectively. And the incidence of numbness was 19.2% vs 12.5% ; 23% vs 25% ; 15.3% vs 20.8% ; and 11.5% vs 12.5% at POD-1, 1, 3, and 6 months in group A and B respectively.

**Conclusion:** The prophylactic excision of the ilioinguinal nerve during Lichtenstein mesh hernia repair decreases the incidence of chronic groin pain after surgery. Furthermore the procedure is not significantly associated with additional morbidities in terms of local cutaneous neurosensory disturbances. So when performing Lichtenstein inguinal hernia repair, routine ilioinguinal neurectomy is a reasonable option.

**Keywords:** Inguinal hernia; Groin; Lichtenstein; Polypropylene mesh; Herniorrhaphy; Ilioinguinal; Neurectomy; Mesh repair.



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## INTRODUCTION

*Hernias may be generally defined as a “Protrusion of a viscus or part of a viscus through an abnormal opening in the walls of its containing cavity”.<sup>1</sup>*

*“A protrusion of any viscus from its proper cavity is denominated a hernia. The protruded parts are generally contained in a bag by a membrane with which the cavity is naturally invested”*

*– Sir Astley Cooper 1804.*

Chronic post herniorrhaphy groin pain is defined as pain lasting for more than 3 months after surgery.

It is one of the most important complications occurring after inguinal hernia repair and it occurs with greater frequency than previously thought.

A review of studies published between 1987 to 2000 showed an overall incidence of 25% with 10% of patients having pain fitting a definition of moderate or severe.<sup>2</sup>

Incidence of long term ( $\geq 1$  year) post operative neuralgia reported for Lichtenstein repair of inguinal hernia range from 6 – 29 %, <sup>3</sup>

Inguinodynia is the recommended generic term for chronic groin pain after hernia repair and should replace ‘neuralgia or mesh inguinodynia ‘ to promote uniformity and avoid confusion in the literature.<sup>4</sup>

In cases that involves workman`s compensation issue, treating a post surgical patient becomes complicated. Although most legal cases results in out of court settlement, worth noting is the fact that 5 – 7% of patients with post herniorrhaphy

neuralgia will sue their surgeons.<sup>5</sup>

The concept of routine neurectomy in surgery is not unique to inguinal hernia repairs. Routine neurectomy is often performed during axillary and neck dissections in which the Intercostobrachial and greater auricular nerves are sacrificed.<sup>6</sup>

Routine ilioinguinal nerve excision has been proposed as a means to avoid the troubling complication of long term post herniorrhaphy neuralgia.<sup>7,8</sup>

Theoretically excision of ilioinguinal nerve would eliminate the possibility of inflammation neuralgia arising from entrapment, neuroma, fibrotic reactions yet controversies persists and the procedure is not widely accepted.<sup>9,10</sup>

The purpose of the current study was to evaluate the effect of routine ilioinguinal nerve excision compared to nerve preservation on chronic groin pain and other sensory symptoms when performing Lichtenstein inguinal hernia repair.

## **AIMS AND OBJECTIVES**

1. To evaluate the effect of preservation versus elective division of the ilioinguinal nerve on chronic groin pain and hypoesthesia after Lichtenstein tension free inguinal hernia repair using Polypropylene mesh.

## REVIEW OF LITERATURE

### HISTORICAL ASPECTS OF INGUINAL HERNIA

*In the entire history of surgery, no subject has been as controversial as the repair of groin hernia.*

**C.B. McVay**

The history of hernia, one of the most beautiful chapters in the triumphs of anatomy and surgery, is replete with ideas and realities, myths and facts, transmutations and Shadows. The history of hernia *in toto* is as old as human race. Inguinal hernias are recorded since 1500 BC by the ancient Greeks. The term hernia is derived from Greek meaning “offshoot, a budding or bulge.”<sup>11</sup>

Hippocrates has barely mentioned about hernia in his writings (500 BC).

#### **Ancient Times**<sup>12, 13</sup>

The word hernia is derived from the Greek word "Hernios", meaning "Nad" or "Shoot". Hernia is known to mankind since time immemorial. Shushruta in Vedic period described hernia as "Antra-vridi" and had thought it to be incurable. Hernia is barely mentioned in the writings of Hippocrates (500 BC). The evolution of surgical treatment of inguinal hernia encompasses the trials and errors of surgeons practicing their art, for thousands of years. Most of the evidence obtained from historical documents, suggest that throughout the ages, till the onset of 19th century, the mainstay of treatment of hernia has been conservative and the evolution of surgical treatment has closely paralleled that of surgery, in general. 3500 years ago,

Egyptian physicians reported the management of hernia by conservative means that included the snugly fitting bandage for reduction and support.



Figure-1. Hippocrates (460-377 B C)

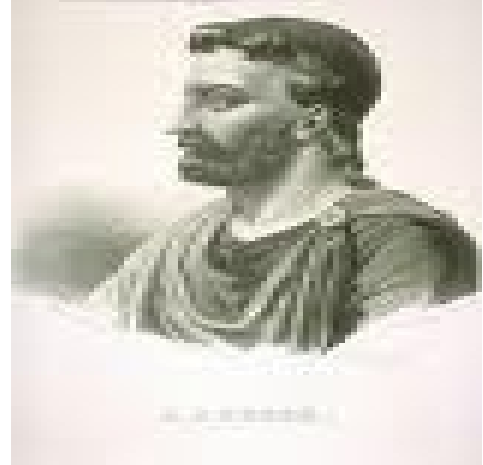


Figure-2. Aulus Celsus of Alexandria (50 A D)

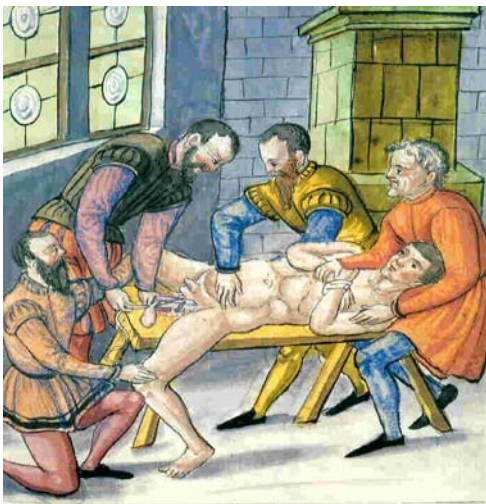


Figure-3. Middle Dark Ages (476-15<sup>th</sup> Century)



Figure-4. Ambrose Pare (1570-1590)

The treatment by taxis for irreducible hernia has been traced back twenty four hundred years. The earliest mention of inguinal hernia is found in "Eber's papyrus" (1500BC), in which it is apparent that the pre-Homeric physicians treated the inguinal hernia by conservative methods. Aulus Celsus, the Greek encyclopedist and surgeon, documented (50AD) the use of transillumination to distinguish hydrocoeles from hernias and described taxis for strangulation. Trusses and bandages were used for reducible hernia. Incomplete hernias (Bubonocoele) were distinguished from Complete (Scrotal) inguinal hernias by Paul of Aegina, around 700AD.

### **Medieval Period** <sup>14</sup>

After the fall of Rome, religious prejudice against mutilation of the human body caused regression of surgical technique. During the lengthy dark Middle Ages, two important advances in herniology were made. Guy de Chauliac, from France (1363 AD), in his text "Chirurgia Magna", distinguished femoral from inguinal hernias. He developed taxis for incarcerated hernia, recommending the head down Trendelenberg position. He considered operations doubtful and dangerous, preferred chemical cauterization to burning skin, fascia and pubic bone. In 1556, Pierre Franco of Switzerland was the first to work on strangulated hernia cases, as a routine procedure. In the early stage of strangulation, cutting the constriction ring, using a grooved director to protect the bowel, which was replaced in the abdomen using fine linen. Ronald, of Parma (1383AD), recommended the use of Trendelenberg position in the management of hernias. In 1556, Pierre Franco of Switzerland was the first to work

on strangulated hernia cases, as a routine procedure. In the early stage of strangulation, cutting the constriction ring, using a grooved director to protect the bowel, which was replaced in the abdomen using fine linen.

### **Post- Renaissance Period**<sup>15, 16</sup>

After the renaissance, autopsy and anatomic dissection spread throughout Europe. Started in Bologna in 1200 AD, knowledge about herniation accumulated rapidly. In 1700AD, Littre reported Meckel's diverticulum in hernial sac. In 1721, William Cheselden successfully operated on strangulated hernias. Heister (1724) in his monograph distinguished indirect from direct inguinal hernias. Hunter and Percival Pott of London pointed out the congenital nature of some indirect inguinal hernia. In 1731, Gimbernat described the ligament that bears his name and advocated its division in instances of strangulated femoral hernias, rather than an upward incision of the Poupart ligament, which occasionally led to serious bleeding from an aberrant inferior epigastric artery. 'Antonio Scarpa'<sup>1</sup> (1752-1832), in his treatise on hernia accurately described the sliding hernia, based on autopsy studies. Astley Patson Cooper<sup>1</sup> (1768-1841), described for the first time the superior pubic ligament, which bears his name and transversalis fascia with full recognition of its role in the pathogenesis of hernias. Frenz Casper Hesselbach(1759-1816), contributed anatomic studies relative to groin hernia - Iliopubic tract and Hesselbach's triangle. Jules German Cloquet<sup>1</sup> (1770-1883), dissected and sketched 345 cases of hernia.

### **Period Of Aseptic Surgery/ The Listerian Era**<sup>12</sup>



In 1867, Joseph Lister, Professor of Orthopedic Surgery at Glasgow infirmary presented his first paper on antiseptic surgery performed under carbolic acid spray. Prior to Lister, all hernia repair were performed through the external ring incisions, fascial planes were scrupulously avoided to prevent infection and its dire consequences. In 1871, Marcy, published the first article in United States on Antiseptic herniorrhaphy, using carbolised catgut ligature. In 1877, Czerny described pulling the sac down through the external ring and excising it, allowing the ligated neck to retract and invert at the internal ring. Lucas-championniere introduced antisepsis to France. In 1885, he incised the external oblique aponeurosis, laid open the inguinal canal and imbricated the roof in the closure. The period 1880-90, has rightly been termed as “The Decade of Inguinal Hernia”,for the significant contributions made towards hernia surgery by Lucas championniere, Marcy and Bassini. The credit for modern herniology should be given to Marcy of United States. Marcy(1837-1924), was the first to indicate the importance of the high ligation of the hernial sac and closure of dilated inguinal ring as essential steps in the repair of inguinal hernia. He was also the first to describe, the trans-abdominal approach.**Edoardo Bassini** <sup>17</sup>(1844-1924) of Pavia, Italy revolutionized the treatment of inguinal hernia by the introduction of a technique designed to restore the conditions in the area of hernial orifice, which existed under normal circumstances. He thought that recurrence was due to the inadequacy of mere ligation of the sac without reconstructing the inguinal canal. In 1890, he published his epoch making report of 206 cases of hernia operations, with very low mortality and

recurrence rates. He initiated the use of transversalis fascia, rectus sheath and interrupted silk sutures. He used to do bilateral hernia repairs and surgery for cryptorchidism in the same sitting. Bassini advocated not to obliterate the inguinal canal with deep suturing of the rings, but to reconstruct it physiologically, recreating the internal and external openings with anterior and posterior walls. He sutured the conjoined transversus abdominis and internal oblique to the inguinal ligament with continuous silk sutures. His triple layer included transversalis fascia, which was divided from pubis to an inch beyond the internal ring. He emphasized closing the floor from below upwards to restore the valve-like mechanism. In 1940, McVay and Anson pointed out that, the rectus fascia, a portion of the transversalis fascia that inserts into the lateral border of rectus muscle, was strong enough to prevent incisional herniation. Shouldice, Obney, Ryan 1950-1953 Performed multiple layer repair of posterior inguinal wall under local anaesthesia (Shouldice technique).

### **Darn Repairs**

McArthur in 1921 used the pedicled strips of external oblique aponeurosis woven between the conjoint tendon and inguinal ligament. Gallie and Lemesurier in 1921, published papers on using fascia lata strips as sutures woven into the muscles and the inguinal ligament and the tissues of the posterior wall of the inguinal canal-- "Much as one would darn a sock". Ogilvy in 1936, practiced floss silk lattice repairs with non absorbable material which was followed by Maingot. Pratt, in 1948, used steel wire followed by Koontz, who used tantalum gauze in 1950. In 1948, Moloney introduced

the forerunner of the modern nylon darn technique.

### **Patch Graft Repairs**

Whenever the local tissues were weak and attenuated, approximation of tissues was under tension, the sutures did not hold and the hernia recurred. So the surgeons thought of exogenous or endogenous prosthesis with good tensile strength. To start with, patch in the form of sheets of natural tissues and biological materials or synthetic sheets to fill the gap in the posterior wall of the canal were tried. Silver wire mesh used in most of the cases, were corroded, fragmented and were rejected through chronic sinuses and lead to recurrence. In 1940, Burke introduced tantalum metal sheets, but due to fragmentation of metal, hernia recurred. Surgeons started getting sheets of natural tissue flaps from fascia of thigh. Aponeurosis of external, internal oblique or rectus sheath were turned downwards and sutured to inguinal ligament. Mayr, in 1943, used skin graft. In 1958 Uscher introduced synthetic polyethylene mesh prosthesis to buttress and reinforce previously sutured repair. A variety of mesh designs and mesh placements have flourished since, Lichtenstein showed that mesh could be used successfully Lichtenstein 1986 Introduced tension-free repair by reconstructing floor of inguinal canal using prosthetic material, Concept of tension free repair introduced by Lichenstein in 1989. In 1991, Gilbert used suture less repair of small to moderate sized inguinal hernia by cones and swatch, i.e. a suture less patch was placed over the whole of the posterior inguinal wall to reinforce this "Swatch". A more controversial use of prosthetic materials concerns its use configured as swatch,

plug or suture less patch. In this, a roll of material is placed in the hernial orifice with or without suture to obstruct the passage of hernia to the exterior, popularized by Robbins and Rutkow in 1993.

Expanded polytetrafluoroethylene (ePTFE) has been adopted for both the external and pre-

peritoneal approach, with good results. In recent years, sheaths of woven monofilament polyamide or knitted monofilament polypropylene have been used extensively. Recently, a bilayered patch device for inguinal hernia has been introduced. The unique feature of this polypropylene mesh device is that it has three components. Its underlay patch provides posterior mesh repair. Its connector has the desirable attributes of the plug repair. Its Onlay patch covers the posterior wall up to internal inguinal ring.<sup>18</sup>

### **Pre-Peritoneal Repairs**

Thomas Annandale of Edinburgh presented for the first time in 1876, the concept of the pre-peritoneal approach. Lawson Tait of Birmingham, England, in 1883 reported the advantages of treating hernias by a median abdominal section. Bates (1913), repaired the defect from the posterior approach, using transversalis fascia. Cheatle (1920) renewed the interest in the pre-peritoneal approach. Henry, in 1936, suggested that this approach might facilitate the technical handling of inguinal and femoral hernias. This approach was strongly recommended by 'Nyhus' in 1960. The foremost proponent of today's pre-peritoneal approach is Stoppa, who recommends it, especially

for problematic cases in which repeated repairs of multiple recurrent hernias have been carried out, and in which tissues have become scarred and weakened and the normal anatomy is destroyed. Stoppa 1984 Devised procedure for reinforcing peritoneum using large unslit prosthesis Rutkow 1993 Modified mesh-plug repair .

### **Laparoscopic Inguinal Hernia Repair** <sup>20,21</sup>

y The wave of minimal access surgery has inevitably swept hernia repair along its surge. Ger and his colleagues, in 1982, through laparoscope used Michel staple applied with a Kocher clamp to close peritoneal opening of the hernia sac.

y Schultz & co workers (1990) described “plug & patch laparoscopic inguinal herniorrhaphy.

y Spaw & co workers (1991) detailed anatomy with respect to laparoscopic approach. Toy & Smoot (1991) described intra peritoneal on lay patch technique (IPOM).

y Dion & Morin (1992) described transabdominal preperitoneal patch (TAPP) technique.

y Mc Kernan (1992) described totally pre peritoneal patch technique (TEP).



Figure-5. Antonio Scarpa(1752–1832)



Figure-6. Astley Cooper (1768-1841)



Figure-7. August Richter (1742-1812)



Figure-8. Edoardo Bassini (1844-1924)

## **EMBRYOLOGY** <sup>17,22</sup>

There is no doubt, that the first appearance of the mammal, with his unexplained need to push his testicles out of their proper home into the air made a mess of the three layered abdominal wall that had done the reptiles well, for millions of years. In a highly synergistic way the skin, the parietal peritoneum and the embryologic and anatomic entities between them, produce the future pathway for the testes. The skin will form the scrotum in males and labia in females. The embryological entities between the skin and the peritoneum, permit the processes vaginalis to penetrate them and to form the inguinal canal. The downward journey of the testis to the scrotum is thus allowed but, the descent of the ovary outside the peritoneal cavity is forbidden.

### **Inguinal Region**

The Testis originally lies on the posterior wall of the abdomen, at the level of the upper lumbar vertebrae on the medial side of the mesonephros, near the lower pole of the mesonephros by a peritoneal fold, called mesorchium. The descent or migration of testis into its corresponding scrotal chamber is accomplished by following the lead of the fibromuscular band – gubernaculum testis. It arises mainly within a peritoneal fold called the plica inguinalis, which stretches from the inguinal region to the lower end of the mesonephros. The gubernaculum attains greatest development about the sixth month, when it becomes a stout thick cord and is

attached, above to the lower end of the testis and below it pierces through the abdominal wall, in its passage to the bottom of the scrotal pouch, thereby forming the inguinal canal. Along with it, a process of peritoneum the processus vaginalis descends into the scrotum, dragging with it thin fascial prolongations of the layers of the abdominal wall. Thus, the processus vaginalis receives coverings from the aponeurosis of the external oblique and internal oblique muscles and from fascia transversalis. As the passage through the abdominal wall occurs, the testes and cord structures are surrounded by vestiges of the external oblique (external spermatic), internal oblique (cremasteric fascia and muscle) and transversalis fascia (internal spermatic). The blind extremity of the processes vaginalis gets invaginated in the form of a cup for the reception of the descending testis. As the migration of the testis proceeds, the gubernaculum shortens and eventually atrophies, but some trace of the gubernaculum persists at the bottom of the scrotum below tunica vaginalis. The shortened remains of the gubernaculum form the scrotal ligament, fixing the testis to the bottom of the scrotal pouch

#### **ANATOMY OF GROIN AND THE INGUINAL CANAL <sup>24,25, 26, 27</sup>**

*No disease of the human body belonging to the province of surgeon requires in its treatment, a better combination of accurate anatomical knowledge with surgical skill than hernia, in all its varieties.*

*Sir Astley Patson Cooper, (1804)<sup>23</sup>*



The groin is that portion of the anterior abdominal wall below the level of anterior superior iliac spines. For proper orientation, the groin is referred to as the surgeon views the patient on the operating table. The pubis and superior pubic (Cooper's) ligament are medial. The epigastric vessels and transversalis fascia condensation at the internal ring are lateral. The anterior femoral sheath, iliopubic tract and inguinal ligament are inferior and the transverses abdominis aponeurosis and its arch are superior.

### **Skin**

Langer's lines are transverse in the groin with convexity facing downwards. The anterior superior spine of ileum is easily palpable in the lateral groin and pubic tubercle on the lateral margin of the pubis. Spermatic cord is identified as it exits from the external ring which overlies the lateral aspect of the pubic tubercle. The deep ring is located approximately 2 cm above the skin crease between the thigh and the abdomen and midway between anterior superior iliac spine and pubic symphysis. The skin of groin is innervated by the **ilioinguinal, iliohypogastric** and **genital branch of genitofemoral** nerves.

### **Subcutaneous Tissues of Groin**

Divided into two strata - superficial fatty layer (Camper's fascia) and deeper membranous layer (Scarpa's fascia), which continues into perineum as the Colles fascia.

## **External Oblique Muscle and Aponeurosis**

It arises from the lower 8 ribs (5 to 12) and its fibers are directed downwards, forwards, and medially. From the anterior superior iliac spine to the pubic spine, the aponeurosis forms a free border which is called inguinal ligament. The muscle becomes totally aponeurotic in the groin with its fibers running obliquely downwards. It becomes the external layer of the anterior rectus sheath and further inserts on the pubis. The superficial inguinal ring is a triangular opening in the external oblique aponeurosis, 1 to 1.5 cm lateral to the pubic tubercle. The opening is formed by the splitting of external oblique.

## **Internal Oblique Muscle and Aponeurosis**

The internal abdominal oblique muscle lies between the external oblique and the transverses abdominis muscles. It originates from the outer half of the inguinal ligament, from the intermediate line on the iliac crests and from the posterior lamella of the lumbodorsal fascia through which it gains attachment to the lumbar spines. The anterior lamella accompanies the external oblique aponeurosis to form the anterior rectus sheath and the posterior lamella accompanies the aponeurosis of the transversus abdominis to form the posterior rectus sheath. They insert conjointly with those of the transverses abdominis into the crest of the pubis. This fusion of the tendinous portions of the internal oblique and transverses muscles that results in the structure known as the conjoint tendon.

## **Transversus Abdominis Muscle and Aponeurosis**

This is the most internal of the three flat muscles of the abdominal wall. It passes medially in a transverse manner around the lateral aspect of the abdomen on to the anterior abdominal wall. This is the key layer, because of its role in hernia repair. The general layer of the muscle (lateral portion) and the aponeurosis (medial portion) is towards the linea alba, where it forms the anterior rectus sheath below the semicircular line of Douglas. In the groin it can be divided into continuous and discontinuous portions.

A. The continuous portion is the extension of the main muscle and aponeurosis, the lower border of which arches above and medial to cord structures and are called Transverses abdominis arch, which in 10% of cases due to its dense nature and insertion into the pubic tubercle and the crest is called falx inguinalis. In 3% of cases the falx receives contribution from the internal oblique aponeurosis also thereby forming the conjoined Tendon.

B. The discontinuous portion lies below the transverses arch, forms the posterior wall of the inguinal canal, medial to the internal ring. One fourth of these fibers show marked individual variations and most often is deficient, represented only by the transversalis fascia, thereby forming a critical weak spot in the posterior wall of the inguinal canal. The inferior most edge of this layer is formed by the "iliopubic tract", a collection of aponeurotic fibers.

## **Transversalis Fascia**

This is a portion of the endo-abdominal fascia that encloses the abdominal cavity and peritoneum. The portion which invests the transverses muscle and aponeurosis is called Transversalis fascia. It is continuous with the lumbar, iliac, psoas, obturator and rectus fascia. It is adherent to the transverses muscle - aponeurosis due to the numerous slips of fibrous tissue that traverse the muscle and attach to the deep interpareital fascia. Hence, practically it forms part of the transverses muscle aponeurosis fascia complex. At the deep inguinal ring there is a tubular projection of this fascia - internal spermatic fascia that extends outwards in a blunt funnel like fashion to cover the ductus deferens and the spermatic vessels. However, the blunt funnel is not perfectly conical, but is skewed and the axis of the funnel is less oblique than the axis of the vessels through the deep inguinal ring. The redundant transversalis fascia in the medial side of the deep ring is called 'Transversalis fascia sling'. The transversalis fascia is somewhat like the letter 'V' with the open end pointing superolaterally to the groin and the diverging ends are called crurae. Most often, the posterior inguinal wall is represented only by this fascia and leads to weak spot in the groin.

## **Rectus Sheath**

In the groin aponeurosis of all the three flat muscles contribute to the anterior sheath.

## **Peritoneum**

In the groin as elsewhere, the peritoneum is a thin elastic membrane that serves only to provide a lubricating surface for its contained viscera. Because of the elastic character of the peritoneum it does not act in the prevention of hernia.

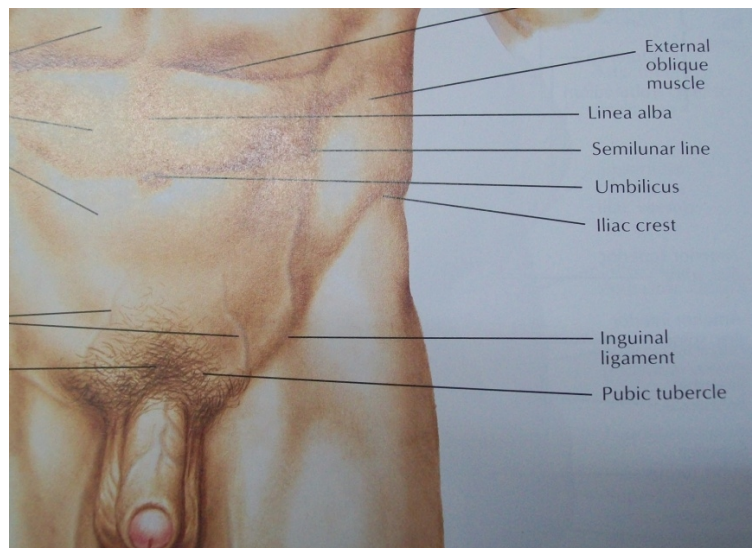
### **The Conjoint Tendon (Falx Inguinalis)**

The aponeurosis of the transverses abdominis and the internal oblique are fused some distance lateral to the rectus sheath, the term conjoint tendon . This anatomic configuration, The transversus muscle contributes 80% of the conjoint tendon. The conjoint tendon lies lateral to the rectus muscle and immediately deep to the superficial inguinal ring. It passes down to its insertion deep to the inguinal and lacunar ligaments. The spermatic cord or round ligament of uterus lies anterior to it while passing through the superficial inguinal ring. The conjoint tendon has a very variable structure and in 20% of the subjects it does not exist as a discrete anatomic structure - it may be absent or slightly developed or it may be replaced by a lateral extension of the tendon or original ring, so that no interval is present between the lower border of the transverses and the inguinal ligament.

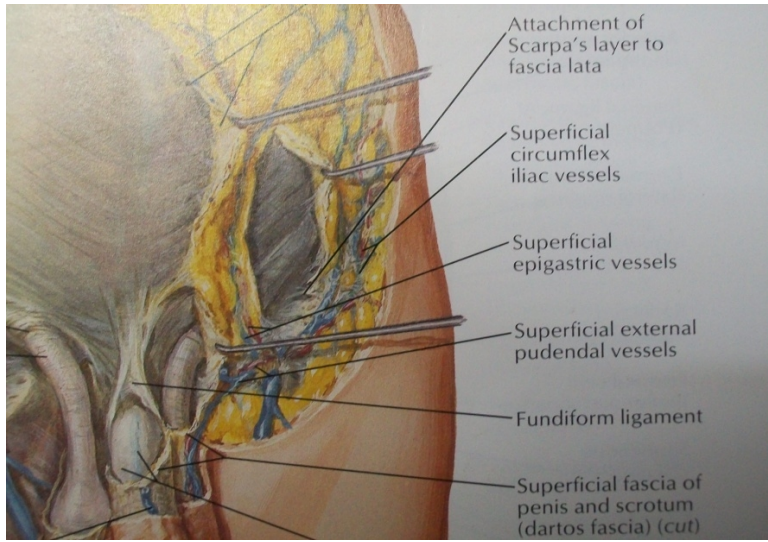
### **Cooper's Ligament (Iliopectineal Ligament)**

Cooper's ligament is remarkably constant in form and extent and represents the strongly reinforced periosteum of the superior ramus of the pubis. On the superior and internal aspect of superior pubic ramus, covering and immediately internal to the

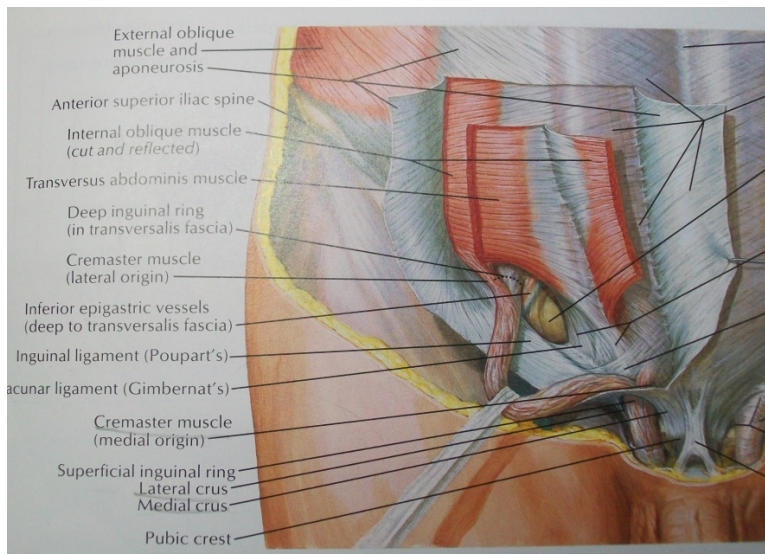
pectineal line, the periosteum is supplemented by a considerable quantity of dense fibrous tissue so that it usually becomes 2 cm or even 3 cm thick. Laterally, it continues posteriorly along the brim of the true pelvis, becoming progressively thinner until it can no longer be distinguished from periosteum of ileum. Cooper's ligament is particularly important in the surgical correction of femoral hernias and large direct inguinal hernias, because it forms a solid anchor along the inferior or posterior aspect of these hernial defects, through which sutures may be placed with confidence that they will hold.



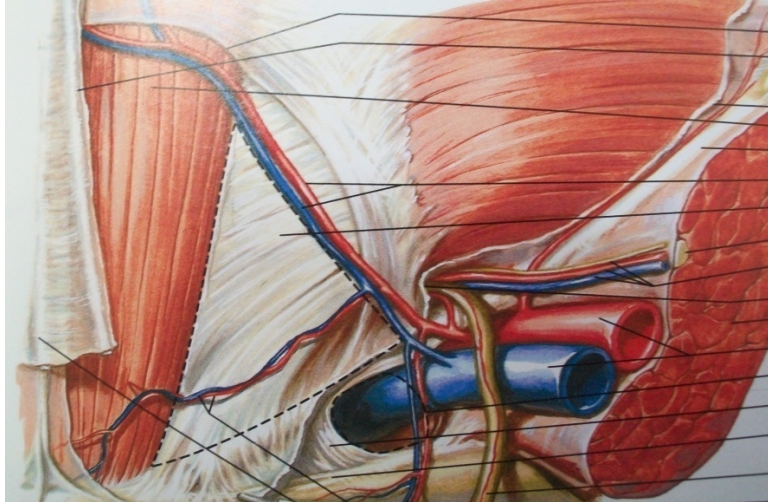
**Figure-9. The left Groin**



**Figure -10. Subcutaneous tissues of Groin**



**Figure -11. Deep ring and Superficial Inguinal ring**



**Figure -12. Hasselbach's Triangle**

### **Inguinal Ligament (Ligament of Poupart)**

It is the lower, thickened portion of external oblique aponeurosis extending from the anterior superior iliac spine to the pubic tubercle. Its edge is rolled inwards to form a gutter. The lower edge of the inguinal ligament is loosely bound to the fascia lata by the Innominate fascia. This fascia also serves to bind together the collagenous fibers of aponeurosis and inguinal ligament. Medially, the inguinal ligament gets inserted on the pubic tubercle and fans downward to the superior pubic ramus as the lacunar ligament.

### **Lacunar Ligament of Gimbernat**

The ligament of Gimbernat is a triangular fascial extension of the inguinal ligament, before its insertion to the pubic tubercle. It is inserted at the pecten pubis and its lateral end meets the proximal end of the ligament of Cooper. It serves to broaden the attachment area for the inguinal ligament by fanning.



## **The Cremaster Muscle**

The cremaster consists of a number of loosely arranged muscle fascicles lying along the spermatic cord. They are united by areolar tissue to form the sac like cremasteric fascia around the cord and testis, within the external spermatic fascia. The lateral part of the muscle, arising from the inguinal ligament, has been variously described as in continuity with the medial edge of the internal oblique, deep to the internal oblique extending as far as the anterior superior iliac spine and in continuity with either the internal oblique or transverses or as a pointed tendon from the middle of the inguinal ligament piercing the internal oblique near its medial margin. The fibres pass along the lateral aspect of the spermatic cord through the superficial inguinal ring and then spread out into the fasciculi in loops, of increasing length along its anterolateral aspect.

## **Inguinal Canal**

It begins at the site of emergence of the spermatic cord through the transversus aponeurosis (internal ring) and ends at the pubic tubercle. It is oblique and 3.75 cm long, slanting downwards and medially, parallel with and a little above the inguinal ligament. It extends from the deep to the superficial inguinal ring. The boundaries are:

**Anteriorly:** Throughout by the skin, superficial fascia, external oblique aponeurosis, in its lateral one third by the muscular fibres of the internal oblique.

**Posteriorly:** The transversalis fascia, reinforced medially by the falx inguinalis (when

present).

**Superiorly:** The arched fibers of internal oblique and transverses aponeurosis.

**Inferiorly:** The inguinal ligament and its continuation, lacunar ligament.

### **Hesselbach's Triangle**

It is bounded medially by the lateral border of the rectus sheath, laterally by the inferior epigastric vessels and below by the inguinal ligament. **Spermatic cord:**

Originates at the deep ring and consists of

- a. Arteries: Testicular, cremasteric and artery to vas.
- b. Veins: Corresponding veins, mainly testicular (pampiniform plexus).
- c. Nerves: Genital branch of genitofemoral nerve, cremasteric nerve, Sympathetic plexus derived from Para aortic and pelvic plexus.
- d. Lymphatics of the testes.
- e. Vas deferens and areolar connective tissue.

Coverings of the spermatic cord from within are: processus vaginalis internal spermatic fascia

(Transversalis fascia), cremasteric fascia (Internal oblique muscle and fascia) and external

spermatic fascia (External oblique muscle and fascia).

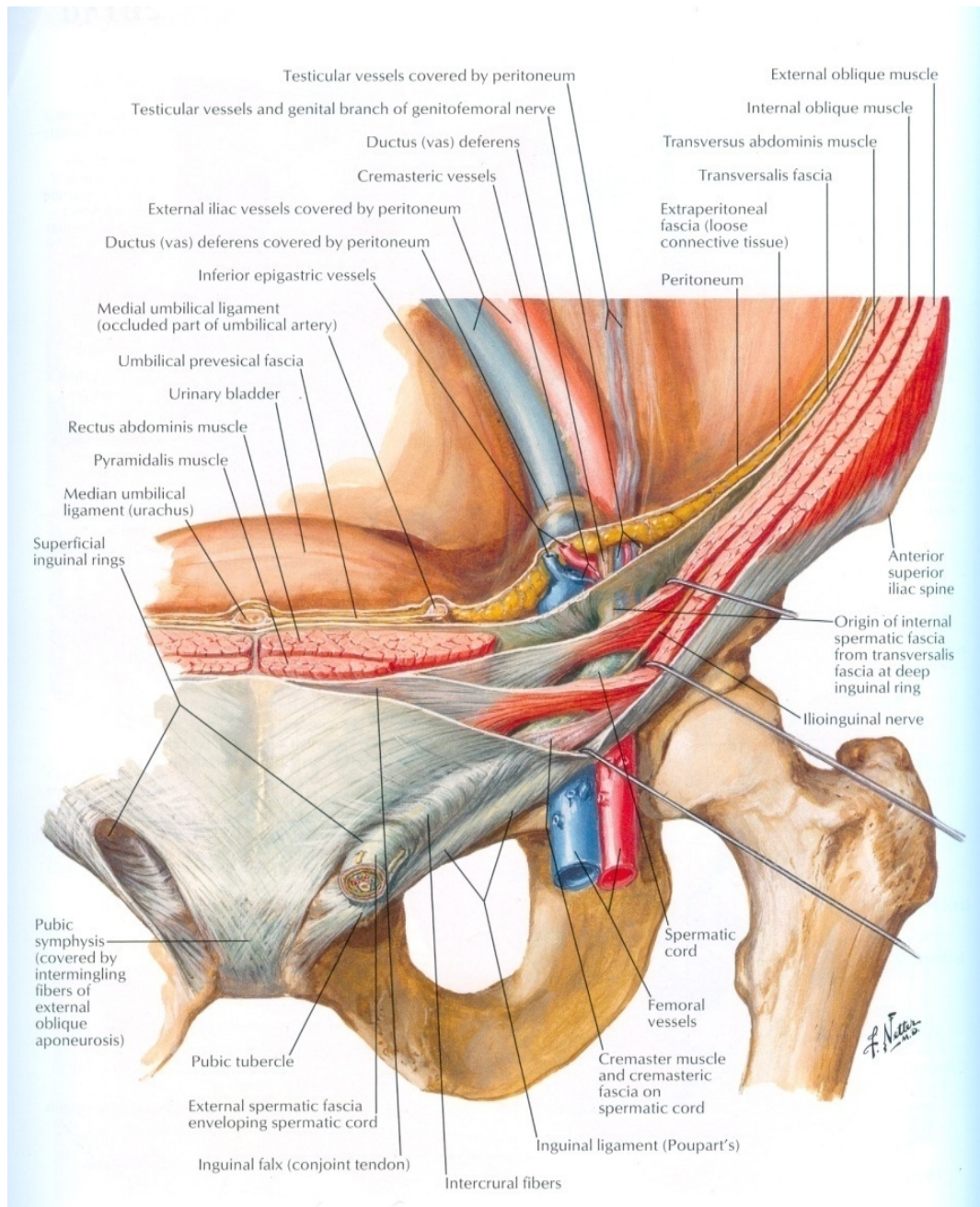
**Blood Vessels and Nerves** The external iliac artery gives off two major branches, before

crossing beneath Poupart's ligament, where it becomes the femoral artery. These

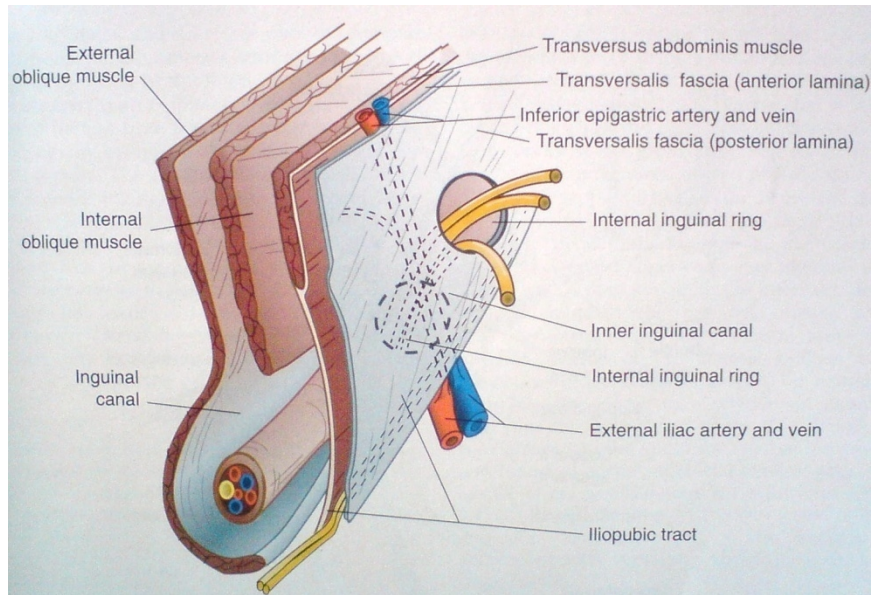
tributaries, the deep circumflex iliac and the inferior epigastric vessels, are not vital. The latter, serves as the medial border of the deep ring, or the lateral border of the direct triangle. There is, therefore an additional method of identifying the position of the internal ring. The epigastric artery gives off two branches, the cremasteric and the pubic. The testicular artery arises directly from the aorta to supply the testis. The spermatic cord contains still one other small vessel, the umbilical artery, to supply the ductus deferens.

## **Nerves 28**

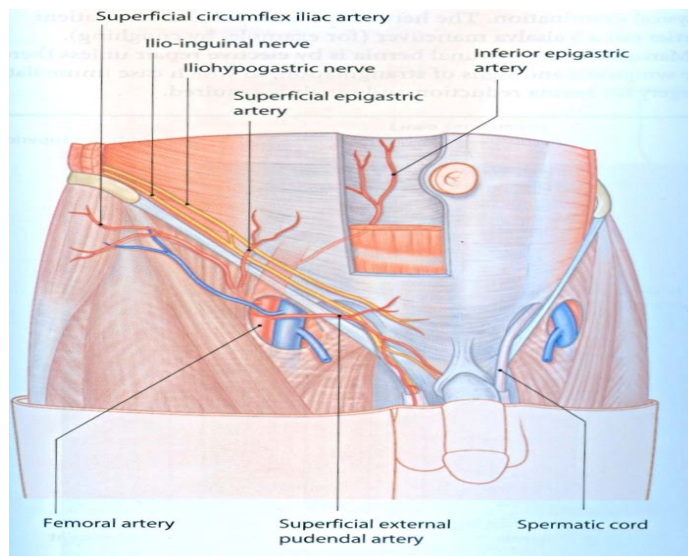
The essential nerves of the groin are the ilioinguinal, the iliohypogastric and the genitofemoral. The last, arising from L1 and L2 supplies the cremaster muscle, the skin of the scrotum and the medial aspect of the thigh, in females to mons pubis and labia majus. Its integrity is essential to the cremaster reflex. The ilioinguinal and iliohypogastric nerves arise primarily from L1. Just medial to the anterior superior spine these nerves traverse the internal oblique and come to lie beneath the external oblique aponeurosis then Ilioinguinal nerve traverses the inguinal canal and emerges through the superficial inguinal ring and supplies sensory innervation to proximal and medial thigh, root of the penis and upper scrotum. In females it innervates mons pubis and labia majus. The hypogastric branch of the iliohypogastric is mainly a motor nerve that supplies the abdominal muscles along its course. It exits through the external oblique aponeurosis above the external ring. Care is necessary to avoid injury to the nerve when performing a relaxing incision.



**Figure-13. Layers of Abdominal wall forming the Inguinal canal and its contents**



**Figure -14. Inguinal canal and its contents**



**Figure -15. Nerves and Blood Vessels at Groin**

## **EPIDEMIOLOGY, ETIOLOGY AND PATHOPHYSIOLOGY<sup>29,30,31,32</sup>**

Seventy –five percent of all abdominal hernias are found in the groin; Of all groin hernias,95% are hernias of the inguinal canal with the remainder being femoral hernia defects.Inguinal hernias are 9 times more common in men than in women, the inguinal hernia is still the most common hernia in women .The overall lifetime risk of developing a groin hernia is approximately 15% in males and less than 5% in females. There is clearly an association between age and hernia diagnosis. In the same way the complications of hernias (incarceration , strangulation ,bowel obstruction ) are found commonly at the extremes of age.Currently in this country approximately 700,000 operations for inguinal hernia repair are performed annually.The cause of hernia is multifactorial and it is assumed that the following factors are involved.

### **1. Evolution**

The absence of posterior rectus sheath below the arcuate line and only rather substantial transversalis fascia unsupported by muscles or aponeurosis resisting the intra-abdominal pressure and holding the breach between the abdomen and the thigh. It is compounded by humans having adopted the upright posture and change from quadrupedal to bipedal locomotion In man, the upright posture causes gravitational stress to pass down to the lower abdominal wall, which is structurally not designed for it nor has the evolution suited it for its new role.

## **2. Congenital and Anatomical Factors**

**a. Patent Processes Vaginalis:** Is the prime cause of indirect inguinal hernia in infants and children. The development of processus vaginalis, its migration and its final obliteration are intimately linked to the descent of the testis from the abdominal cavity into the scrotum. The incidence of patent processus vaginalis in adults who do not develop hernia during their life is up to 20%.

**b. Subtle varieties in the attachment and arrangement of abdominal muscles.**

**c. Females are particularly free of direct inguinal hernia:** The narrowness of the interval between the transversus arch and the inguinal ligament and the hermetical attachment of external oblique aponeurosis are the important factors in protecting women against direct hernia. On the other hand, musculoaponeurotic attachments in woman are such that they frequently develop femoral hernia. Other factors that are significant in the etiology are the number of aponeurotic fibers in the transversus aponeurosis which determines the intrinsic strength of the layer. The disposition of the transversus arch in relation to the Iliopubic tract indirectly determines the size of the inguinal gap or defect in the Hesselbach's triangle.

**d. The obliquity of the inguinal canal:** During sudden exertion increases the intraperitoneal pressure, compresses in the anterior and posterior walls of the canal there by occluding the canal.

## **3. Shutter Mechanism**

The accepted explanation for this is the physiologic "Shutter mechanism" which is

activated, when the abdominal muscles contract to raise the intra abdominal pressure. As the internal oblique and transverse abdominis muscles contract, their lower fibers forming the myoaponeurotic roof of the inguinal canal "the conjoined tendon", that arches over the spermatic cord also sharply contracts and as the fibers shorten, the arch straightens out and descends to come to lie close to or on the inguinal ligament and so covers and protects the fascia transversalis. The shutter also passes down in front of the internal ring and counteracts the pressure on the ring from inside the abdomen. Contraction of the transverse abdominis muscle also pulls up and tenses the crurae of the internal ring which make up the thickened bands of the iliopubic tract and fascia transversalis causing the ring to close like a sphincter snugly around the cord.

#### **4. Integrity of the Fascia Transversalis<sup>31</sup>**

The ability of the fascia transversalis to withstand physiologic and pathologic elevations in the intra abdominal pressure is dependent on the state of the collagen fibers that make up its tissues and give its strength. The factor which interferes with normal production of collagen or causes its increased destruction or abnormal production of collagen fibers decreases the strength of transversalis fascia. These factors include congenital connective tissue disorders like Marfan's, Ehler-Danlos and Hurler-Hunter syndromes and mesenchymal metabolic defects. It is found that substances in cigarette smoke inactivate anti-proteases in lung tissues and so upset the protease/antiprotease system which is responsible for destruction of elastin



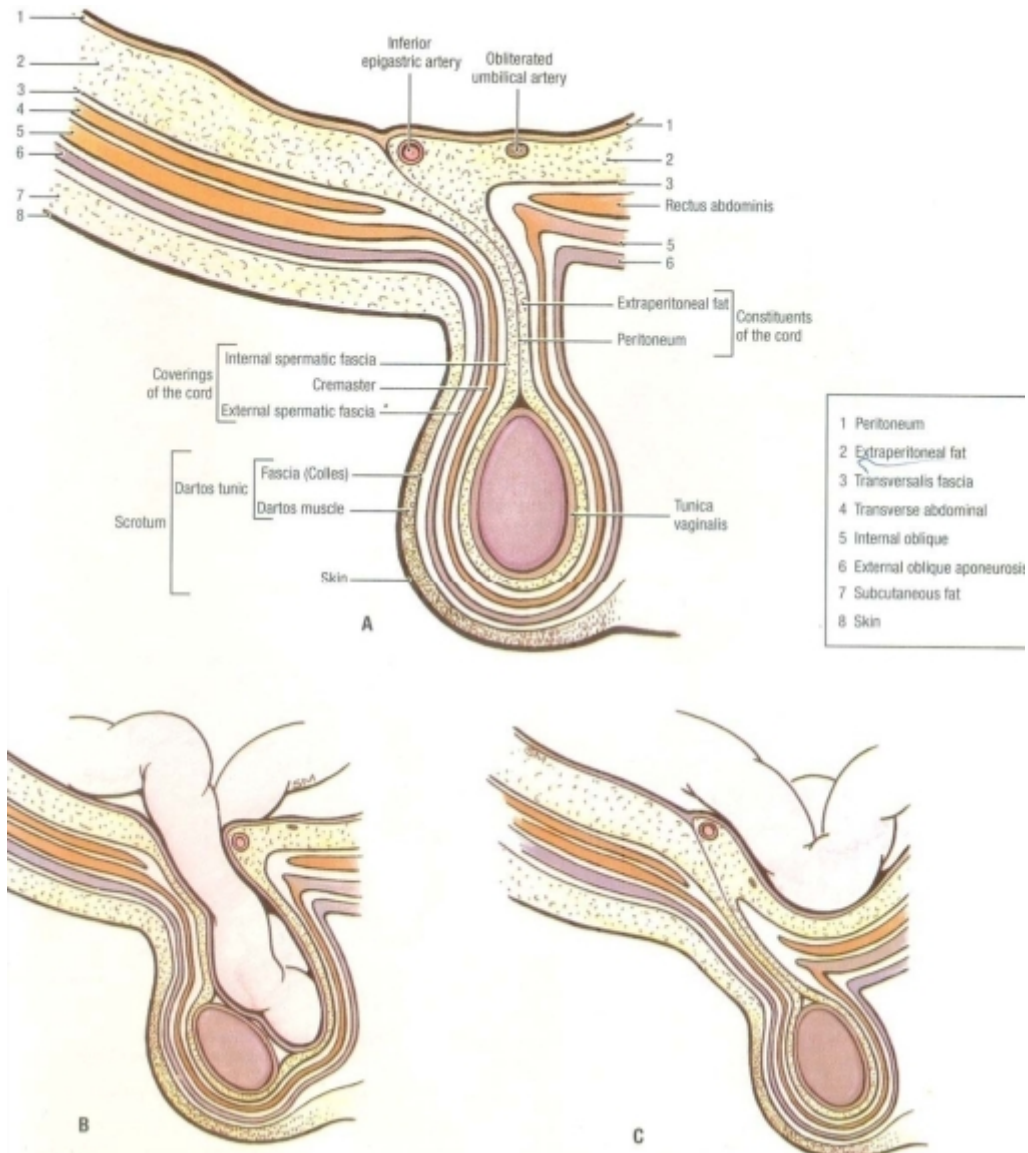
and collagen of the rectus sheath and fascia transversalis and predispose to herniation in smokers.

### **5. General Contributing Factors**

Like weakening of muscle and fascia by advancing age, lack of physical exercise, obesity and multiple pregnancies. Loss of weight and body fitness as may occur after illness, operation or prolonged bed rest, very low and unduly long transverse abdominal incisions for gynecological, urological and appendectomy incision. Pulmonary diseases like COPD and emphysema, prostatism, chronic constipation, diverticular disease, genito-urinary causes like cystitis, cystocele and urethrocele contribute to the formation of groin hernia.

### 3. Coverings<sup>27</sup>

Coverings in case of an indirect inguinal hernia are, from inside out, as follows:



**Figure-16. Coverings of inguinal hernia (A), Indirect (B), and Direct (C)**

## Components of Inguinal Hernia<sup>23</sup>

**1.The sac** consists of a diverticulum of peritoneum, which is divided into mouth, neck, body and fundus.

**Mouth :** This is the part between the sac interior and the abdominal cavity.

**Neck :** This is the narrowest section between the mouth and the body of the sac.

**Body :** It lies between the neck and the fundus.

**Fundus :** This is the blind end or the distal most part of the sac.

## 2. Contents of Hernia

These can be almost any abdominal viscera, except the liver. The commonest are;

- a. Fluid - Derived from peritoneal exudates, usually in congenital hernias..
- b. Omentum - Omentocele (Synonym -Epiptocele).
- c. A loop of intestine - Enterocele (Usually small intestine, but in some instances large intestine or vermiform appendix).
- d. A portion of the circumference of the intestine - Richter's hernia.
- e. A portion of urinary bladder wall or a diverticulum of the bladder.
- f. Ovary with or without the corresponding Fallopian tube.
- g. Meckel's diverticulum - Littre's Hernia.
- h. Two loops of intestine in the manner of W - Maydl's hernia.
- i. Rarely stomach, spleen or caecum may be found within the sac.
- j. Sliding or Hernia-en-Glissade (Contents - Caecum, Urinary bladder).
- k. Maydl's hernia or Hernia-en-W (Contents-W shaped loop of intestine).

1. Dual hernia (saddle or pantaloons). Hernia, on either side of the inferior epigastric vessels.

## **CLASSIFICATION OF INGUINAL HERNIAS**<sup>33,34</sup>

### **Clinical Classification**

This is based on the clinical presentation of hernia:

- Reducible hernia
- Irreducible hernia
- Obstructed hernia (Incarcerated hernia)
- Strangulated hernia
- Inflamed hernia

### **Gilbert's Classification (Addition by Rutkow and Robbins)**

It is based on anatomical and functional defects established intra-operatively, categorized groin hernias into 5 types. Type 1, 2 and 3 were indirect whereas type 4 and 5 were direct.

### **Indirect Hernia**

**Type I :** Snug internal ring, intact canal floor.

**Type II :** One finger breadth internal ring, intact canal floor. Not more than 4 cm.

**Type III :** Two-finger breadth internal ring. Canal floor is defective (Scrotal and sliding hernias).

### **Direct Hernia**

**Type IV :** Entire canal floor defective, no peritoneal sac anterior to canal floor, intact

internal ring.

**Type V :** Diverticular defect, admitting no more than one finger, internal ring intact.

**Type VI :** Consists of both direct and indirect components.

**Type VII :** Covers all femoral hernias.

### **Nyhus Classification of Groin Hernias**

Is based on strict anatomic criteria, focusing on functional state of the internal ring and posterior wall of the inguinal canal.

**Type I :** Indirect inguinal hernia -- internal inguinal ring normal (Congenital hernia).

**Type II :** Indirect inguinal hernia -- internal ring dilated but posterior inguinal wall intact, inferior deep epigastric vessels not displaced.

**Type III :** Posterior wall defects

A. Direct inguinal hernia.

B. Indirect inguinal hernia - internal ring dilated, medially encroaching or destroying the transversalis fascia of the Hesselbach's triangle. (e.g. massive scrotal, Sliding or Pantaloon hernias).

C. Femoral hernia.

**Type IV :** Recurrent hernias

### **Classification as per the Patency of Processes Vaginalis**

a. Vaginal hernia:

b. Infantile hernia:

c. Funicular hernia:

## **BEN DAVID TSD CLASSIFICATION**

Type	Anterolateral (indirect)
	Anteromedial (direct)
	Posteromedial (femoral)
	Posterolateral ( perivascular )
Stage	I.Sac in canal
	II.Sac outside external ring
	III.Sac into scrotum

### **Anatomical Classification**

- a. Direct hernia
- b. Indirect hernia
- c. Femoral hernia

### **Classification according to Descent of the Sac**

- A. Bubonocele
- B. Funicular
- C. Complete

## **CLINICAL FEATURES OF INGUINAL HERNIA<sup>35,36</sup>**

### **History**

**Age:** Inguinal hernias occur at all ages. They may be present at birth or appear suddenly in an 80 year old. Peak times of presentation are in the first few months of life, in the late teens and early 20's and between 10 and 60 years. Indirect hernias are seen in young individuals where as direct are seen in older subjects.

**Sex:** Males are 20 times more commonly affected than females.

**Occupation:** Heavy work, especially lifting puts a great strain on the abdominal muscles. If there is an underlying weakness, the appearance of a hernia may coincide with strenuous physical effort. Hard labour workers, sportsmen and weight lifters are more prone.

**Associated diseases:**

Many a times, hernia is due to diseases causing weakness of anterior abdominal wall like obesity, previous lower abdominal operations, ascites and Malgaigne's bulges. Certain diseases lead to increase in abdominal pressure such as prostatic enlargement, stricture urethra, chronic cough and respiratory disorders and chronic smoking.

**Local symptoms:**

**Pain :** The commonest symptoms are discomfort, heaviness and pain in the initial stages. The patient complains of a dragging, aching sensation in the groin, which gets worse as the day passes.

**Lump :** A lump in the groin is the second most common complaint. This may be a small lump of 2-3 cm or a huge lump going down to the knee level. Patient feels that it gets smaller when he lies down and bigger when he strains or stands.

**Systemic symptoms:**

If the hernia is obstructing the lumen of a loop of bowel, the patient may complain of one or more of the four cardinal symptoms of intestinal obstruction – colicky

abdominal pain, vomiting, abdominal distension and absolute constipation. In late cases of strangulation where gangrene has set in, patient can present with features of peritonitis, more so if perforation of bowel has occurred.

## **Signs**

**Inspection:** In standing position, a bulge or swelling will be seen in groin. This might disappear on lying down, if the hernia is reducible spontaneously in direct hernia. Impulse on coughing is present in reducible hernia. Loss of rugosities of scrotal skin in large inguino-scrotal hernias is seen. Visible peristalsis is seen in enterocele. Malgaigne's bulges are seen in patients with lax abdominal wall. An indirect hernia is sausage or pear shaped and lies parallel to the inguinal ligament. After reduction it reappears more laterally and runs down above the inguinal ligament towards the scrotum. A direct hernia is more rounded, more medial, bulges forward and tends not to go down to scrotum. After reduction it reappears in a forward direction.

**Palpation:** Reducing the hernia by manipulation is called taxis and it is performed in lying down position of the patient. As the hernia is reduced following features are noted:

- a. Gurgling sound is felt in enterocele.
- b. In enterocele first part takes longer to reduce and in omentocele later part.
- c. Impulse on coughing is felt.

**Internal Ring Occlusion Test:** Internal ring is occluded and patient is asked to cough. If a bulge is seen medial to the occluding finger, then it is a direct hernia, if not an indirect hernia.



**External Ring Occlusion Test:** After complete reduction, the external ring is occluded with a finger and patient is asked to stand up gently. The reducible inguinoscrotal swelling will not come down as its descent is prevented by occluding finger, where as swelling fills gradually from below in case of varicocele and lymphvarix.

**Finger Invagination Test:** After reduction of the hernia, this test may be performed to palpate the hernial orifice. The skin is invaginated from the bottom of the scrotum by little finger, which is pushed up to palpate the pubic tubercle. The finger is then rotated and pushed further up into the superficial inguinal ring. Normal ring is a triangular slit which admits only the tip of a finger. When the finger enters the ring, it goes directly backwards in direct hernia and it goes upwards, backwards and outwards in indirect hernia. The finger is again rotated so that the pulp of the finger faces backwards. The patient is again asked to cough. If the impulse is felt on the pulp of the finger, the hernia is a direct one, if it is felt on the tip, then it is an indirect hernia. “Sharma's ring”, may be felt in the sac during finger invagination test.

**Percussion:** Over the swelling, tympanic, if it is an enterocele and impaired or dull in case of omentocele.

**Auscultation:** Bowel sounds will be heard in enterocele.

### **Always examine**

#### **1. External Genitalia**

- Scrotum for thickened spermatic cord.
- Epididymis and Testes.
- Prepuce for phimosis and External urethral meatus for pinhole meatus.

#### **2. Per Rectal examination**

**3. Per Abdomen Examination:** To rule out any abdominal mass, ascites and Divarification of recti.

**4. Respiratory System:** To rule out COPD and Koch's.

### **Differential Diagnosis of Inguinal Hernia**

**I. When the swelling is incomplete i.e. an inguinal or a groin swelling:**

- a. Femoral hernia.
- b. Enlarged Inguinal Lymph Nodes.
- c. Saphena Varix:
- d. Femoral Aneurysm.
- e. Encysted Hydrocele of the Cord.
- f. Lipoma of the Cord.
- g. Undescended or Ectopic Testis.
- h. Psoas Abscess.

i. Malgaigne Bulges.

j. Spermatocele.

k. Lymph Varix.

## **II. When the swelling is complete i.e., inguinoscrotal swelling.**

a. Infantile Hydrocele.

b. Congenital Hydrocele.

c. Encysted Hydrocele of the Cord: Already discussed.

d. Varicocele.

## **COMPLICATIONS OF GROIN HERNIA <sup>37</sup>**

Certain complications are well recognized. Others are not.

- Irreducibility
- Incarceration
- Reduction-en-masse
- Strangulation
- Gangrene
- Peritonitis due to perforation of the intestinal wall and
- Malignant mesothelioma ( very rarely).

## **INVESTIGATIONS** <sup>38,39,40</sup>

Laboratory and radiological aids are of limited use in the diagnosis of inguinal hernias. Routine laboratory investigations like Hb%, urine routine, blood urea, serum Creatinine will aid in the search of normal parameters before taking the patient for Surgery. Roentgenographic examination of the abdomen may reveal the patterns characteristic of intestinal obstruction with air and fluid filled loops of intestine on Plain x-ray erect abdomen as in complicated presentations of inguinal hernias. Ultrasound of the abdomen to know the obstructive urinary outflow diseases and Chest xray to find pulmonary pathology.

### **Herniography:**

According to the literature, herniography is used primarily in patients with unexplained groin pain, or to find nonpalpable, symptomatic cases of hernia recurrence. The technique of examination is described by Gullmo. A 20 to 22 gauge Veress needle is used to puncture the midline below the umbilicus. The catheter is guided into the lesser pelvis and 50 to 80 ml of contrast medium is injected. As the patients turns from side to side in the prone position, the contrast medium pools in the inguinal region. With the techniques now available, we believe that there is no indication for herniography, even if the complication rate is low.

## **TREATMENT OF INGUINAL HERNIAS 41,42,43**

Aim of treatment of inguinal hernia comprises of exposing the site of defect, correcting the anatomical defect, strengthening or reinforcing the deficiency in the posterior wall of the inguinal canal. Treatment of inguinal hernias is essentially surgical, exceptionally temporarily conservative, when efforts are made to keep the hernia in reduced state by clinical maneuvering, till the time the patient becomes fit for surgery.

### **TYPES OF SURGICAL TREATMENT FOR INGUINAL HERNIA**

**Herniotomy:** This is the essential and basic operation and it entails dissecting out and opening the hernial sac, reducing any contents and then transfixing the neck of the sac and removing the remainder. It is employed either by itself or as the first step in herniorrhaphy or hernioplasty. Herniotomy is sufficient for the treatment of hernia in infants and adolescents. In High herniotomy, the sac is removed at the level of deep inguinal ring.

**Herniorrhaphy:** refers to the strengthening or reconstruction of the posterior wall of the inguinal canal.

**Hernioplasty:** is the addition of grafts or prosthetics to herniorrhaphy (Reinforcement).

#### **Bassini's Repair:**

This classical operation was first described by Bassini in 1888.

#### **Indications:**

1. Indirect inguinal hernia in healthy young adults with good musculature, in whom

the deep ring is not stretched.

2. Adults in whom the internal ring is stretched.

3. Also suitable for large indirect inguinal hernia where the internal ring is stretched and posterior inguinal wall is distorted.

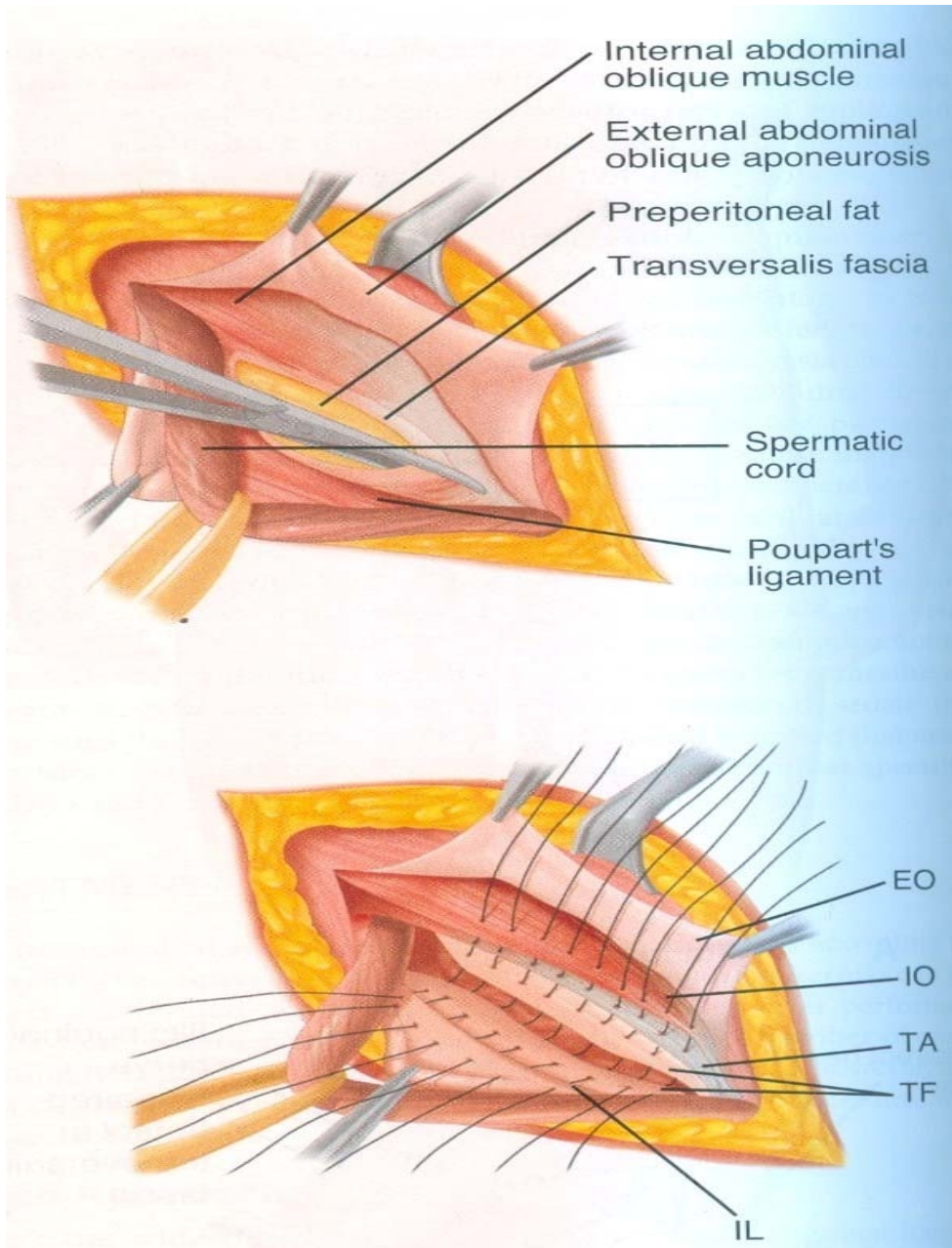
**Aim of the operation:** To narrow the internal ring and to reinforce the posterior wall of the inguinal canal with conjoint tendon.

**Technique:** Simple herniotomy is done. The lower part of the conjoint tendon and upper surface of the inguinal ligament are carefully cleared off fat and areolar tissue. The muscle and tendon are lifted forwards on finger and 4 to 5 stitches are inserted at about one centimeter interval between conjoint tendon and the inguinal ligament at medial end of the canal, since it is the site of maximum recurrence. To make sure of closing the medial gap it is advised to take the first bite through the periosteum of the pubic bone. The stitches should be introduced at different depths into the inguinal ligament in order not to cause splitting of the inguinal ligament along the line of suture. In placing sutures in the inguinal ligament, care should be taken not to injure the external iliac vessels, which lie immediately deep to the inguinal ligament. Non-absorbable monofilament suture (prolene) is usually used but any other suture material of surgeon's choice can be used. It is particularly important that the stitches should not be too tight. Care should be taken not to include the iliohypogastric nerve. The conjoint muscle should lie snugly around the internal ring. Care should be taken not to tie the suture under tension. The cord is placed over the strengthened posterior

wall and external oblique aponeurosis, sutured with interrupted or continuous suture. The skin wound is sutured.

**The darn:**

Obney and Ryan working with Shouldice at his hernia clinic, developed *denovo* a hernioplasty (1950-53) that is essentially identical to Bassini procedure. In this operation, the transversalis fascia is not incised, but is imbricated with a continuous suture of at least two layers, approximating identical myoaponeuroticofascial layers between the conjoint tendon and the inguinal ligament. The darning is conducted from pubic tubercle up to and above the internal ring and back to the starting point. The darning is kept fairly loose and it forms a lattice upon which fibrous tissue is laid down. A darn does not draw tissues together and there is no tension in the stitches.



**Figure -17. Bassini Repair**



## **Shouldice operation** : 37,44,45

The classical Shouldice method of hernial repair was described by Shouldice of Toronto (1908-1965). It is the most popular of those, using only local tissues. It is basically a multilayered Bassini's operation. In Shouldice hospital all operations are done under local anesthesia. After opening the inguinal canal herniotomy is done. The posterior wall repair done by four layers using non absorbable 2/0 polypropylene.

The first line of the repair: It is started from pubic tubercle and just medial to the internal ring, approximates the upper and lower flaps of transversalis fascia.

The second line of repair: the same running suture is used in the reverse direction.

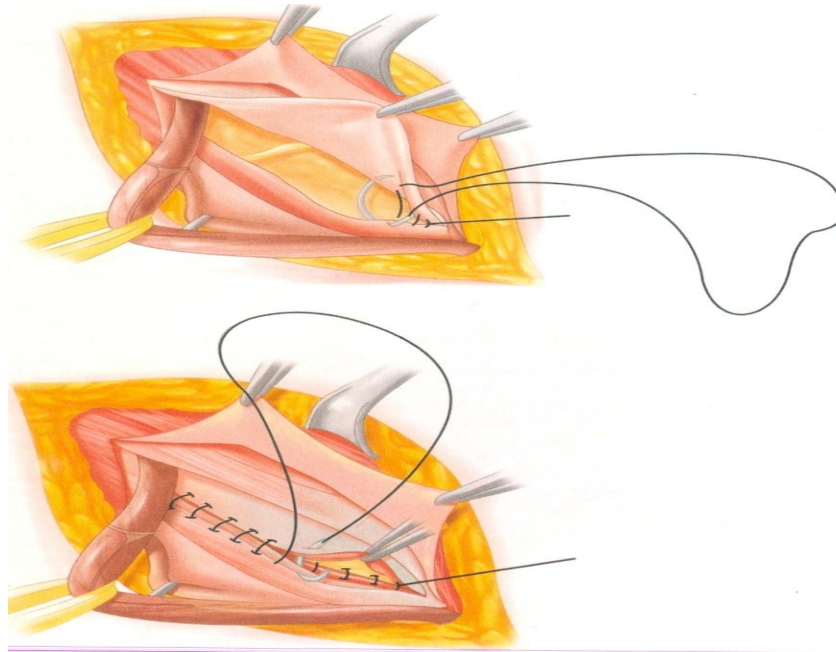
The full thickness of the upper flap, which includes muscle and aponeurotic fibers of the internal oblique and transverses muscles, is sutured to the inguinal ligament below.

The third line of the repair: It is commenced just medial to the internal ring. Above, it picks up the surface of the internal oblique muscle and below, the undersurface of the lower flap of the external oblique aponeurosis close to the inguinal ligament.

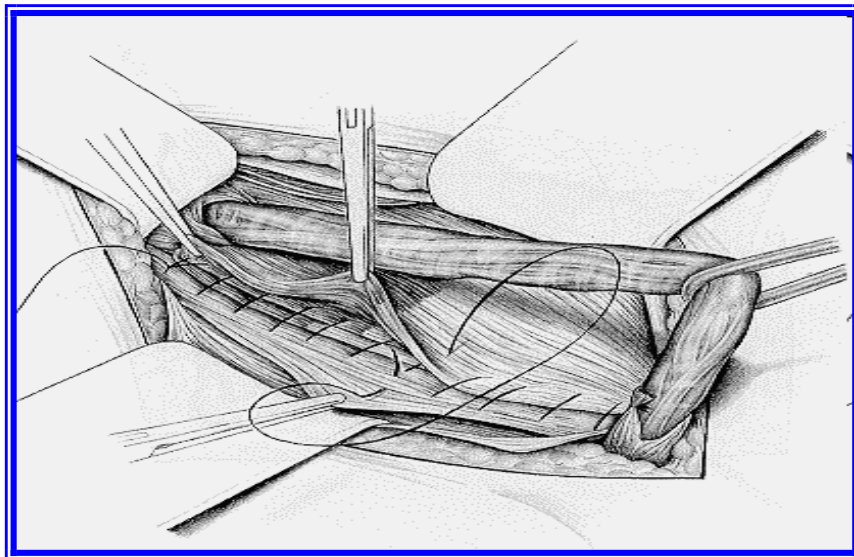
The fourth line of the repair: Returning from the pubic bone, this suture attaches the same structures of third line of repair to one another in a slightly more superficial plane, taking down as much of the lower flap as desired over the aponeurotic and muscle surface above. Closure of External oblique aponeurosis: When the spermatic cord and ilioinguinal nerve are returned to the canal, they will lie in a higher arch than before, as 1 cm or more of the lower flap of the external oblique has been taken up by the repair. The new external ring will be higher and further lateral. The subcutaneous

plane and skin is closed separately.

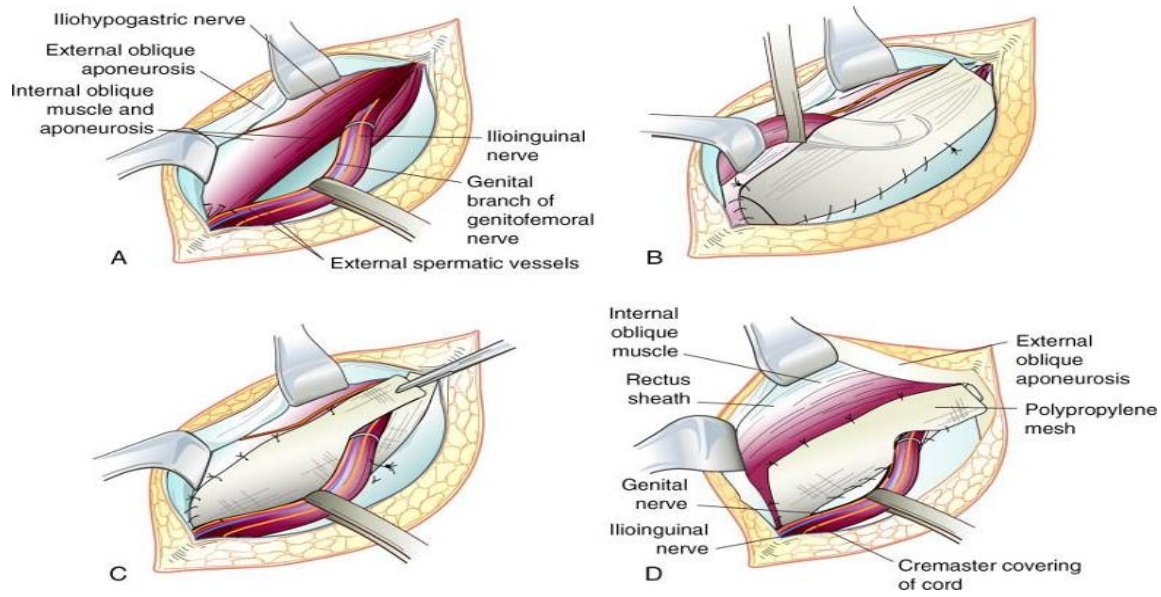
A



B



**Figure -18. Shouldice Repair (A and B)**



**Figure -19. Lichtenstein Tension free Mesh Repair**



**Figure-20. Polypropylene Mesh**

## **Tension – Free Mesh Hernioplasty (Lichtenstein Repair)**<sup>14,46</sup>

In 1984, Lichtenstein described a "tension free" onlay of polypropylene mesh for inguinal hernia repairs. In this technique Lichtenstein repairs all primary direct and indirect hernias without closure of defect.

**Operative technique:** A transverse skin crease incision is deepened down to the external oblique aponeurosis. The spermatic cord is mobilized in the usual way. Direct sacs are inverted and imbricated using a non absorbable suture to flatten the posterior wall. Indirect sacs are dissected from the cord up to extra peritoneal fat and then either excised or inverted. High dissection, rather than high ligation, is the important feature of this stage. If deep ring is widened (Gilbert classification 2 or 3), a cone of mesh is inserted and anchored, usually superolaterally and sometimes inferiorly to the inguinal ligament by two or three non absorbable sutures. Inguinoscrotal sacs are transected in the canal and the proximal portion closed and dealt as mentioned earlier, whereas the mouth of distal portion is left undissected, but wide open.

**Onlay mesh:**<sup>47,48</sup> A polypropylene mesh is sutured along its lower border to the pubic tubercle, the lacunar ligament and the inguinal ligament to beyond the internal ring with a continuous suture of monofilament 3-0 polypropylene. The medial edge is sutured to the rectus sheath, also with continuous suture. The superior edge is tacked down to the aponeurosis or muscle of the internal oblique with few absorbable

interrupted sutures while avoiding injury to or entrapment of the iliohypogastric nerve. A slit is made at the lateral end creating two tails, a wider one (2/3) above and a narrower one (1/3) below. The lower edges of the two tails which encircle the cord are fixed to the shelving margin of Poupart's ligament. This creates a new internal ring made of mesh. The excess patch on the lateral side is trimmed, leaving approximately 3-4 cm of mesh beyond the internal ring. The wound is closed in a routine fashion with absorbable deep and subcuticular sutures.

### **Gilbert's sutureless Repair.**<sup>49</sup>

Arthur L. Gilbert (1992) described a suture less repair of small and medium sized indirect inguinal hernias. The repair was performed by forming one swatch of polypropylene mesh into an umbrella plug, placing it through and immediately deep to internal ring. A second swatch with a slit in the upper part is placed as an overlay graft covering the canal's posterior wall, under and around the spermatic cord.

### **The Mesh Plug Hernioplasty (Robbins and Rutkow Repair)**<sup>50</sup>

Robbins and Rutkow used this method to include treatment for all groin hernias, both primary and recurrent. In indirect inguinal hernia, high dissection of the sac is done which is simply placed back through the internal ring into the abdominal cavity. A mesh plug is inserted, tapered end first, through the internal ring and placed into position just beneath the crurae. The plug is kept in place by interrupted 3-0 vicryl.

### **Giant prosthetic reinforcement of visceral sac (GPRVS or Stoppa)**

Since Stoppa's original description, his technique for the procedure has been applied to

a single groin hernia for use with local anaesthesia. The essential feature of GPRVS is the reinforcement of the transversalis fascia in the groin by a large prosthesis that extends far beyond the myopectineal orifice of Fruchaud. The prosthesis envelopes the visceral sac, held in place by intra-abdominal pressure and later by connective tissue in growth. The mesh adheres to the peritoneum and renders it inextensible so that it cannot protrude through the parietal defect. GPRVS is a sutureless and tension-free repair. GPRVS via a transabdominal incision directly provides access to the pre-peritoneal space and the parietal defects of hernias without dissection of the inguinal canal, spermatic cord, and sensory nerves of the groin. The recurrent rate of primary inguinal hernia is 0.7% and for recurrent inguinal hernia 0.8%.

### **Laparoscopic Inguinal Hernia Surgery<sup>8, 9,38</sup>**

Although, the laparoscopic approach is not minimally invasive, it has several advantages like, reduced postoperative pain and disability. The femoral and inguinal areas can be inspected bilaterally and repaired bilaterally in a single sitting. It avoids previous operative site in patients with recurrent hernias, decreasing the risk for nerve injury or ischemic orchitis. The disadvantages are the violation of the peritoneal cavity, need for general anesthesia and the cost of the procedure. For some patients general anaesthesia is contraindicated. For others, the laparoscopic technique is too invasive a procedure. Although many different techniques of laparoscopic hernia repair are available, only the following two types of laparoscopic inguinal herniorrhaphy are in common use.

## **1. Transabdominal pre peritoneal (TAPP)**

Presently, the most frequently used technique. Diagnostic laparoscopy is done to detect the presence of hernia. Peritoneum is incised transversely above the hernial defect and a complete dissection of pre-peritoneal space is accomplished using instruments placed intra abdominally via accessory ports. During the course of pre-peritoneal dissection, direct sacs are reduced and indirect sacs are either dissected from the cord structures and reduced or divided circumferentially at the internal ring, leaving the distal sac in place. Prosthetic mesh required for TAPP ,and a large piece of polypropylene mesh (16/12cm) is used to cover the myopectineal orifices including direct, indirect ,and femoral hernial spaces.The prosthesis is either slit to accommodate the cord structure or simply placed over them according to surgeon's preference. Finally the mesh is stapled in place using the following landmarks.

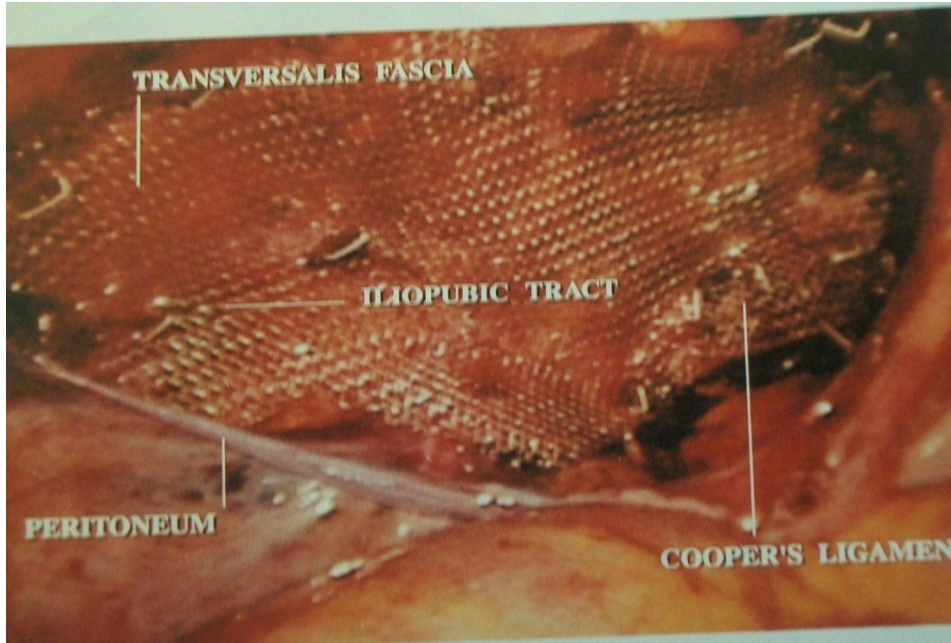
- a. Symphysis pubis medially.
- b. Superiorly, transversalis fascia above the internal ring.
- c. Laterally, an arbitrary point approximately 1 cm medial to ASIS.
- d. Inferomedially Cooper's ligament.
- e. Inferolaterally Iliopubic tract.

It is the preferred technique, in patients with lower abdominal wall incision, which results in peritoneal adherence.

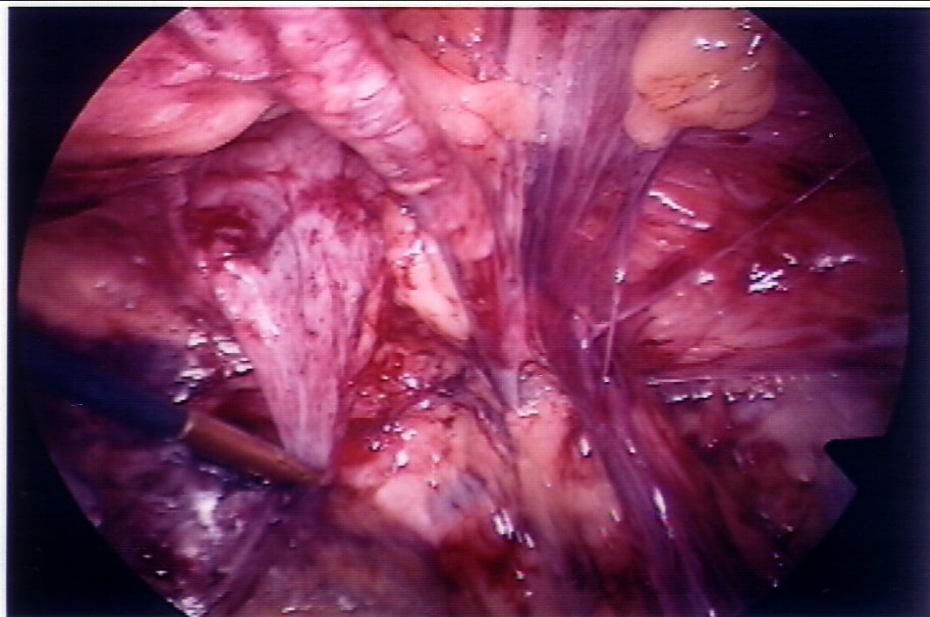
## **2. Totally Extra Peritoneal Herniorrhaphy (TEP)**

Approach is totally extra-peritoneal in which avoids bowel and vascular injuries and intra peritoneal adhesions. A 1.5 cm infra-umbilical incision is made and advanced through the subcutaneous tissues to expose the rectus muscles, which are separated bluntly. A tunnel is developed between rectus muscles and the underlying pre-peritoneal fat by retractors or by use of balloon dissection device. The peritoneum has been dissected of the posterior aspect of the rectus muscle and the pubic symphysis is exposed. Dissection is continued up to iliac crest, the cord structures are inspected, if indirect sac is present it is reduced. Polypropylene mesh is placed such that it covers all hernia orifices ( direct, indirect, femoral and obturator ). In case of bilateral hernia two mirror image pieces of polypropylene mesh are prepared.





**Figure-21. Laparoscopic Hernia Repair (TAPP)**



**Figure -22. Laparoscopic Hernia Repair (TEP)**

## **COMPLICATIONS OF INGUINAL HERNIA SURGERY<sup>54,55</sup>**

Nothing so prevents the occurrence of complications as one's awareness as well as fear of them. The complications cannot be eliminated altogether. They may be minimized by meticulous and precise surgical techniques.

### **Intra operative Complications**

- Haemorrhage
- Severance of nerves
- Nerve-entrapment by sutures
- Severance of testicular blood supply
- Trauma to vas deferens
- Damage to intestine
- Injury to the bladder
- Transection of spermatic cord

### **Post operative complications<sup>55</sup>**

- **General:** Systemic complications occur at a rate comparable with that after other surgical procedures of the same magnitude. Atelectasis and pneumonitis were most frequent followed by thrombophlebitis and urinary retention.
- Scrotal Ecchymosis.
- Swollen Testis
- Ischemic orchitis and testicular atrophy
- Hydrocoele

- Wound infection

- **Recurrence**<sup>44,56</sup> : A weakness in the operation area necessitating further operation'.

There is no question that, both through anatomical knowledge and skilled technique are necessary for successful repair. Absence of tension in the completed hernial repair is essential to the success of repair. Recurrence, after 6 months are due to factors other than technical error or selection of inferior procedure<sup>46</sup> . Recurrence is also due to decreased collagen synthesis. Prevention of recurrence is done by supplementing the basic repair with additional support by prosthetic mesh. The overall recurrence reported is 10% for primary and 25% for recurrent inguinal hernia.

**Others:**

- Urinary retention,
- Neuroma,
- Haematoma,
- Seroma,
- Sinus formation,
- Sexual dysfunction.

**Persistent post operative pain :**

- Groin pain.** Common causes are nerve entrapment, neuroma, periostitis.
- Numbness.**
- Paraesthesia.**

## **PHYSIOLOGY AND ANATOMY OF CHRONIC GROIN PAIN AFTER INGUINAL HERNIORRHAPHY**

Pain is defined as “an unpleasant sensory and emotional experience with actual or potential tissue damage or described in terms of such damage” by the International Association for the Study of pain.<sup>58</sup>

Chronic groin pain lasts >3 months.

Chronic groin pain can be Nociceptive or Neuropathic

**Nociceptive pain** : Nociceptive pain is a dull , Burning , tugging, type of pain which is brought on by lifting or stretching. It is akin to ligamentous or tendon injury. It can be **somatic** or **visceral** in origin, and the nervous conducting system is intact. A lot of these patients have nociceptive pain from sutures or staples in ligamentous structures.

**Neuropathic pain:** Neuropathic pain presents as a jabbing, electrical, or brief, sharp pain may be provoked by movement or it may occur spontaneously. There is an abnormality in conduction. Neuropathic pain is subdivided into three sub groups:

**Peripherally generated, Centrally generated, and Sympathetically maintained.**

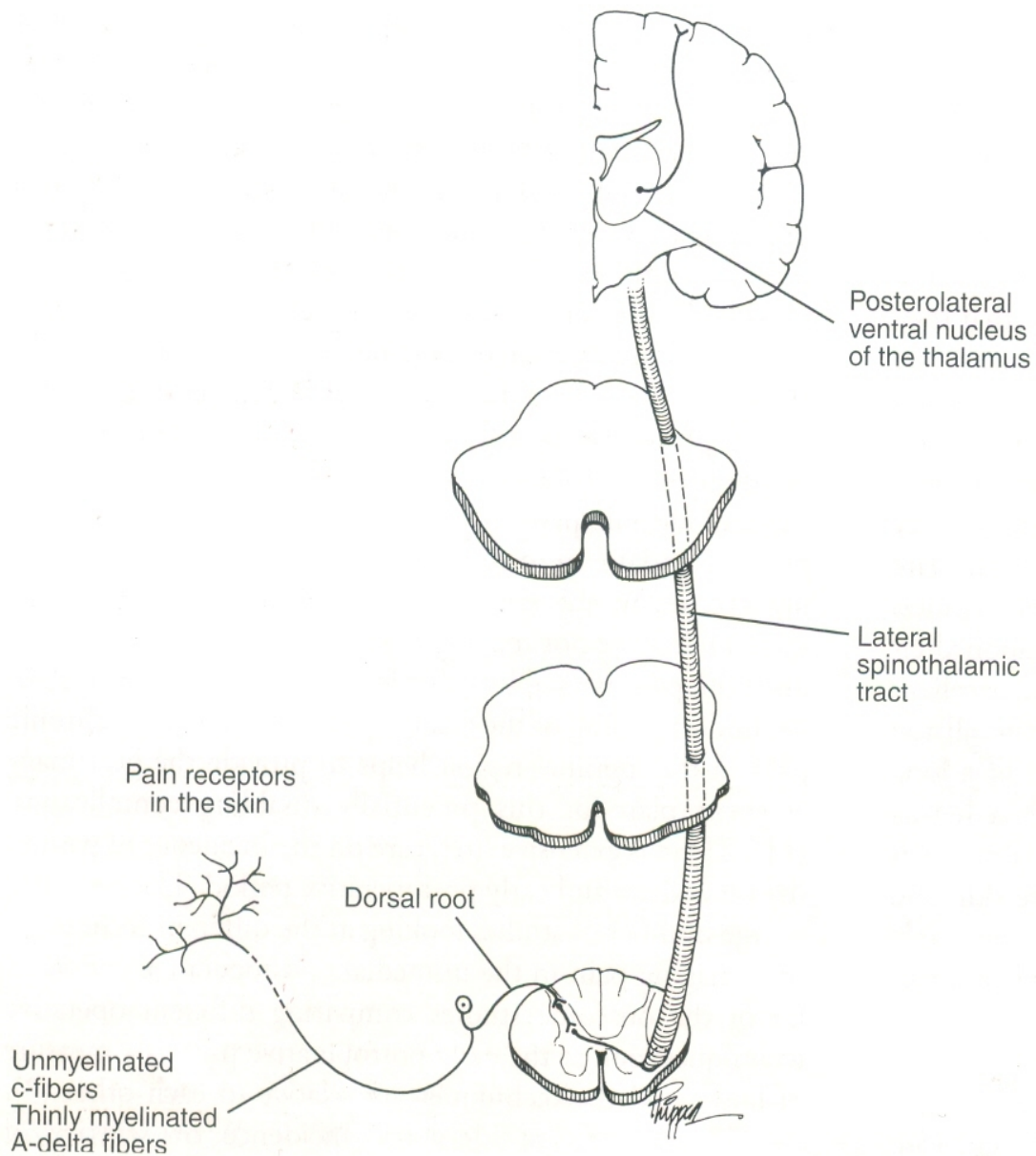
Classic causes of chronic pain are osteitis pubis , and ilioinguinal nerve entrapment. The majority of chronic pain has been attributed to **ilioinguinal nerve entrapment**. Postoperative pain is assessed using a 4- point verbal scale (none, mild, moderate, severe) assigning numerical values of 0 to 3.

**Mild pain** was defined as an occasional disturbance that did not limit normal

activities

**Moderate pain** as pain that interfered with normal –day life activities

**Severe pain** as pain that rendered the patient unable to perform normal activities. <sup>10</sup>



**Figure-23. Physiology of Pain**

## **Anatomic considerations**

When the groin is explored via the anterior approach, one may encounter the **Ilioinguinal nerve**, **Genital branch of genitofemoral nerve**, and **Ilioypogastric nerve**.

### **1. Ilioinguinal nerve (T 12 – L 1 )**

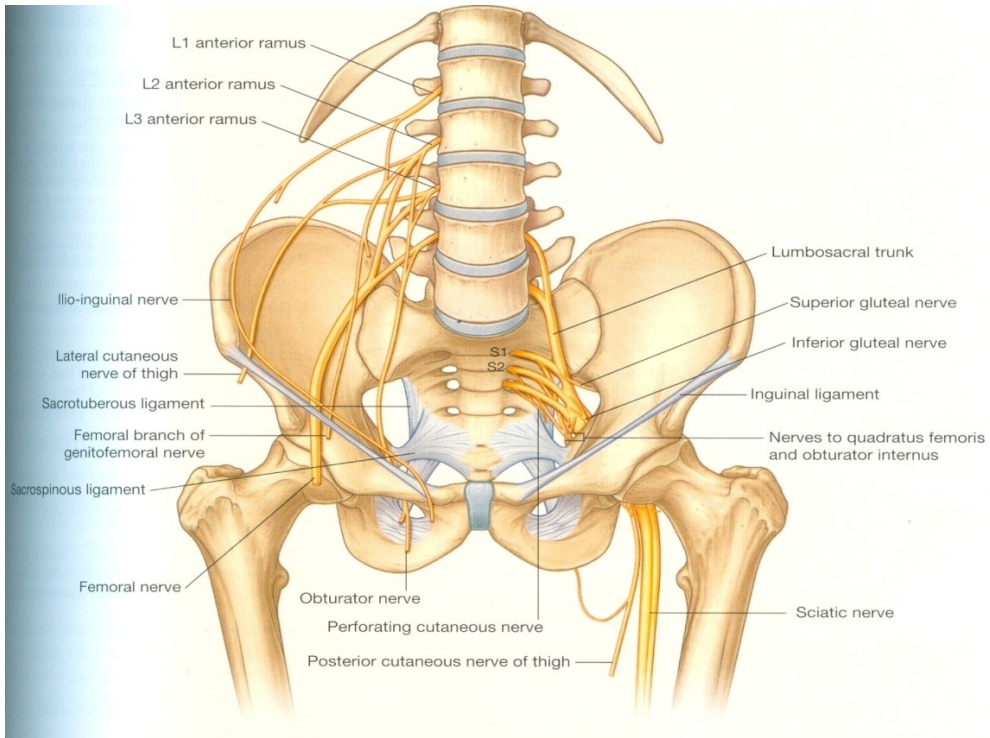
It emerges from behind the psoas along with or just inferior to the ilioypogastric nerve. It passes obliquely across the quadratus lumborum muscle, perforates the transvesus abdominus muscle near the anterior end of the iliac crest, and then pierces the internal oblique muscle to run along the inguinal canal until it leaves by the external ring or by piercing the fascia just adjacent to the ring.

**Function:** It provides motor function to the internal oblique and sensory innervation to upper medial thigh, upper scrotum and root of the penis in males, mons pubis and labia majora in females .

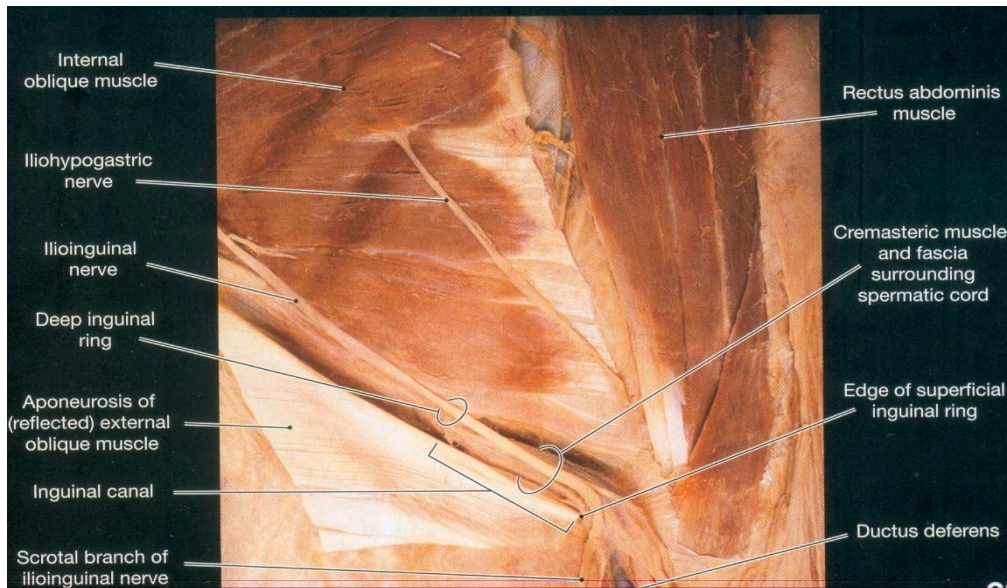
**-It is the nerve that is classically described as the primary cause of chronic pain.**

### **2 . Genitofemoral nerve (L 1– L 2 )**

It passes obliquely through the psoas muscle, exiting on the medial border of the L-4 spinous process. It then passing behind the ureter and dividing superior to the inguinal ligament. The genital branch follows the external iliac artery, passes through the internal ring into the inguinal canal and innervates the cremasteric muscle and scrotal skin or labia majora and mons pubis. Lateral femoral branch innervates anterolateral part of thigh.



**Figure-24- Lumbar Plexus**



**Figure -25 – Ilioinguinal Nerve**

### **3.Iliohypogastric nerve ( T12 - L1 )**

It emerges lateral to the psoas muscle and runs in front of quadratus lumborum muscle . Above the iliac crest ,it perforates the transversus abdominus to provide the musculature with its innervation. Anterior cutaneous branch runs between the transversus abdominis muscle and internal oblique muscle until about 2 cm medial to the anterosuperior iliac spine, where it passes through the internal oblique muscle .It then proceeds medially and pierces the external oblique aponeurosis above the external ring. It innervates to suprapubic skin and gives branches to ilioinguinal nerve.

### **Risk factors for chronic pain following herniorrhaphy<sup>28, 59</sup>**

Preoperative pain may indicate complicated disease pathology prior to surgical intervention resulting in stretching, entrapment, or inflammation of inguinal nerves. It may also indicate the presence of psychological predisposition and lowered pain threshold among these patients , increasing potential for postoperative pain.Direct injury to nerves that results in either partial or complete transection can lead to neuroma formation and contusion, crushing, cautery damage, suture compression can cause the subsequent development of chronic pain.Some have implicated the role of mesh as well. It has been demonstrated experimentally that when peripheral nerve tissue comes in contact with polypropylene mesh, myelin degeneration,edema, and fibrosis result and can lead to neuralgia and peripheral neuropathy.<sup>60</sup>The implantation of mesh, which induces scar formation through inflammation, also causes pain.



## DIFFERENTIAL DIAGNOSIS OF CHRONIC GROIN PAIN

<p>Dermatology</p> <ul style="list-style-type: none"> <li>• Lymphadenitis</li> <li>• Psoriasis/burn</li> <li>• Sebaceous cyst/hioradenitis</li> <li>• Thrombophlebitis/cellulites</li> </ul>	<p>Gynecology</p> <ul style="list-style-type: none"> <li>• C-section</li> <li>• Cervical cancer</li> <li>• Endometriosis</li> <li>• Tubal/ovarian disorders</li> </ul>	<p>Orthopedic</p> <p>Hip disorders</p> <ul style="list-style-type: none"> <li>• Acetabular labral tears</li> <li>• Avascular necrosis</li> <li>• Chondritis dissecans</li> <li>• Legge-Calve Perthes disease</li> <li>• Osteoarthritis</li> <li>• Pelvic stress fractures</li> <li>• Slipped femoral capsule epiphysis</li> <li>• Snapping hip syndrome</li> <li>• Synovitis</li> </ul>	<p>Surgery</p> <ul style="list-style-type: none"> <li>• Compensation (workman's)</li> <li>• Hernia</li> <li>• Recurrent hernia</li> <li>• Posthernia</li> </ul> <p>Open</p> <ul style="list-style-type: none"> <li>• Neuropathic</li> <li>• Non-neuropathic</li> </ul> <p>Laparoscopic</p> <ul style="list-style-type: none"> <li>• Neuropathic</li> <li>• Non-neuropathic</li> </ul>
<p>Infectious disease</p> <ul style="list-style-type: none"> <li>• Herpes zoster</li> <li>• HIV/tuberculosis</li> <li>• Lyme disease</li> <li>• Psoas abscess</li> </ul>	<p>Neurology</p> <ul style="list-style-type: none"> <li>• Lumbosacral disorders</li> <li>• Neurofibromatosis</li> </ul>	<p>Rheumatology</p> <ul style="list-style-type: none"> <li>• Connective tissue disease</li> <li>• Iliopsoas bursitis</li> <li>• Osteitis pubis</li> <li>• Systemic lupus eritematosus</li> </ul>	<p>Urology</p> <ul style="list-style-type: none"> <li>• Cystitis</li> <li>• Epididymitis</li> <li>• Nephrolithiasis</li> <li>• Prostatitis</li> <li>• Torsion of testes</li> <li>• Urethral extravasation</li> <li>• Urinary tract infection</li> <li>• Vas granuloma/fibrosis</li> </ul>
<p>Gastroenterology</p> <ul style="list-style-type: none"> <li>• Appendicitis/adhesions</li> <li>• Diverticulitis</li> <li>• Inflammatory retroperitoneal phlegmon (pancreatitis)</li> <li>• Meckel diverticulitis</li> <li>• Granulomatous colitis</li> </ul>	<p>Neurosurgery</p> <ul style="list-style-type: none"> <li>• Disc disease</li> <li>• Spinal injuries, inflammation, tumors</li> <li>• Spondylosisthesis</li> <li>• Spondylolysis</li> </ul>	<p>Sports medicine</p> <ul style="list-style-type: none"> <li>• "Sports hernia" (adductor strains)</li> <li>• Gilmore's groin</li> </ul>	<p>Vascular</p> <ul style="list-style-type: none"> <li>• Abscess hematoma</li> <li>• Postvein stripping</li> <li>• Pseudoaneurysm</li> <li>• Vascular graft</li> </ul>

## **Avoiding chronic pain following inguinal herniorrhaphy<sup>28, 61,62</sup>**

Judicious clinical judgment advocate early intervention with careful dissection to avoid preventable nerve injury, thereby minimizing this potential debilitating morbidity. Care must be taken to avoid placement of sutures at the medial insertion of the inguinal ligament to avoid excessive tightness of the inguinal ligament at pubic tubercle. Avoiding indiscriminate division of subcutaneous tissue. Avoiding removal of the cremastic muscle fibres. Avoiding placement of sutures in the lower edge of the internal oblique muscle, and Avoiding making the external ring too tight. A study performed by Lichtenstein that investigated prevention of postherniorrhaphy neuralgia proposed that transection of ilioinguinal and genitofemoral nerve prove to be a useful solution. A double blinded, RCT trial to investigate the effects prophylactic ilioinguinal neurectomy following tension free mesh repair of inguinal hernia was conducted with 100 male patients, randomized into two groups : Prophylactic ilioinguinal neurectomy or ilioinguinal nerve preservation. The findings demonstrated that the incident of chronic pain at 6 months was significantly lower compared with the nerve preservation group (8% versus 28.6% , $P=0.0008$ ). And no significant difference was found in the incidence of neurosensory complaints, including groin numbness and sensory loss. However, it has been postulated that the sensory loss that may result following prophylactic neurectomy might be compensated for by cross innervations provided by cutaneous nerves from the contralateral side and, therefore the morbidity following neurectomy would be negligible.<sup>62</sup>

## **Evaluating and treating the chronic pain<sup>60-68</sup>**

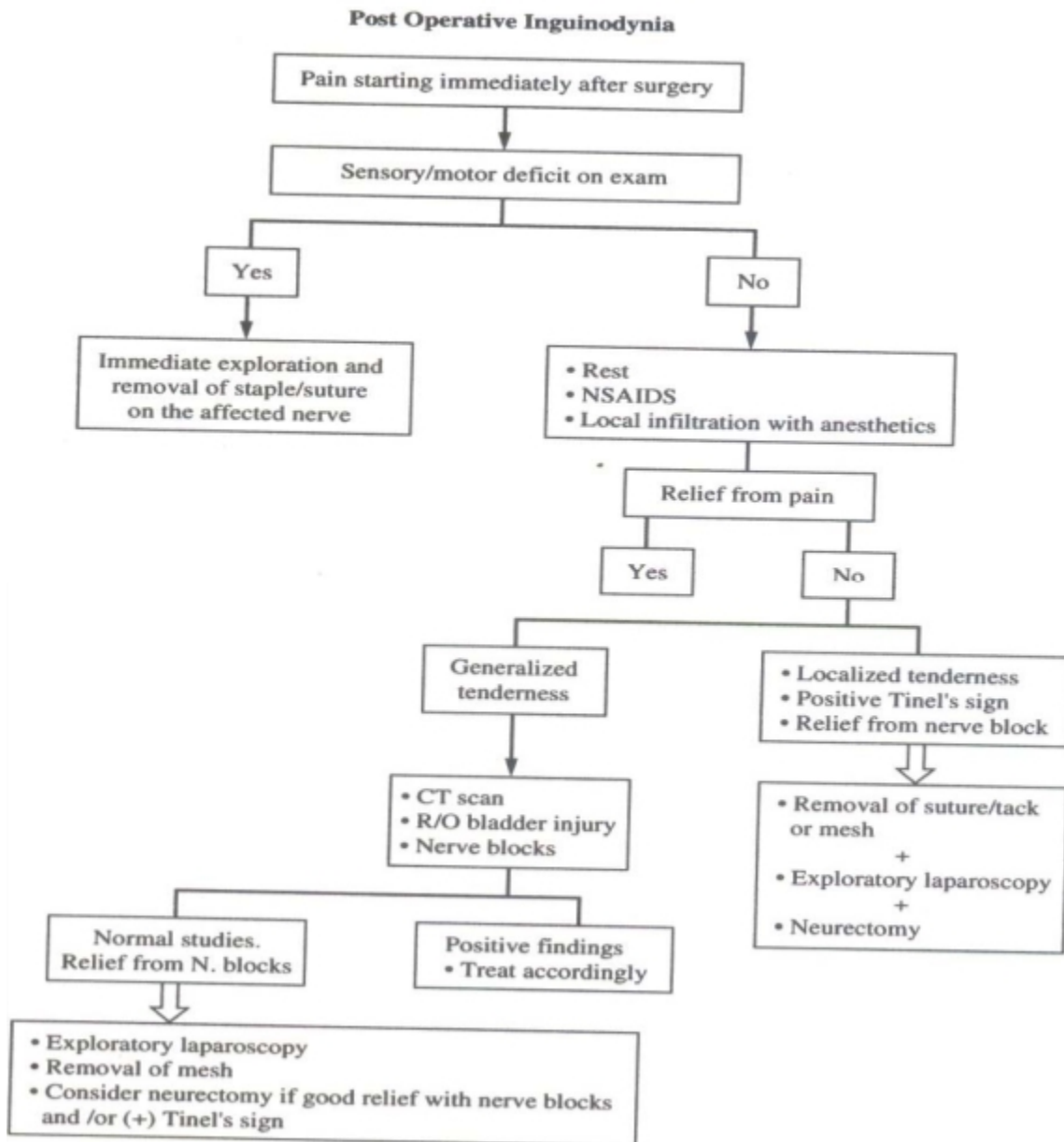
Causes of chronic pain following inguinal herniorrhaphy can be divided into Neuropathic and Non neuropathic etiologies. The most common non neuropathic causes include, hernia recurrence, excessive scar formation, and pressure from the bulk of the mesh. The neuropathic etiologies of chronic pain include nerve entrapment by sutures or staples and Neuroma formation with partial and complete transaction of the nerve. Neuropathic pain related to the genitofemoral nerve may result in testicular pain in men and labial pain in women. In these patients thorough urological evaluation aimed at identification underlying testicular or epididymal pathology in men and careful gynecological examination in women also necessary.<sup>64</sup> Ultrasound is another potential diagnostic modality to help determine occult recurrences.<sup>65</sup> MRI also been used to detect recurrence, delineate mesh position, and demonstrate non hernia related causes of pain.<sup>66</sup> By physical examination one can specifically elicit ilioinguinal nerve entrapment by having the patient hyperextended and twist the trunk of the body opposite side of hernia repair.<sup>67</sup>

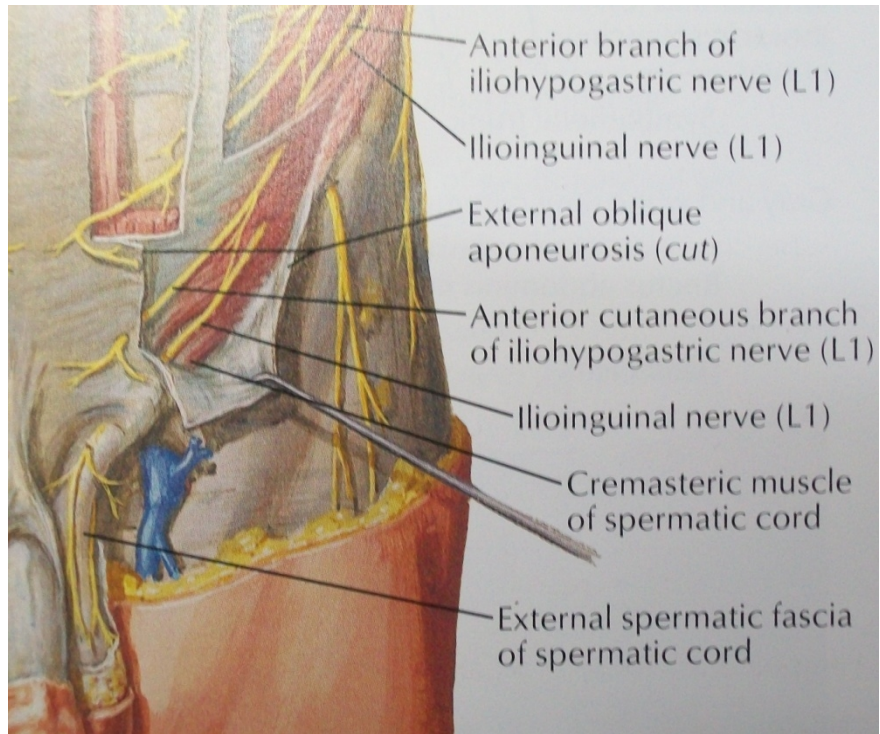
### **Treatment modalities**

1. Oral analgesics
2. Regional nerve blocks
3. Re-operation with mesh extraction, and
4. Surgical neurectomy: The best surgical option to date may in fact be exploration with neurectomy and possible mesh removal.

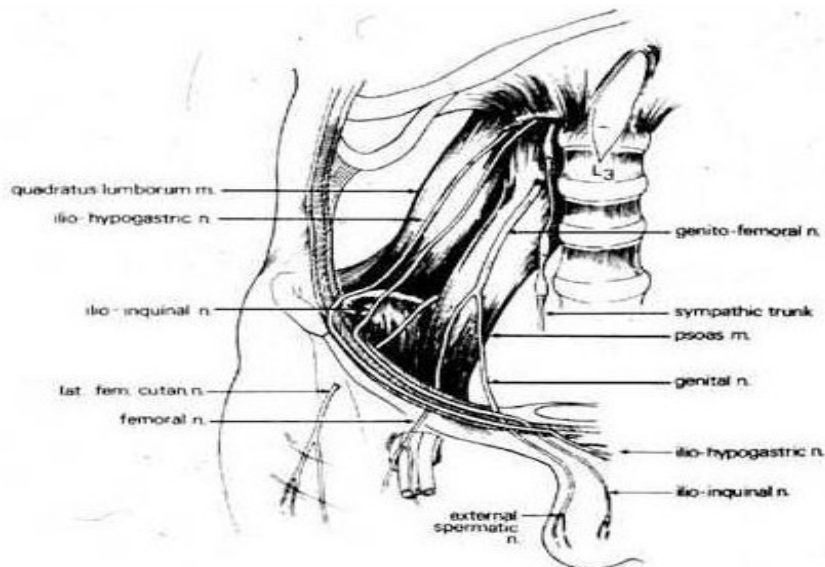
On a reported series of 54 patients who underwent groin exploration with triple neurectomy that included the ilioinguinal, iliohypogastric, genitofemoral nerves, 68% were relieved of pain. This was confirmed in another study, which demonstrated that triple neurectomy resulted in a 72% complete pain relief 25% partial relief.<sup>67</sup>

### ALGORITHM OF TREATING CHRONIC GROIN PAIN





**Figure-26. Nerves in relation to Groin**



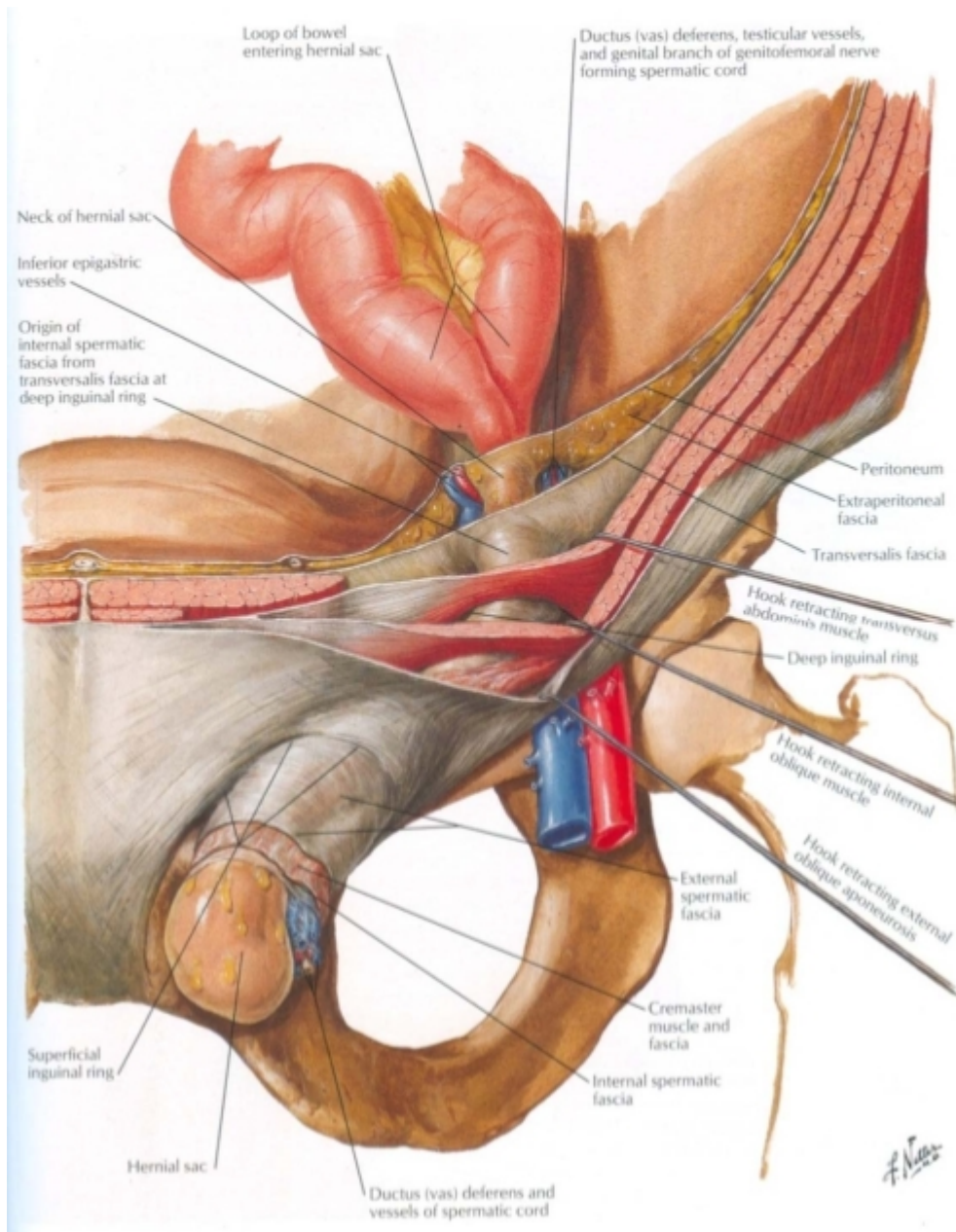
**Figure -27. Course of Ilioinguinal Nerve**



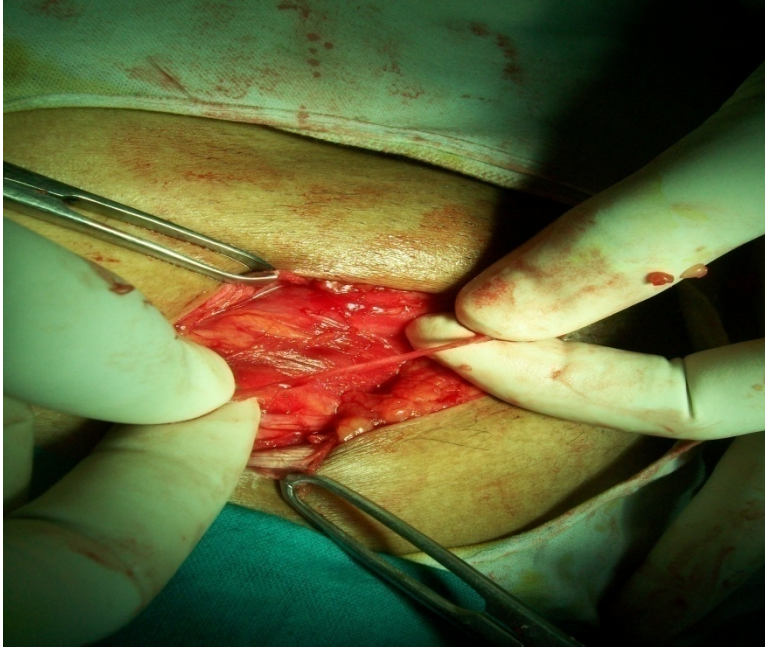
**Figure -28. Bilateral direct Inguinal Hernia**



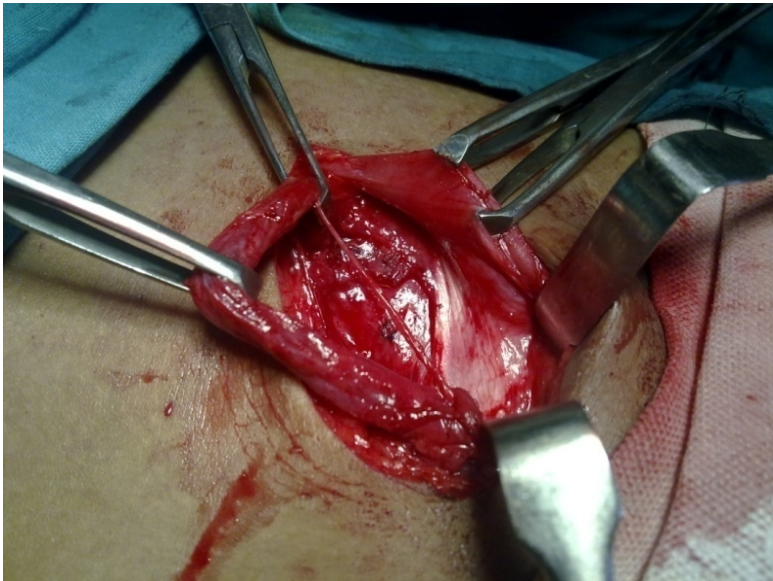
**Figure -29. Lt sided Indirect Inguinal Hernia**



**Figure -30. Hernial sac with Indirect Component**



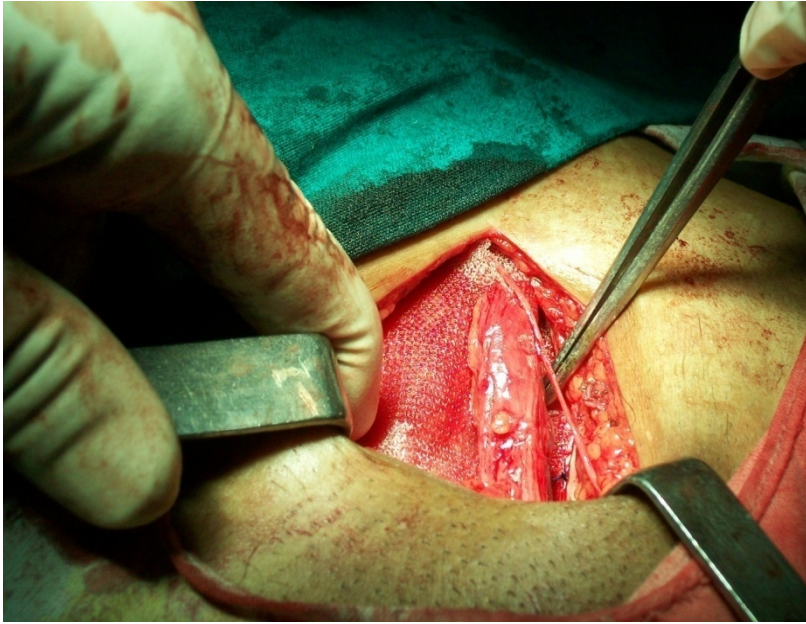
**A**



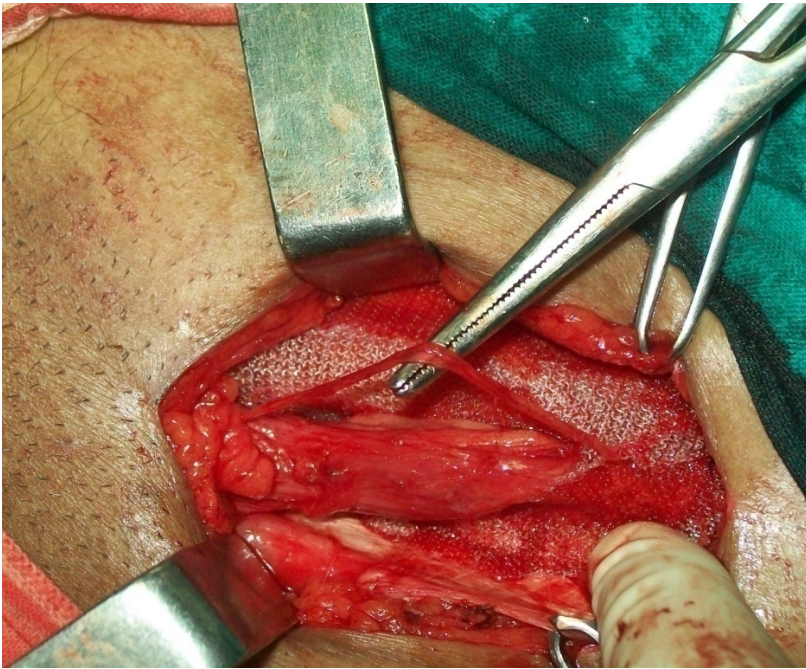
**B**

**Figure -31. Ilioinguinal Nerve during operation(A and B)**





**A**



**B**

**Figure -32. Polypropylene Mesh placement (A and B )**

## **METHODOLOGY**

### **SOURCE OF DATA:**

This is a prospective study comprising 60 patients of inguinal hernia over a period of 12 months from August 2013 to August 2014 with 6 months follow-up. In this present study, the clinical material consists of patients admitted with uncomplicated inguinal hernia (both males and females) in the Department of General Surgery, at Government Rajaji Hospital, Madurai.

### **METHOD OF COLLECTION OF DATA:**

#### **Sample size:**

The size of the sample works to 60 cases.

30 cases with ilioinguinal nerve preservation (group A)

30 cases with elective division of the nerve (group B).

#### **Inclusion criteria:**

Patients admitted with uncomplicated inguinal hernia ( Direct& Indirect).

#### **Exclusion Criteria:**

Patients below 18 and above 60 years.

Patients with diabetes mellitus.

Patients with complicated inguinal hernias and recurrent hernias.

Previous surgery in the inguinal region.

Mesh allergy and Subsequent hernia repair in the observation period.

Previous history of trauma and pain at the inguinal region.

The data will be collected in prescribed PROFORMA where in it contains,

particulars of the patient, Clinical history, clinical examination and diagnosis, Relevant investigations, and details of surgery.

### **FOLLOW-UP**

Period of follow up being 6 months from the day of surgery.

Parameters used for **comparison-**

Pain (using 4 point verbal scale).

Hypoesthesia.

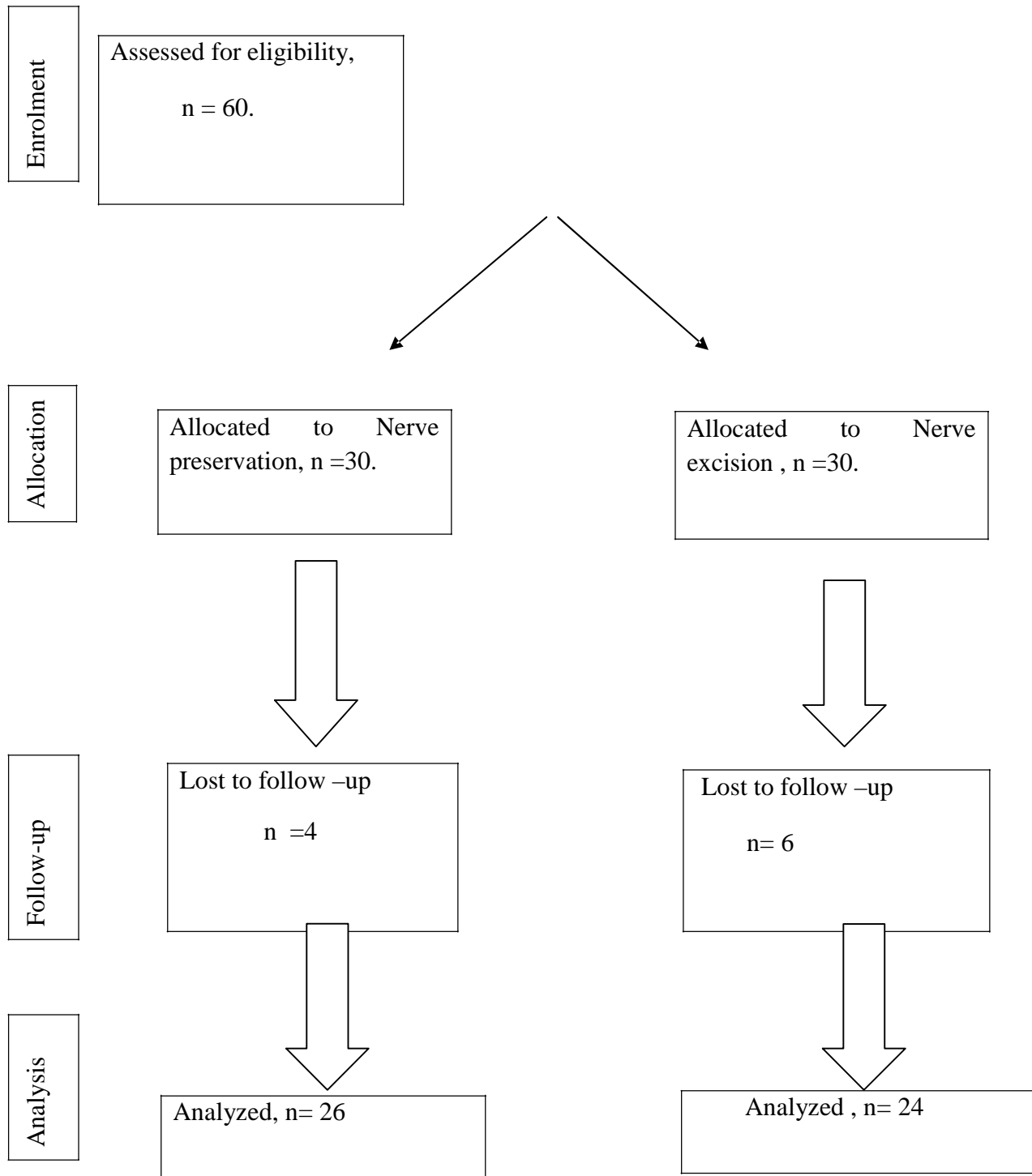
Numbness.

Ethical clearance has been obtained from ethical committee of Government Rajaji Hospital, Madurai, prior to conducting the study.

### **Statistical analysis:**

In this study the results of the two groups were compared and analyzed by using Chi square test.

# CONSORT DIAGRAM



## RESULTS AND OBSERVATIONS

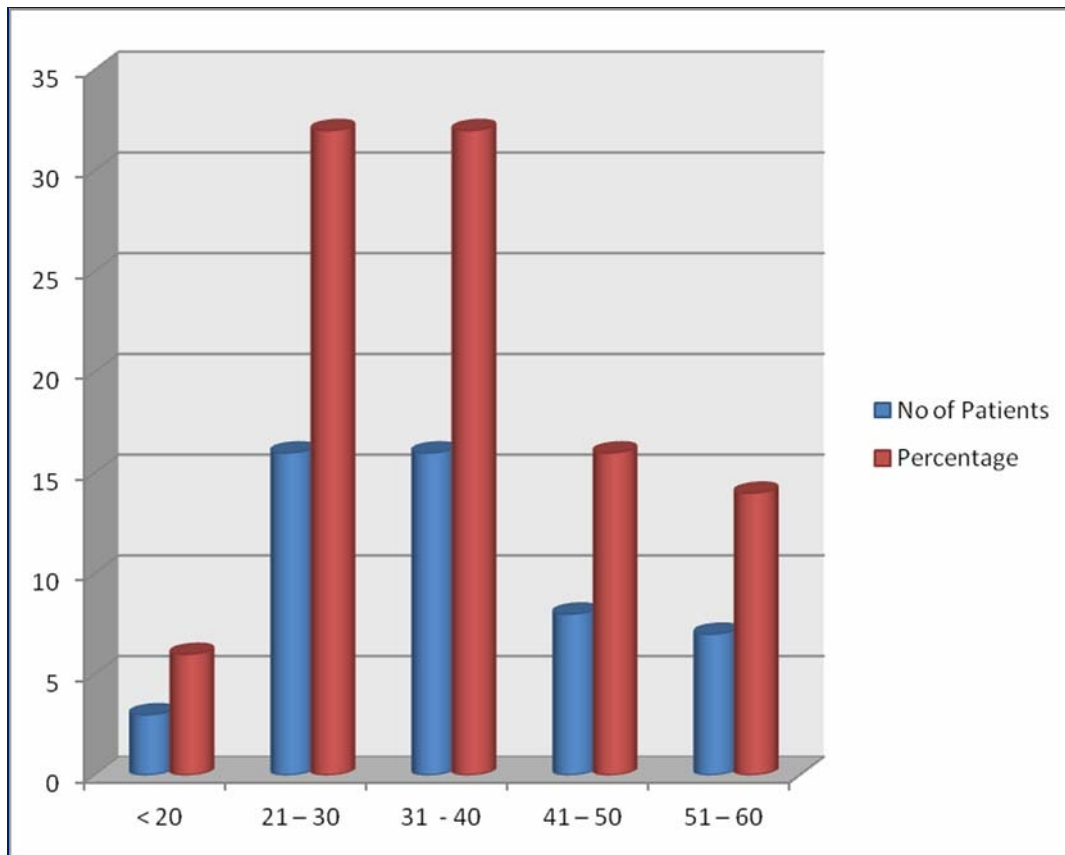
In this "Comparative study of preservation versus elective division of ilioinguinal nerve on post operative groin pain , in open mesh repair of inguinal hernia" Conducted in department of Surgey at Government Rajaji Hospital, Madurai. From August 2013 to August 2014. A Total of 60 Patients of uncomplicated inguinal hernia who underwent Lichtenstein mesh Hernioplasty included for this Prospective comparative study, 4 of 30 patients in Nerve preservation and 6 of 30 patients in nerve excision group were lost to follow -up, leaving 50 patients who completed the study protocol fully. So 26 patients with Nerve preservation (group A) and 24 patients with nerve excision (group B) were considered for the study.

### PATIENTS DEMOGRAPHY

Table -1 Age at Presentation.

Age group (in years)	No of Patients	Percentage (%)	Group A n=26 (%)	Group B n= (24) (%)
< 20	3	6	2 (7)	1 (4)
21 – 30	16	32	9 (34)	7 (30)
31 - 40	16	32	8 (30)	8 (33)
41 – 50	8	16	4 (15)	4 (16)
51 – 60	7	14	3 (11)	4 (16)

**Graph -1 Age at Presentation**



In this study the age of the patients ranged between 18 years to 60 years . The youngest patient included in this study series was 19 years, and eldest was 58 years old .

Almost 64% of the patients were in 20 – 40 age group. This includes 34% in group A and 30% in group B.

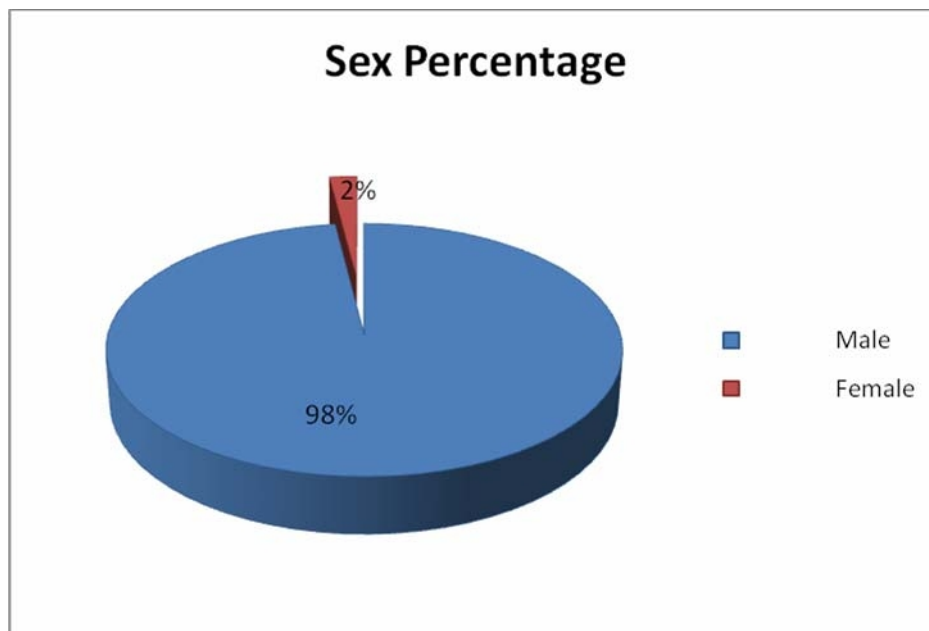
## SEX DISTRIBUTION

**Table -2 Sex distribution**

Sex	No of patients	Percentage
Male	49	98
Female	01	2

In this study only 2% of the patients were female, as compared to males who made 98% of the total cases.

**Graph -2 Sex distribution**



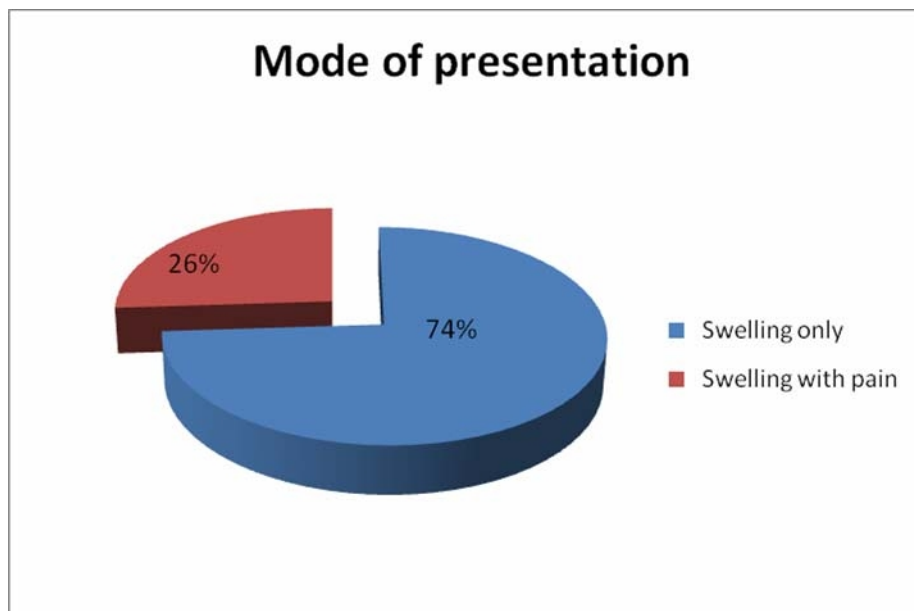
## MODE OF PRESENTATION

**Table -3 Mode of presentation**

MOP	No of patients	Percentage
Swelling only	37	74
Swelling with pain	13	26

Without exception all the patients presented with swelling , Of these 74 % of patients presented with swelling only , While 26 % patients presented with both swelling and pain.

**Graph -3 Mode of presentation**





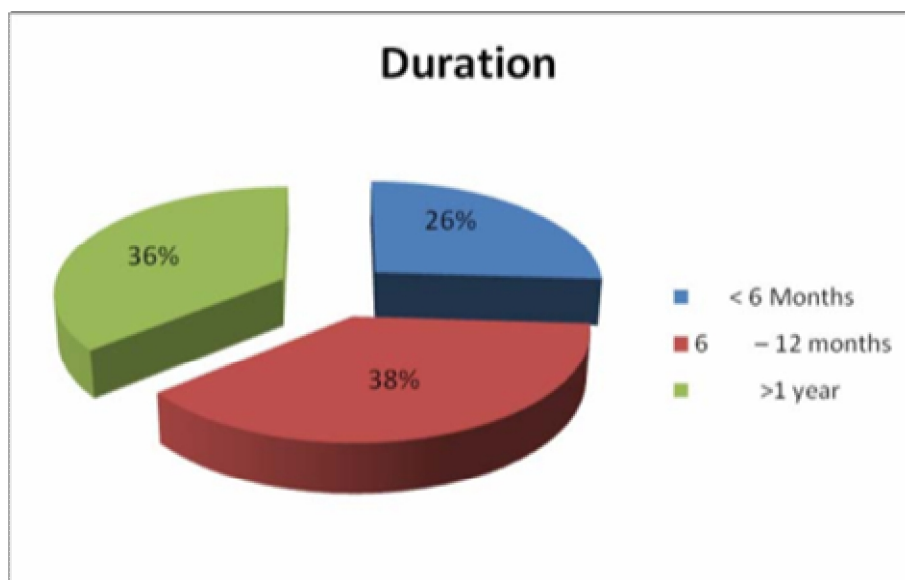
## DURATION OF ILLNESS

Table -4 Duration of illness

Duration	No of patients	Percentage
< 6 Months	13	26
6– 12 Months	19	38
>1 year	18	36

Majority of the patients in this study ie, 64 % of patients presented and were operated with in 1 year of the onset of hernia, and 36 % presented later than a year for operation.

Graph -4 Duration of illness.



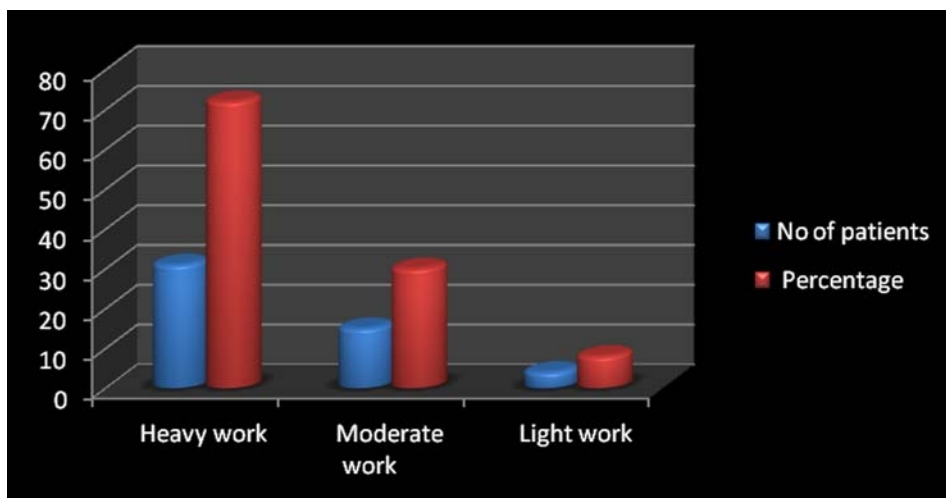
## RELATION WITH OCCUPATION

Table -5 Relation with occupation

Occupation	No of patients	Percentage
Heavy work	31	72
Moderate work	15	30
Light work	4	8

The present study shows that 72 % patients were involved in heavy and strenuous work like Agricultural labour, Manual labour, and Coolie. 30 % of patients were involved with moderate work like Cooks, Teachers and Drivers. And 8% of patients involved with light work.

Graph- 5 Relation with Occupation



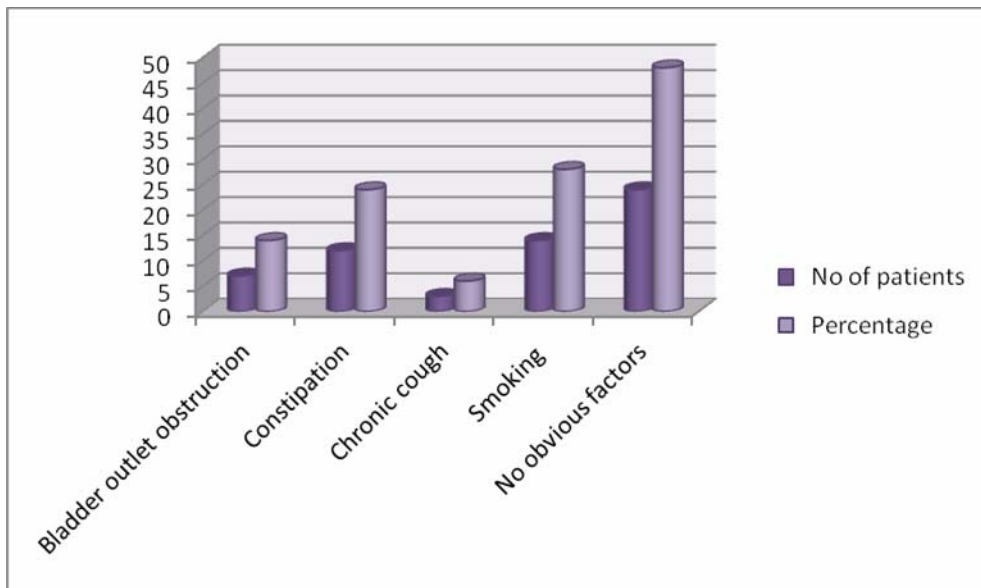
## PREDISPOSING FACTORS

**Table- 6 Predisposing factors**

<b>Factors</b>	<b>No of patients</b>	<b>Percentage</b>
Bladder outlet obstruction	7	14
Constipation	12	24
Chronic cough	3	6
Smoking	14	28
No obvious factors	24	48

In this study 14% of the patients showed the features of bladder outlet obstruction, 24% had constipation, 6% had chronic cough, 24% of patients work was lifting heavy weight eg, farmers, and 28% were smokers.

**Graph-6 Predisposing factors**



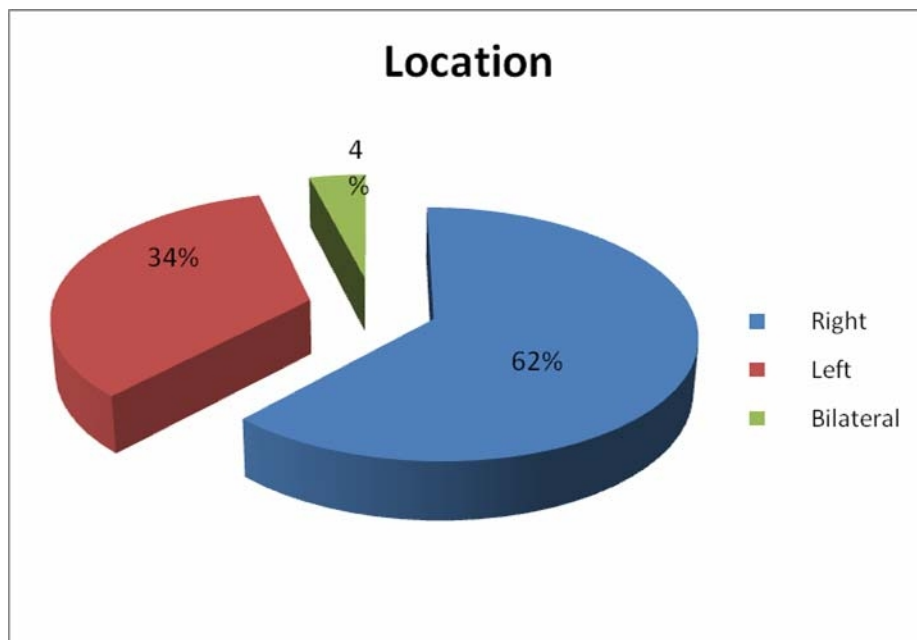
## LOCATION OF THE HERNIA

**Table- 7. Location of hernia**

Side	No of patients	Percentage
Right	31	62
Left	17	34
Bilateral	2	4

The Present study showed that hernia was more common on right side ie, 62% . Left side hernia comprised about 34 % , where as 4% was bilateral.

**Graph-7. Location of hernia**



## TYPE OF INGUINAL HERNIA

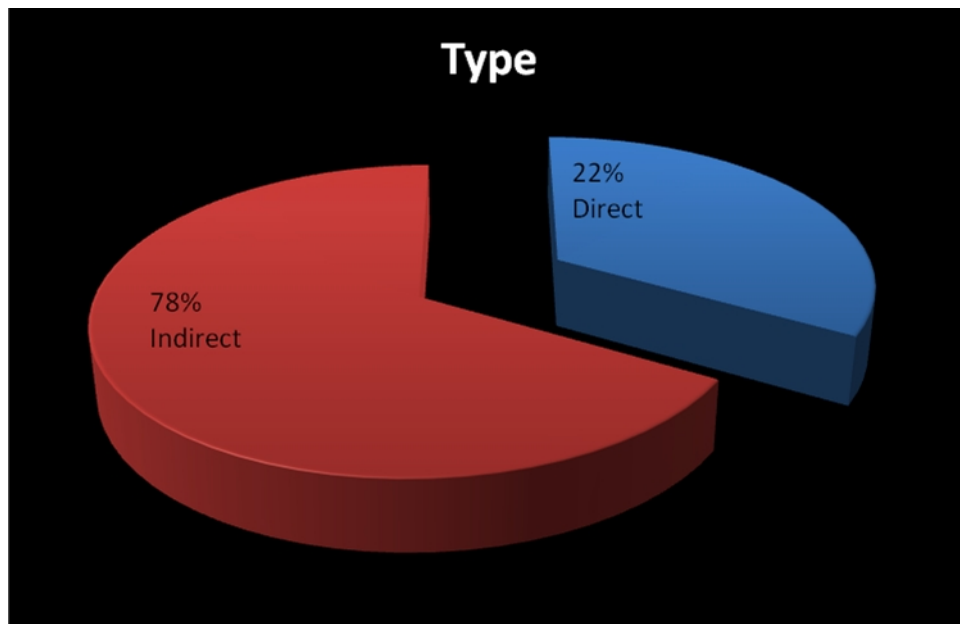
Table -8 Type of Hernia

Type	No of patients	Percentage
Direct	11	22
Indirect	39	78

In this present study 39 cases were belongs to indirect hernia which contributed 78 %.

And 11 cases belongs to direct hernia which contributed 22% of the total.

Graph -8 Type of Hernia



## COMPARISON OF STUDY GROUPS

Table -9 Comparison of study groups

Comparison of	Nerve preservation Group A ( n=26 ) (%)	Nerve excision Group B (n=24 ) (%)
<b>1. Demography</b>		
Male	25 (96)	24 (100)
Female	01 (4)	0 (0)
Mean age	31 ± 20	39 ± 14
<b>2.Mode of presentation</b>		
Swelling only	20 (76)	17 (71)
Swelling with pain	6 (24)	7 (29)
<b>3 .Strain factors</b>		
B O O	4 (16)	6 (25)
Constipation	7 (28)	5 (21)
Chronic cough	1 (4)	2 (8)
<b>4 .Location</b>		
Right	15 (58)	16 (67)
Left	11 (42)	6 (25)
Bilateral	0 (0)	2 (8)
<b>5 . Type</b>		
Direct	5 (19)	6 (25)
Indirect	21 (81)	18 (75)

In the present study Preservation of ilioinguinal nerve during Lichtenstein Inguinal hernia repair was performed in 26 patients mean age of  $31 \pm 20$  years including 25 (96%) men and 1 (4%) women.

Of the 26 patients, 20 (76%) presented with swelling in the groin only, where 6 (24%) presented with swelling associated with pain.

Of the 25 male patients, 4(16%) showed features of bladder outlet obstruction, 7 (28%) had constipation, and 1 (4%) had chronic cough. And 1 woman had no obvious predisposing factors.

Regarding type, 15 (58%) patients had right sided inguinal hernia and 11(42%) had left side inguinal hernia.

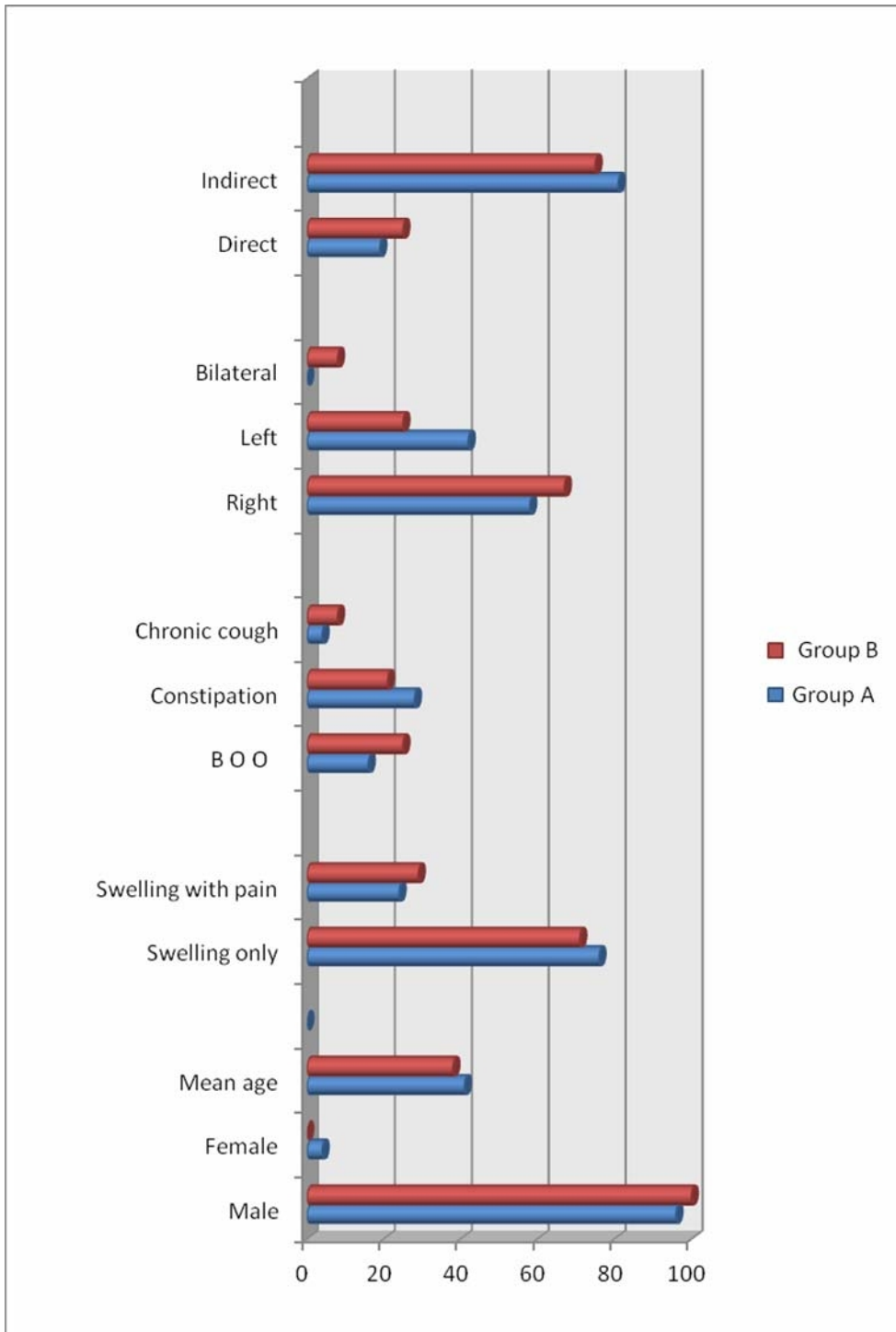
Of the 26 patients , 21(81%) cases were indirect inguinal hernia ,and 5 (19%) cases were direct hernia.

Routine excision of ilioinguinal nerve during Lichtenstein hernia repair was performed in 24 patients , all are male patients with mean age of  $39 \pm 14$  years.

Of the 24 patients, 17 (71%) patients presented with swelling in the groin only, where as 7 (29%) are presented with swelling associated with pain. 6 (25%) patients showed features of bladder outlet obstruction, 5(21%) had constipation, 2(8%) had chronic cough.

Of the 24 patients, 16 (67%) had right sided inguinal hernia , 6 (25%) had left sided inguinal hernia , and 2 (8%) were bilateral. 18 (78%) patients were indirect inguinal hernia, and 6 (25%) were direct hernia.

**Graph -9 Comparison of Study groups**





## FOLLOW-UP

Post operative Chronic groin pain, Hypoesthesia, and Numbness has been compared between two groups(A & B), At POD -1, At 1 Month , At 3 Months , At 6 Months and Results are compared with p value using Chi Square test.

**Table -10 Incidence of post operative neuralgia**

Severity	Nerve Preservation (n=26)	Nerve excision (n= 24)	p' value
POD -1	24	19	0.87 NS
1 month	13	10	0.91 NS
3 months	10	2	0.09 NS
6 months	8	1	0.03 S

In the present study the incidence of post operative neuralgia in group A ( ilioinguinal nerve preservation ) was compared with group B ( ilioinguinal nerve excised ) during Lichtenstein hernioplasty.

The results of the follow up visits are 24 Vs 19 (  $p>0.05$  ) at POD-1 ; 13 Vs 10 (  $p>0.05$  ) at 1 month ; 10 Vs 2 (  $p>0.05$  ) at 3 months ; and 8 Vs 1 (  $p<0.05$  ) at 6 months in group A and group B respectively.

### INCIDENCE OF POST OPERATIVE NEURALGIA

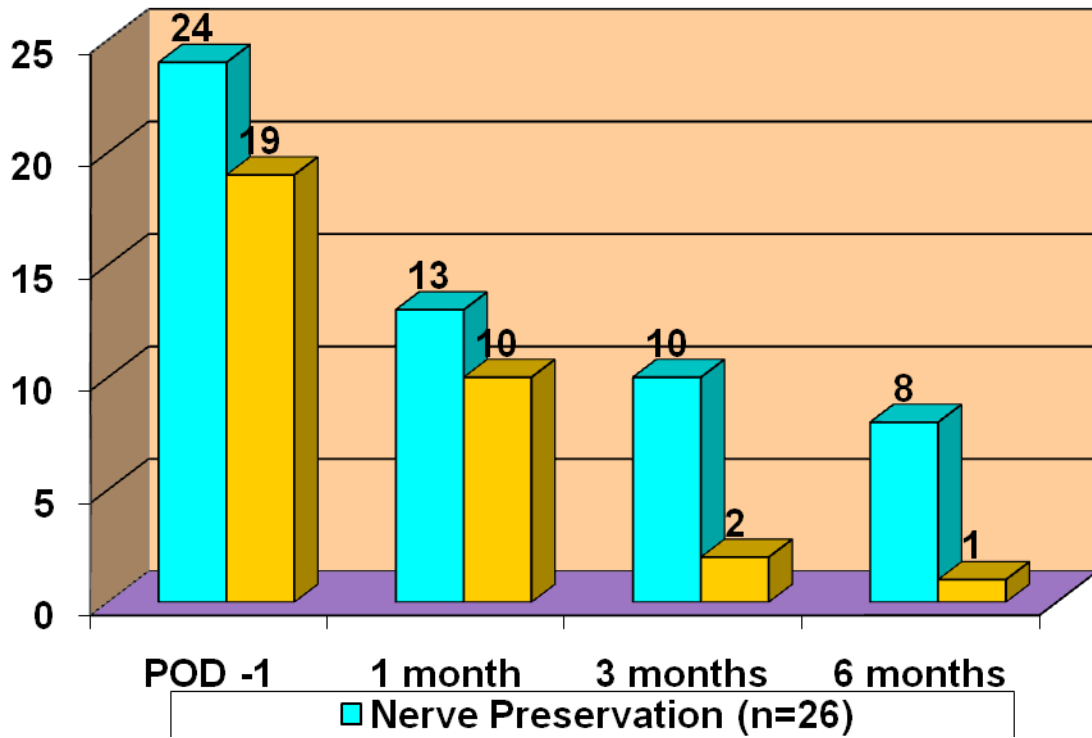


Table -11 Mean Severity score

Follow up	Group A (26)						Group B (24)						p value
	0	1	2	3	Mean	SD	0	1	2	3	Mean	SD	
POD -1	2	8	13	3	1.65	0.79	5	7	10	2	1.37	0.92	0.26
1 month	13	6	6	1	0.81	0.94	14	10	0	0	0.42	0.5	0.08
3 months	15	7	2	1	0.58	0.81	22	2	0	0	0.08	0.28	0.007
6 months	19	5	3	0	0.39	0.09	23	1	0	0	0.05	0.2	0.02

Group A

In the present study severity of pain was compared between group A and group B, by using 4- Point verbal scale.

The pain was Absent in 2 Vs 5 , Mild in 8 vs 7 , Moderate in 13 vs 10, and Severe in 3 vs 2 at POD-1 ; Absent in 13 vs 14 , Mild in 6 vs 10, Moderate in 6 vs 0 ,and Severe in 1 vs 0 at 1 Month ; Absent in 15 vs 22 , Mild in 7 vs 2 , Moderate in 2 vs 0, and Severe in 1 vs 0 at 3 Months ; Absent in 19 vs 23, Mild in 5 vs 1 , and Moderate in 3 vs 0 ;Severe in 0 Vs 0 Months in group A and group B respectively

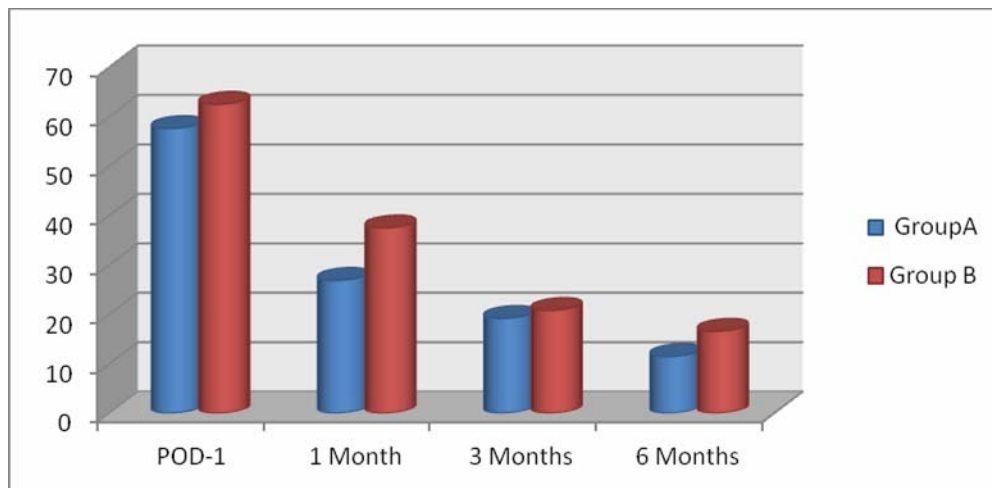
The mean severity score by using 4-point verbal scale in patients who reported post operative neuralgia was  $1.65 \pm 0.79$  vs  $1.37 \pm 0.92$  at POD-1 ;  $0.81 \pm 0.94$  vs  $0.42 \pm 0.50$  at 1 month ;  $0.58 \pm 0.81$  vs  $0.08 \pm 0.28$  at 3 months ; and  $0.39 \pm 0.09$  vs  $0.05 \pm 0.20$  at 6 months in group A and group B respectively.

There was no Statistically Significant difference of post operative neuralgia ( $p > 0.05$  ) at POD-1, at 1 month, and statistical significance at 3 months and at 6 months.

**Table -12. Incidence of post operative hypoesthesia**

Hypoesthesia Follow-up at	Group A (n=26)(%)	Group B (n=24)(%)	P Value
<b>POD-1</b>	15 (57.6)	15 (62.5)	0.75
<b>1 Month</b>	7 (26.9)	9 (37.5)	0.50
<b>3 Months</b>	5 (19.2)	5 (20.8)	0.90
<b>6 Months</b>	3 (11.5)	4 (16.6)	0.75

In the present study the incidence of post operative groin hypoesthesia was compared between group A and group B. The results of the follow up visits are 57.65 vs 62.5% (  $p>0.05$  ) at POD-1; 26.9% vs 37.5% (  $p>0.05$  ) at 1 month ; 19.2%vs 20.8% (  $p>0.05$  ) at three months ; and 11.6%vs 16.6% (  $p>0.05$  ) at 6 months in group A and B respectively. Here the p value was found to be insignificant (  $p>0.05$  ).

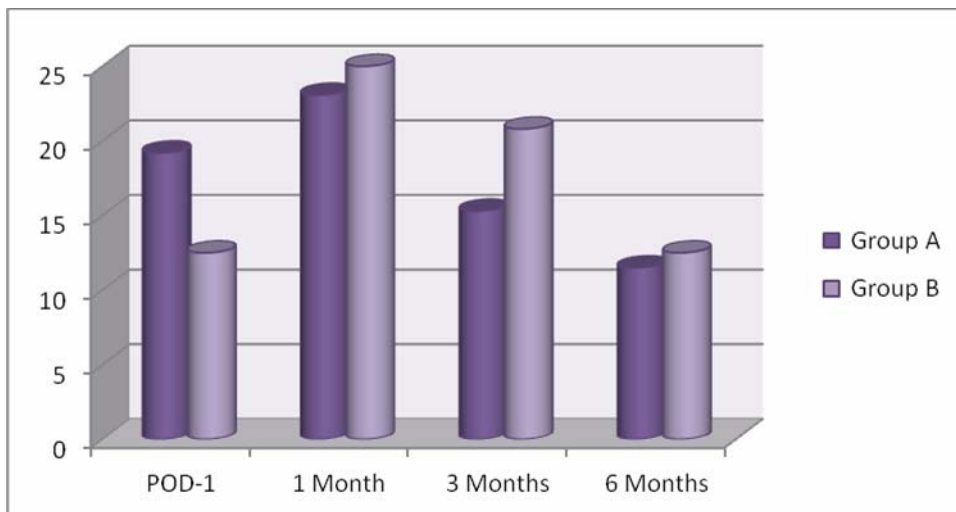


**Graph -11. Incidence of post operative hypoesthesia**

**Table -13 Incidence of post operative numbness**

<b>Numbness</b>	<b>Group A( n=26)</b>	<b>Group B (n=24 )</b>	<b>P value</b>
<b>Follow-up at</b>			
<b>POD-1</b>	5 ((19.2)	3 (12.5)	0.50
<b>1 Month</b>	6 (23.07)	6 (25)	0.90
<b>3 Months</b>	4 (15.3)	5 (20.8)	0.75
<b>6 Months</b>	3 (11.5)	3 (12.5)	0.90

In the present study the incidence of post operative numbness was compared between group A and B. The results of the follow up visits are 19.2% vs 12,5% (  $p>0.05$  ) at POD-1 ; 23% vs 25% (  $p> 0.05$  ) at 1month ; 15,3% vs 20.8 % (  $p>0.05$  ) at 3 months ; and 11.5% vs 12.5% (  $p>0.05$  ) at 6 months. The difference was insignificant (  $p\text{-value} >0.05$  ).



**Graph -12 Incidence of post operative numbness**

## DISCUSSION

Chronic groin pain is a significant problem following open hernia repair with mesh, although the pain is often mild in nature, the quality of life studies have shown that chronic pain irrespective of severity can significantly interfere with normal daily activity.<sup>69</sup>

Routine excision of ilioinguinal nerve in an attempt to decrease the incidence of chronic inguinodynia has been proposed by many studies, yet controversies persists. So the present study was undertaken to evaluate the effect of ilioinguinal nerve excision on post operative groin pain, hypoesthesia, and numbness.

In the present study No of patients were evaluated for pain, hypoesthesia, and numbness are 50, in two study groups ( group A – 26 patients, and group B – 24 patients).

In group A ilioinguinal nerve carefully protected throughout the operation, extreme care was taken during surgery to avoid inclusion of nerve during suturing and mesh placement.

In group B the ilioinguinal nerve was excised as far as lateral to the deep ring.

The patients were followed up for assessment of pain, hypoesthesia, and numbness at POD -1, 1, 3 and 6 months after operation.

## RESULTS ARE COMPARED WITH OTHER STUDIES

### INCIDENCE OF CHRONIC GROIN PAIN

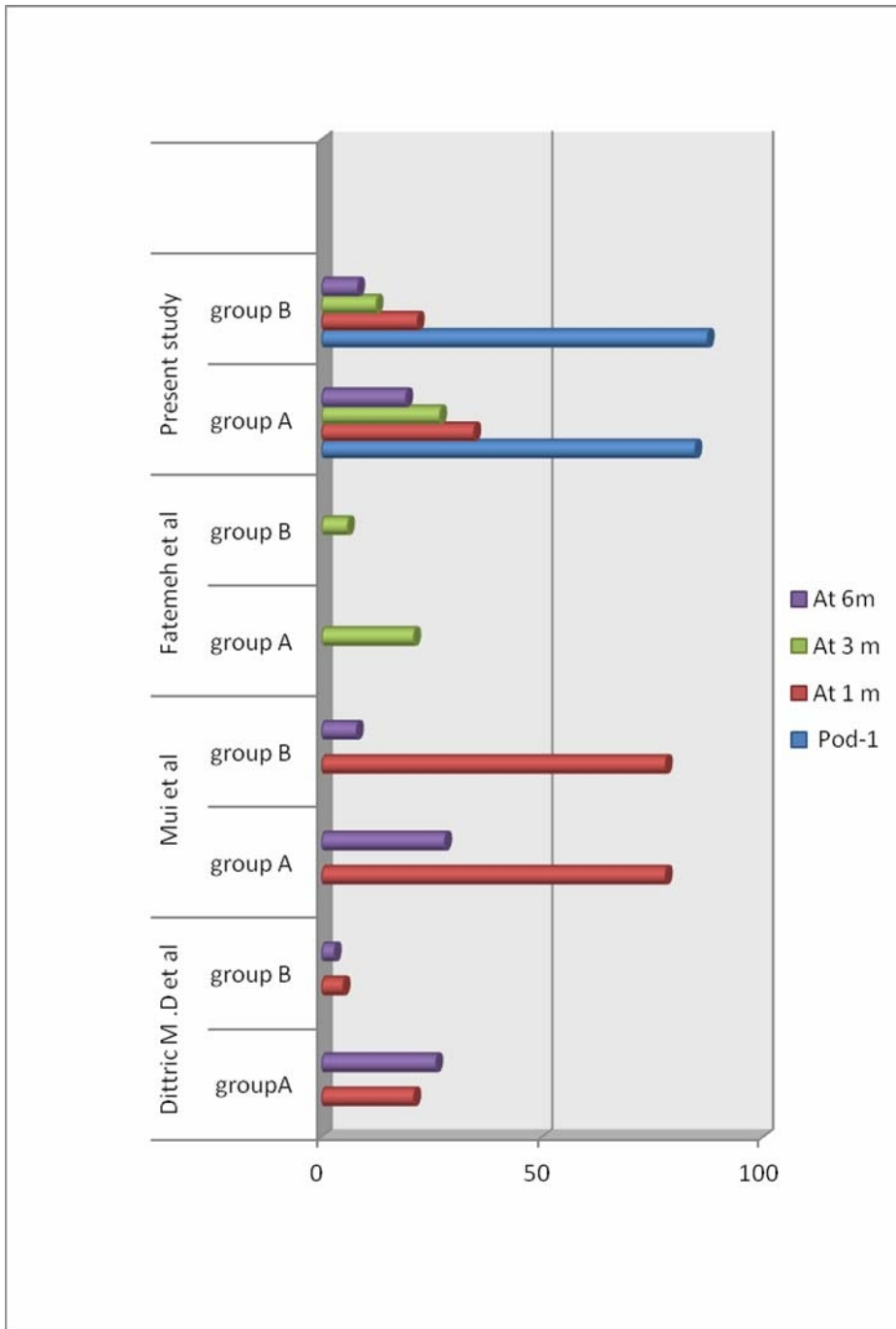
**Table -14 Comparison of incidence of groin pain with other studies**

Studies	Dittrick M .D et al		Mui et al		Fatemeh et al		Present study	
	N P n=24 (%)	NE n=66 (%)	N P n=50 (%)	NE =	N P n=50 (%)	NE =	N P n=26 (%)	NE n=24 (%)
<b>Pod-1</b>							24	19
<b>At 1 m</b>	5 (21)	3 (5)	37 (78)	37(78)			13	10
<b>At 3 m</b>					10 (21)	3 (6)	10	2
<b>At 6m</b>	6 (26)	2 (3)	14 (28)	4 (8 )			8	1

The above table shows the number of patients and percentage of incidence of post operative chronic groin pain in three previous studies and the present study.

The incidence of post operative groin pain in the present study compared ilioinguinal nerve preservation versus routine excision of ilioinguinal nerve showing the results 24 vs 19 at POD-1 ;13 vs 10 at 1month comparable with study conducted by Dittrick (Dittrick M.D et al, 2004 ).<sup>7</sup> ; 26.9% vs 12.5% at 3 months correlates well with the study done by fatemeh (Fatemeh M.D et al, 2008 ).<sup>70</sup> ; 19.2% vs 8.2% at 6 months correlates well with studies done by (Mui M.B et al, 2006)<sup>69</sup> and Dittrick (Dittrick M.D et al,2004 ). Here the incidence of pain at POD-1 is not considered for post operative chronic groin pain.

**Graph- 13. Comparison of incidence of groin pain**





## INCIDENCE OF HYPOESTHESIA

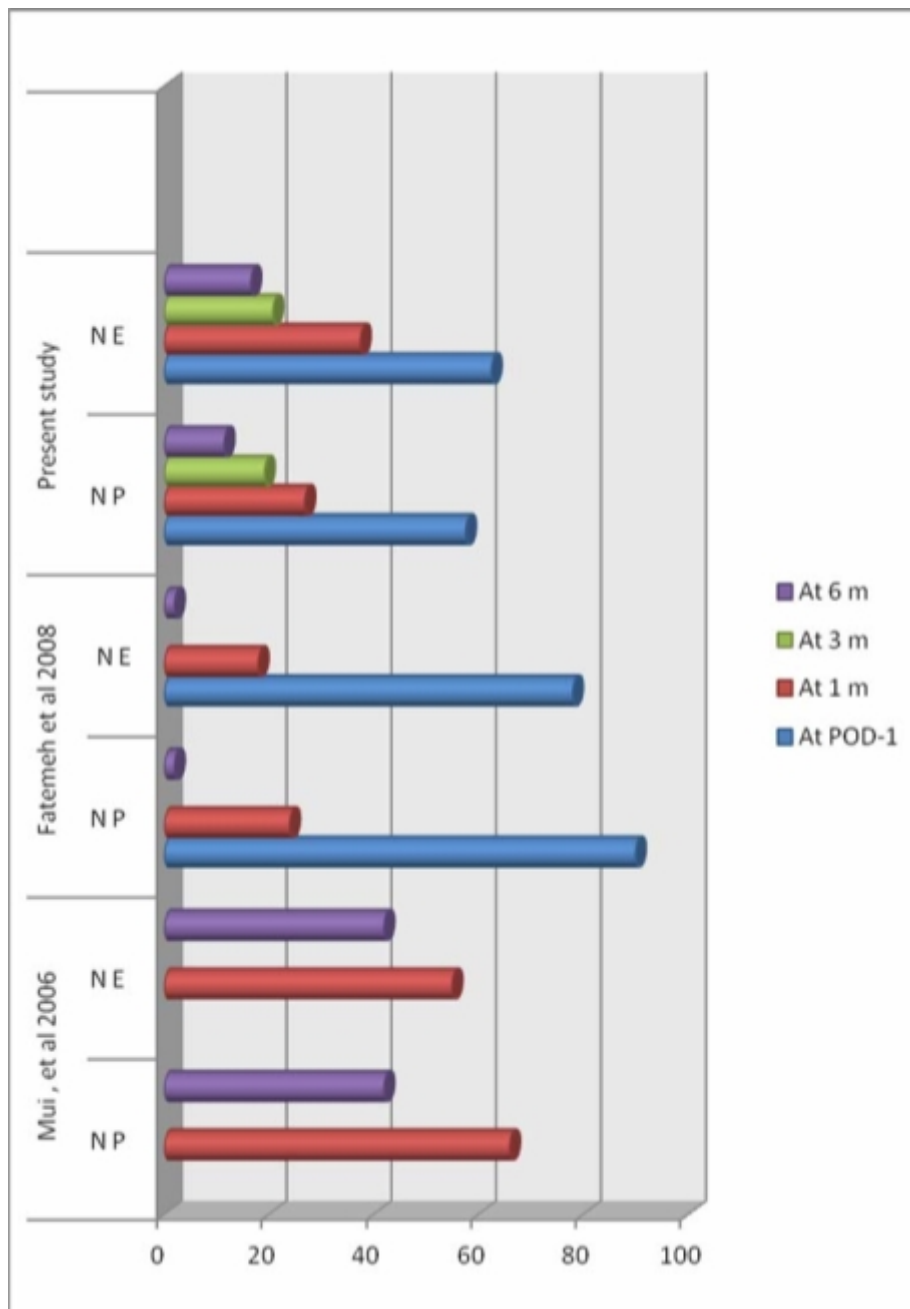
**Table-15. Comparison of incidence of hypoesthesia**

Studies	Mui et al 2006		Fatemeh et al 2008		Present study	
Group	N P n=50 (%)	N E n=50 (%)	N P n=50 (%)	N E n=50 (%)	N P n=26 (%)	N E n=24 (%)
At POD-1			45 (90)	39 (78)	15 (57.6)	15 (62.5)
At 1 m	31 (66)	26 (55)	12 (24)	9 (18)	7 (26.9)	9 (37.5)
At 3 m					5 (19.2)	5 (20.8)
At 6 m	21 (42)	21 (42)	1 (2)	1 (2)	3 (11.5)	4 (16.6)

The above table shows the incidence of hypoesthesia in the present study compared with two other studies.

In the present study the incidence of post operative hypoesthesia at groin between ilioinguinal nerve preservation and nerve excision during surgery , The results obtained are 57.6% vs 62.5% at POD-1 ; 26.9% vs 37.5% at 1 month ; and 11.5% vs 16.6% at 6 months are comparable with studies conducted by Fatemeh (Fatemeh M.D et al, 2008 ).<sup>70</sup> and Mui ( Mui M.B et al, 2006 ).<sup>69</sup>

**Graph-14. Comparison of incidence of hypoesthesia**



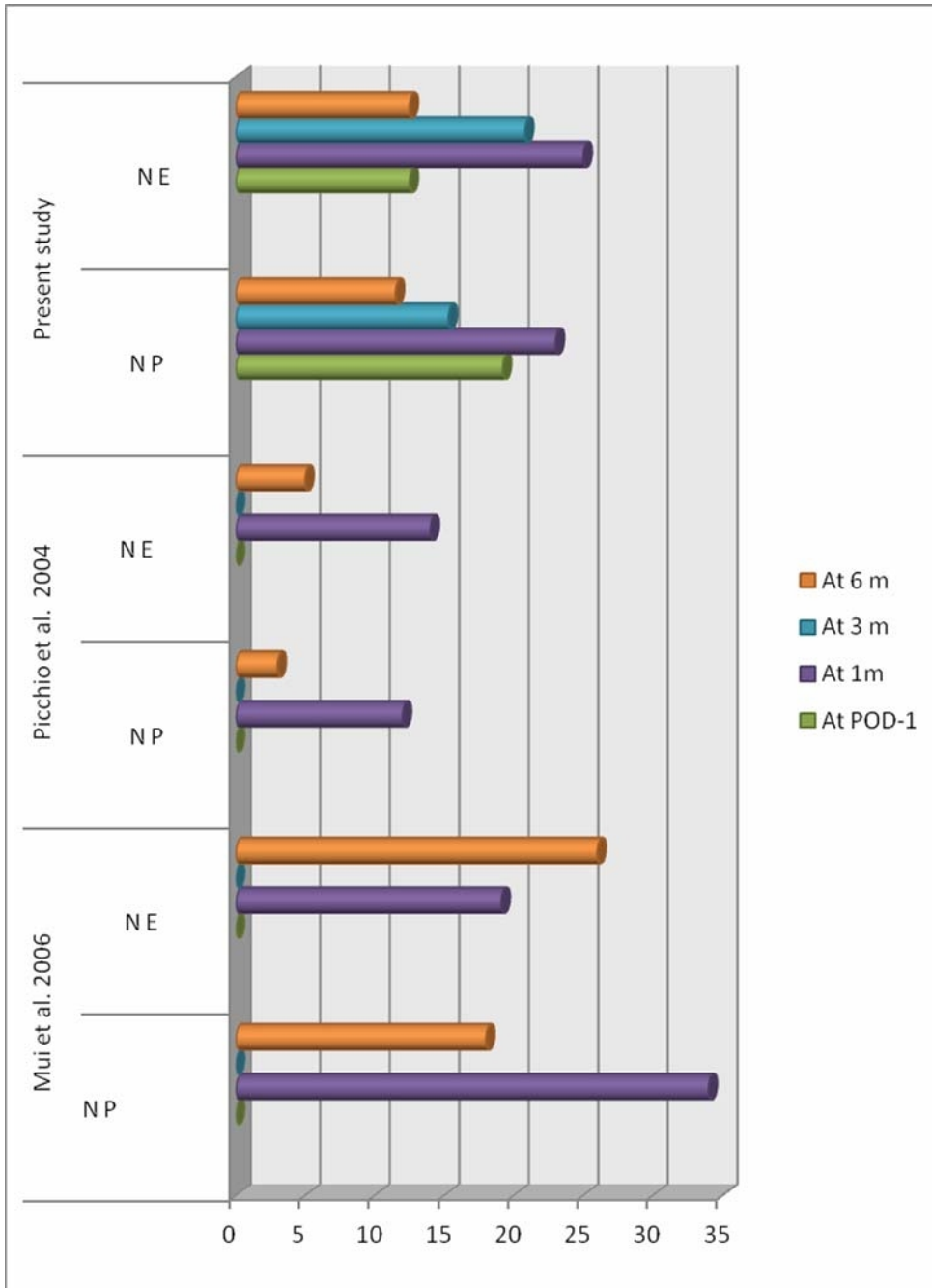
## INCIDENCE OF NUMBNESS

**Table – 16. Comparison of incidence of numbness**

Study	Mui et al. 2006		Picchio et al. 2004		Present study	
Group	NP n=50 (%)	NE n=50 (%)	NP n=391 (%)	NE n=380 (%)	NP n=26 (%)	NE n=24 (%)
<b>At POD-1</b>	-	-	-	-	5 (19.2)	3 (12.5)
<b>At 1m</b>	16 (34)	9 (19.1)	46 (12)	54 (14)	6 (23)	6 (25)
<b>At 3 m</b>	-	-	-	-	4 (15.3)	5 (20.8)
<b>At 6 m</b>	9 (18)	13 (26)	12 (3)	18 (5)	3 (11.5)	3 (12.5)

In the present study the incidence of post operative numbness compared ilioinguinal nerve preservation versus nerve excision, results showing 23% vs 25% at 1 month, and 11.5% vs 12.5% are comparable with results of studies conducted by Picchio ( Picchio et al, 2004 )<sup>10</sup> and Mui (Mui M.B et al, 2006 ).<sup>69</sup>

**Graph-15. Comparison of incidence of numbness**



## COMMENTS

After the publication of several retrospective and prospective studies that showed an incidence of 6% to 29% for post herniorrhaphy inguinal pain.<sup>61,70</sup> Many investigators and pioneers started to establish algorithm for management of these chronic pain syndrome, others tried to define a method to prevent this complications rather than treat it. A proposed mechanism for the development of post operative chronic groin pain is inflammation and fibrosis induced by the mesh, which is in close proximity to the ilioinguinal nerve.<sup>70,71</sup> In addition unintentional injury or strangulation of the nerve during suturing may also contribute to the phenomenon.

There is increasing evidence to suggest that prophylactic excision of ilioinguinal nerve during open hernia repair can potentially decreases the incidence of chronic groin pain following operation.<sup>7</sup> Some studies have failed to show any relationship between the division or preservation of ilioinguinal nerve and risk of developing chronic groin pain.<sup>10</sup>

### **Ravichandran et al in 2000**<sup>8</sup>

One of the early studies in the fields of elective neurectomy in inguinal hernia repair was a pilot study conducted by Ravichandran et al at 2000, in which 20 patients with bilateral inguinal hernia underwent surgery with the ilioinguinal nerve being preserved on one side and divided on the other side, all of the differences in the post surgical pain and numbness between the two sides were insignificant.

### **Dittrick et al 2004**<sup>7</sup>

Retrospective chart review performed by Dittrick et al 2004, on 90 patients who

underwent Lichtenstein inguinal hernia repair.

The ilioinguinal nerve was excised in 66 patients and preserved in 24 patients.

These investigators concluded that the incidence of neuralgia was significantly lower in the neurectomy group versus the nerve preservation group (3% vs 26%  $P < 0.001$ ). At one year post operatively the neurectomy patient continued to have a significantly lower incidence of neuralgia (3% vs 25%  $p = 0.003$ ). The incidence of paraesthesia in the distribution of the ilioinguinal nerve was not significantly higher in the neurectomy group (13% vs 5% ,  $p = 0.32$  ) at 1 year.

**Mui M.D et al 2006**<sup>62,69</sup>

Conducted a double blinded randomized controlled trial to investigate the short to mid-term neurosensory effect of prophylactic ilioinguinal neurectomy during Lichtenstein repair of inguinal hernia. 100 male patients were randomized into two groups. Ilioinguinal neurectomy (group A). ilioinguinal nerve preserved (group B) during operation. Results concluded that the incidence of chronic groin pain at 6 months was significantly lower in the group A than group B. (8% vs 28.6% )  $p = 0.008$ . No significant inter group differences were found regarding the incidence of groin numbness. Post operative sensory loss or changes at the groin region. And they postulated that the sensory loss caused by the neurectomy might be compensated by cross innervations from the collateral cutaneous nerves.

### **Fatemeh malekpour et al 2008 <sup>70</sup>**

Double blinded randomized controlled clinical trial was performed on 121 patients undergoing open anterior mesh repair of inguinal hernia.

Of the 121 patients, 61 were nerve excision group and 60 were nerve preserving group. The chronic post surgical inguinodynia was seen in 6% in nerve excision group and 21% in nerve preserved group ( $p=0.033$ ). Results were concluded that the neurectomy decreases the post surgical pain after elective inguinal hernia repair.

### **Picchio Marcello M.D et al, 2004 <sup>10</sup>,**

Conducted a double blinded randomized controlled trial on 813 patients, One year after surgery pain was absent in 231 (76.5) of nerve preserved and 213 (73%) of nerve transected patients. (difference 3.30% ; 95% confidence interval – 3.68% to 10.28%), mild pain in 55(18%) and moderate in 11 (4%) and 9 (3%), and severe in 5(2%) and 9 (3%). respectively  $p=55$  Pearson test.

They suggested that post surgical pain after hernia repair is not affected by elective inguinal nerve division, yet sensory disturbances in the area are significantly increased.

These controversial result, as well an article by Madura et al <sup>67</sup> - reporting the effectiveness of inguinal neurectomy for inguinal nerve entrapment to relieve pain in post surgical patients motivated us to study the comparison between elective ilio-inguinal nerve excision versus preservation on chronic groin pain and other symptoms.

## **In the present study –Results.**

A Prospective comparative study conducted at Department of General Surgery at Government Rajaji Hospital, Madurai from August 2013 to August 2014 with 6 months follow up. 50 of 60 patients who completed the study protocol fully, this includes 26 of 30 patients in group A ( ilioinguinal nerve preservation ) and 24 of 30 patients in group B ( ilioinguinal nerve divided).

The results of the follow up visits are 24 Vs 19 (  $p>0.05$  ) at POD-1 ; 13 Vs 10 (  $p>0.05$  ) at 1 month ; 10 Vs 2 (  $p>0.05$  ) at 3 months ; and 8 Vs 1 (  $p<0.05$  ) at 6 months in group A and group B respectively. The mean severity score was  $1.65\pm 0.79$  vs  $1.37\pm 0.92$  at POD-1 ;  $0.81\pm 0.94$  vs  $0.42\pm 0.50$  at 1 month ;  $0.58\pm 0.81$  vs  $0.08\pm 0.28$  at 3 months ; and  $0.39\pm 0.09$  vs  $0.05\pm 0.20$  at 6 months in group A and group B respectively.

The incidence of hypoesthesia was 57.6% vs 62.0% ; 26.9% vs 37.5% ; 19.2% vs 20.8% ; and 11.5% vs 16.6% at POD-1, 1, 3, and 6 months in group A and B respectively, ( $p>0.05$ )

The incidence of numbness was 19.2% vs 12.5% ; 23% vs 25% ; 15.3% vs 20.8% ; and 11.5% vs 12.5% at POD-1, 1, 3, and 6 months in group A and B respectively, ( $p>0.05$ ) Thus showed the incidence of chronic groin pain is lower in ilioinguinal nerve excision (group B) compared to nerve preservation (group A). But Statistically insignificant ( $p>0.05$  ). No significant difference noted in Neurosensory disturbances in either group.



## CONCLUSION

In the present study 50 of 60 patients who have completed the study protocol fully, this includes 26 of 30 patients in group A ( ilioinguinal nerve preservation ) and 24 of 30 patients in group B (ilioinguinal nerve divided) who underwent Lichtenstein mesh hernioplasty at Government Rajaji Hospital ,Madurai.

### **After analyzing the data and observations.**

The present prospective comparative study demonstrated that the prophylactic excision of ilioinguinal nerve during Lichtenstein mesh hernia repair decreases the incidence of chronic groin pain after surgery. Furthermore the procedure is not significantly associated with additional morbidities in terms of local cutaneous neurosensory disturbances.

However the sample size and the follow up period in the current study is relatively short , A larger study sample and longer follow-up may be needed before any further conclusion can be made.

Although the study sample and follow period is short in this present study than reported by many previous studies it is still wise to recommend ilioinguinal neurectomy in patients undergoing anterior inguinal hernia mesh repair. So when performing Lichtenstein inguinal hernia repair,routine ilioinguinal neurectomy is a reasonable option.

## SUMMARY

“Comparative study of preservation versus elective division of ilioinguinal nerve on post operative groin pain in open mesh repair of inguinal hernia”

Conducted in department of Surgery at GRH, Madurai from August 2013 to August 2014.

¾ Data collected in a prescribed proforma, analyzed and evaluated for the Pain, Hypoesthesia and Numbness at POD-1, 1, 3, and 6 months after surgery.

¾ Sample size was 60 patients in two groups, group A- 30 ( ilioinguinal nerve preserved ) and group B- 30 ( ilioinguinal nerve divided ) . 50 of 60 patients were completed the study protocol with 6 months follow-up.

¾ Of the 50 Patients, 26 patients ( 25 men and 1 women ) with mean age  $31 \pm 20$  belongs to group A, and 24 patients ( all are men) with mean age of  $39 \pm 14$  belongs to group B.

¾ 76% in the group A and 71% in the group B presented with only swelling in the groin, rest associated with pain.

¾ 15% in group A showed bladder outlet obstruction compared to 25% in group B, and also 27% in group B had constipation compared to 21% in group B, and 4% (group A) compared to 8% (group B) had chronic cough.

¾ 57% in the group A compared to 67% in group B had right sided inguinal hernia, rest had left sided hernia.

¾ 81% in the group A compared to 78% in group B had indirect inguinal hernia right sided indirect inguinal hernia is the common type .

¾ The results of the follow up visits are 24 Vs 19 (  $p>0.05$  ) at POD-1 ; 13 Vs 10 (  $p>0.05$  ) at 1 month ; 10 Vs 2 (  $p>0.05$  ) at 3 months ; and 8 Vs 1 (  $p<0.05$  ) at 6 months in group A and group B respectively.

¾ The incidence of hypoesthesia was 57.6% vs 62.% ; 26.9% vs 37.5% ; 19.2% vs 20.8% ; and 11.5% vs 16.6% at POD-1, 1,3,and 6 months in group A and B respectively,( $p>0.05$ )

¾ The incidence of numbness was 19.2% vs 12.5 ; 23% vs 25% ; 15.3% vs 20.8% ; and 11.5% vs 12.5% at POD-1,1,3, and 6 months in group A and B respectively,( $p>0.05$  )

¾ Thus showed the incidence of chronic groin pain is lower in ilioinguinal nerve excision (group B) compared to nerve preservation (group A). And no significant difference noted in neurosensory disturbances in either group.

¾ However the sample size and the follow up period in the current study is relatively short, A larger study sample and longer follow-up may be needed before any further conclusion can be made.

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**MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL ,  
MADURAI**

**“Comparative study of preservation versus elective division of ilio-inguinal nerve on post operative groin pain, in open mesh repair of inguinal hernia”**

**PROFORMA**

Name : IP No :  
Age / Sex : Date of Admission :  
Occupation : Date of Operation :  
Address : Date of Discharge :

**CHIEF COMPLAINTS**

**HISTORY OF PRESENT ILLNESS**

**1. Swelling in the groin**

- a) Duration
- b) Site
- c) Mode of onset
- d) Swelling appears first at
- e) Progress
- f) Extension
- g) Size on stand up & Straining
- h) Size on lying down

**2. Pain : Present / Absent**

- a) Site
- b) Onset
- c) Radiation

- d) Character
- e) Severity
- f) Pain on standing
- g) Pain on lying down

**3. Vomiting:** Present / Absent

Nature of vomitus

No of bouts

**4. Distension of abdomen:** Present / Absent

**5. Other straining factors**

- a) Cough / Breathlessness / Asthma
- b) Constipation / Straining at stools
- c) Urgency / Frequency / Hesitancy

**6. Any treatment before admitting to the hospital** : Yes / No

If Yes:

**PAST HISTORY**

History of similar illness in the past

History of Diabetes, Hypertension, Asthma

Epilepsy or Tuberculosis

**TREATMENT HISTORY**

Medical : Surgical :

**PERSONAL HISTORY**

**MENSTRUAL HISTORY** (If Female)

**FAMILY HISTORY**

## GENERAL PHYSICAL EXAMINATION

Built :

Nourishment :

Mental state :

Pallor : Clubbing :

Icterus : Edema :

Cyanosis: Lymphadenopathy:

## VITALS

Pulse : Respiratory rate:

Blood pressure : Temperature:

## LOCAL EXAMINATION

### A . Inspection :

- a) Site : Rt groin / Left groin / Bilateral
- b) Extent
- c) Size : Measuring about
- d) Shape : Pyriform / Globular
- e) Surface : Smooth / Irregular
- f) Margin : Well defined / Ill defined
- g) Skin over the swelling : Stretched / Inflamed / Normal
- h) Impulse on cough : Present / Absent
- i) Visible peristalsis over swelling : Present or Absent
- j) Position of Penis

## **B. Palpation**

- a) Temperature : Normal / Raised / Decreased
- b) Tenderness : Present / Absent
- c) To get above the swelling : Possible / Not possible
- d) Position and extent : Rt groin / Lt groin / Bilateral
- e) Size
- f) Shape : Pyriform / Globular
- g) Surface : Smooth / Irregular
- h) Consistency : Soft & elastic / Doughy & Granular
- i) Reducibility : Spontaneous / by Manipulation
- j) Deep ring occlusion test : Positive / Negative
- k) Invagination test
- l) Zieman's test

Can testis be felt separately  
from the swelling



### **C. Percussion**

Over the swelling : Resonant / Dull note

### **D. Auscultation**

Bowel sounds heard over the swelling? : Yes / No

### **E. Examination of abdominal muscle tone**

On head raising test malgaigne`s bulgings : Present / Absent

## **SYSTEMIC EXAMINATION**

### **A. Per Abdomen :**

- a) Shape :
- b) Umbilicus :
- c) Tenderness :
- d) Organomegaly :
- e) Other findings :

### **Per Rectal examination:**

**Per vaginal examination (If female):**

### **B. Respiratory system :**

### **C. Cardiovascular system :**

### **D. Nervous system :**

## **CLINICAL DIAGNOSIS**

## **INVESTIGATIONS**

### **A. Routine blood**

HB %

RBS

Blood urea

Blood group

Serum Creatinine

HIV HbsAG



***AT ONE MONTH***

Pain : None / Mild / Moderate / Severe

Hypoesthesia : Present / Absent

Numbness : Present / Absent

***AT THREE MONTHS***

Pain : None / Mild / Moderate / Severe

Hypoesthesia : Present / Absent

Numbness : Present / Absent

***AFTER SIX MONTHS***

Pain : None / Mild / Moderate / Severe

Hypoesthesia : Present / Absent

Numbness : Present / Absent

**KEY TO MASTER CHART**

SL No: Serial Number IP No: Inpatient Number

Age : In Years Sex : M :Male, F : Female

Occupation:

Ag: Agriculture

T : Teacher

B : Business

S : Student

D : Driver

Ck : Cook

E; Employee

M : Manual  
Labour

C : Coolie

Duration:

d : days      m: Months    y : Years.

Side:    Rt : Right      Lt : Left    B/L : Bilateral

Mode of presentation:

1 : Swelling only    2 : Swelling with pain

Straining Factors: S F

CC : Chronic cough      SS : Straining at stools

Bladder outlet obstruction Boo.    + : Present .    - : Absent.

Clinical Presentation: C P

C : Complete      I : Incomplete

Reducibility:      R : Reducible    I : Irreducible

Type:              1 : Direct      2 : Indirect

Surgery: L : Lichtenstein`s mesh hernioplasty

Study Group : A : Nerve preservation      B : Nerve Excision

Follow-Up:

0 : No pain

1 : Mild pain

2: Moderate pain ,

3 : Severe Pain

H: Hypoesthesia

N : Numbness

+ : Present .- : Absent.

PoD-1: Post operative day1

3m : At Three Months

1m : At one Month

6m : At Six Months

# MASTER CHART

																Follow up												
								S F			C P			Pain				Hypoesthesia			Numbness							
SL No	Name	Age	Sex	IP No	Duration	Side	study Group	BOO	S S	C	Reducibility	E	T	O	S	S	POD-1	1 month	3 months	6 months	POD-1	1 month	3 months	6 months	POD-1	1 month	3 months	6 months
1	Sekhar	35	M	10187	4y	Lt	1	-	-	-	R	C	1	C	L	A	1	1	0	0	+	+	-	-	-	+	-	+
2	Ayyanar	45	M	14627	6m	Rt	1	+	-	-	R	I	2	Ck	L	A	2	2	2	0	-	-	-	-	-	-	-	-
3	Pandi	27	M	11725	8y	Rt	1	-	-	-	R	C	2	M	L	A	2	1	1	1	+	+	+	+	-	-	-	-
4	Bhasker	32	M	11750	1.5y	Rt	1	-	+	-	R	C	2	C	L	A	2	2	0	0	-	-	-	-	-	-	-	-
5	Anil Kumar	22	M	01877	10m	Rt	1	-	-	-	R	I	2	M	L	A	1	2	0	0	+	-	-	-	-	-	-	-
6	Duraipandi	45	M	11463	6y	B/L	1	-	-	-	R	I	2	Ag	L	B	2	3	1	2	+	+	-	-	-	-	+	+
7	Subbaiya	48	M	12469	2m	Rt	1	-	+	-	R	I	2	M	L	B	3	2	1	0	+	+	+	-	+	-	-	-
8	Hariharan	34	M	11143	8m	Lt	1	-	-	-	R	I	1	Ag	L	B	1	0	1	0	-	-	-	-	-	-	-	-
9	Shridharan	52	M	14294	12d	Rt	1	+	-	-	R	I	1	Ag	L	B	2	0	0	0	+	+	+	+	-	+	-	-
10	Krishnan	23	M	12075	6m	Lt	1	-	-	-	R	I	2	Ag	L	B	3	1	0	0	-	+	+	+	+	+	+	-
11	Rafeeq	22	M	22477	1m	Rt	1	-	-	-	R	I	2	S	L	A	2	0	0	0	-	-	+	+	-	-	-	-
12	Karuppaiya	45	M	21532	15d	Lt	1	-	-	-	R	C	2	B	L	A	3	1	0	0	+	+	-	-	-	-	-	-
13	Hameed	35	M	13121	7m	Rt	1	-	-	-	R	I	2	Ag	L	A	2	2	3	1	-	-	-	-	+	+	+	+
14	Prashanth	26	M	14247	4m	Rt	1	-	-	-	R	I	2	T	L	B	2	0	0	0	+	-	-	-	-	+	+	+
15	Shivakumar	19	M	15916	2y	Lt	1	-	-	-	R	I	2	S	L	B	1	1	0	0	+	-	-	-	-	-	-	-
16	Muneer	25	M	16048	2m	Rt	1	-	-	-	R	C	2	S	L	B	2	0	0	0	+	+	+	-	-	-	-	-

