"A CLINICAL STUDY OF LICHTENSTEINS TENSION - FREE PROLENE MESH HERNIOPLASTY IN CASES OF INGUINAL HERNIA IN TIRUNELVELI MEDICAL COLLEGE HOSPITAL"

A DISSERTATION SUBMITTED TO THE TAMILNADU

DR. MGR MEDICAL UNIVERSITY

CHENNAI

In partial fulfillment of the requirement for the degree of

M.S. (GENERAL SURGERY)

BRANCH – I

Register No: 221711364

DEPARTMENT OF GENERAL SURGERY

TIRUNELVELI MEDICAL COLLEGE

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Prof. Dr. S.M. KANNAN M.S, M.Ch (Uro)

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I solemnly declare that the dissertation entitled **"A CLINICAL STUDY OF LICHTENSTEINS TENSION - FREE PROLENE MESH HERNIOPLASTY IN CASES OF INGUINAL HERNIA IN TIRUNELVELI MEDICAL COLLEGE HOSPITAL"** is done by me at Tirunelveli Medical College hospital, Tirunelveli. I also declare that this bonafide work or a part of this work was not submitted by me or any others for any award, degree, or diploma to any other University, Board, either in or abroad. The dissertation is submitted to The Tamilnadu Dr. M.G.R.Medical University towards the partial fulfilment of requirements for the award of M.S. Degree (Branch I) in General Surgery.

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Dear Dr.A.B.PEER MOHAMEED, MBBS.,, The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during The IEC meeting held on 15.12.2017.

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
6.	Proposed Methods for Patient Accrual Proposed	☐
7.	Curriculum Vitae of The Principal Investigator	☐
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10.	Investigator's Undertaking	☐
11.	DCGI/DGFT approval	☐
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1. The approval is valid for a period of 2 year/s or duration of project whichever is later
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This is certify that this dissertation work title **"A CLINICAL STUDY OF LICHTENSTEINS TENSION - FREE PROLENE MESH HERNIOPLASTY IN CASES OF INGUINAL HERNIA IN TIRUNELVELI MEDICAL COLLEGE HOSPITAL"** of the candidate **Dr.PEER MOHAMED A B** with registration Number **221711364** for the award of M.S. Degree in the branch of **GENEARL SURGERY (I).** I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion page and result shows **16 percentage** of plagiarism in the dissertation.

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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6029728/
https://de.slideshare.net/maxangeloterrenal/inguinal-hernia-31529390
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https://www.freezingblue.com/flashcards/print_preview.cgi?cardsetID=328972
https://thoracickey.com/hernias/
https://quizlet.com/338700557/12-inguinal-hernia-flash-cards/
https://www.slideshare.net/tonyscaria/hernia-37050501
https://quizlet.com/215243635/anatomy-of-the-umbilical-and-inguinal-region-flash-cards/

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ABBREVIATIONS

BPH	-	Benign Prostatic Hyperplasia
CGRP	-	Calcitonin Gene Related Peptide
INSL 3	-	Insulin Like Hormone 3
MUL	-	Medial Umblical Ligament
POD	-	Post Operative Day
RL	-	Round Ligament
TURP	-	Transurethral Resection of Prostate

CONTENTS

INTRODUCTION

More than 500,000 hernias are diagnosed in India annually, making hernia repair one of the most common operations performed by a general surgeon. Despite the frequency of the procedure, no surgeon has ideal results, and complications such as postoperative pain, nerve injury, surgical site infection and recurrences remain.

The surgery for inguinal hernia repair has evolved over centuries, the prolene mesh tension free repair introduced by irwing Lichtenstein caused a dramatic drop in the recurrence rate and became the procedure of choice, the profound understanding of the functional anatomy and pathophysiology of the abdominal wall and the inguinal canal has helped reach this end.

The modern era in hernia repair demands to be proficient in analysing outcomes of their own surgeries and in using statistics, he is expected to know exactly his own complication rate, infection rate and recurrence rate while using various modalities. Thus he can judge his operative skill in an unbiased manner.

AIMS AND OBJECTIVES OF STUDY

1. To estimate the distribution of various etiological factors of inguinal hernia such as presence of chronic respiratory illness, pulmonary tuberculosis, benign prostatic hyperplasia, and manual heavy labour.

2. To estimate the case distribution in relation to age, sex and type of hernia(direct, indirect, pantaloons).

3. To estimate the distribution of early postoperative complications such as urinary retention, urinary tract infection, orchitis, surgical site infection, neuralgia, pain.

4. To estimate distribution of long term complications such as seroma, chronic pain and recurrences.

REVIEW OF LITREATURE

EMBRYOLOGY[1-4]

The testis forms on the front of the urogenital ridge on the posterior abdominal wall in the early embryo. At -8 weeks of development the ambiguous gonad develops into a testis in boys, with the mesonephric duct differentiating into the vas deferens and the paramesonephric or mullerian duct regressing.

The testis is anchored to the future inguinal abdominal wall by the genito-inguinal ligament or gubernaculum. Which controls descent of the testis in what is now recognized as two basic steps. In the first phase, which occurs between 8 and 15 weeks, the gubernaculum enlarges in response to testicular hormones, effectively anchoring the testis near the groin as the abdomen and pelvic cavity enlarge with fetal growth.

This so-called **transabdominal phase** of testicular descent is controlled primarily by secretion of insulin-like-hormone 3 (INSL3) from the Leydig cells of the developing testis. There is also some evidence that Mullerian inhibiting substance (also known as antimullerian hormone) is an important subsidiary factor. By 15 weeks of gestation the testis is anchored in a position just inside the future internal inguinal ring and is already in a different position from the developing ovary. Between 15 and 25 weeks of development there is very little change in testicular position. 'The reason for this remains unknown but it has been speculated that it is because sexual dimorphism of the nervous system is

required for the second phase of testicular descent. Which commences at about 25 weeks of development. The second or **inguinoscrotal phase** of descent is controlled by testosterone from the testis and this hormone appears to act mostly indirectly on the gubernaculum by the genitofemoral nerve.

Which releases a neurotransmitter. Calcitonin gene-related peptide (CGRP), from its sensory fibres in the inguinoscrotal region. CGRP appears to provide a concentration gradient as well as a growth stimulus to enable the gubernaculum to elongate toward the scrotum. Simultaneously. The gubernaculum is hollowed out by a diverticulum of the peritoneum the processus vaginalis which enables the intra-abdominal foetal testis to descend to a subcutaneous position while still remaining within the peritoneal cavity.

The second phase of descent requires a significant migratory step for the gubernaculum. The regulation of which remains unknown but is likely to be initiated by a complicated series of trophic factors.

The vaginalis process descends into the scrotum dragging thin fascial prolongations of the abdominal wall layers with it, thus the vaginalis process receives covering from the external oblique and internal oblique aponeurosis and from the fascia tranversalis.

The blind extremity of the processus vaginalis gets invaginated for the reception of descending testis. As the migration of the testis proceeds, the gubernaculums shortens and eventually atrophies, but some trace of

gubernaculums persists at the bottom of the scrotum, below tunica vaginalis forms the scrotal ligament fixing the testis to the bottom of scrotal pouch.

By the end of the eight month the cavity of the upper part of the processus vaginalis disappears. The lower part of the processus vaginalis is entirely cut off from the general peritoneal cavity and consists of two layers, the parietal portion of the tunica vaginalis lining the scrotum, while visceral portion of that membrane is applied on to the surface of the testis. In female, the gubernaculums extends from the lower poles of the ovaries to the labium majus through the inguinal canal.

This part atrophies and is represented by the ligament of the ovary while the lower part which is developed is within the plica inguinalis is represented by the round ligament of the uterus, extending from the side of uterus to the labium majus.

A pouch of peritoneum is called the canal of nuck, similar to the processus vaginalis in the male, accompanies the gubernaculums along the inguinal canal into the labium majus. This is normally obliterated well before birth, the occasional persistence of the vaginal process after birth serves the genesis of induction of inguinal hernia in the female.

ANATOMY [5-16]

The anatomy of the inguinal region is complex with multiple entities joining to form the supportive foundation of the inferior anterolateral abdominal wall as it attaches to the pubic tubercle, pelvic rami and the anterior superior iliac spine. Four hernias are encountered in this region: indirect-inguinal, direct-inguinal, external (anterior) supravesical and femoral. All of these originate from the fossae of the anterolateral abdominal wall.

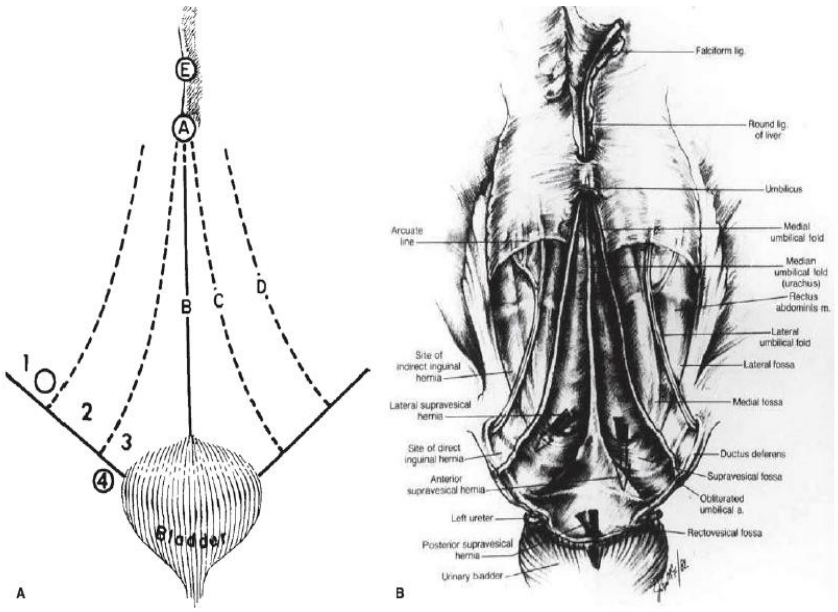

Fig 1 internal view of abdomen showing fossae of anterolateral wall.

A-umbilicus B-median umbilical ligament (obliterated urachus) C. medial umbilical ligament (MUL) (obliterated umbilical arteries D lateral umbilical ligament containing inferior {deep) epigastric arteries, E falciform ligament. Sites of possible hernias- 1-lateral fossa (indirect inguinal hernia); 2- medial

fossa (direct inguinal hernia) 3-supravesical fossa (supravesical hernia); 4-femoral ring (femoral hernia).

EXTERNAL OBLIQUE MUSCLE AND APONEUROSIS

Below the arcuate line this aponeurosis joins with the aponeurosis of the internal oblique and transversus abdominis muscles to form the anterior layer of the rectus sheath. This aponeurosis contributes to the inguinal ligament (Poupart's). The lacunar ligament (Gimbernat's). The reflected inguinal ligament (Colle’s) and the pectineal ligament (Cooper's).The pectineal ligament is also formed from tendinous fibers of the Internal oblique, transversus and pectineus muscles.

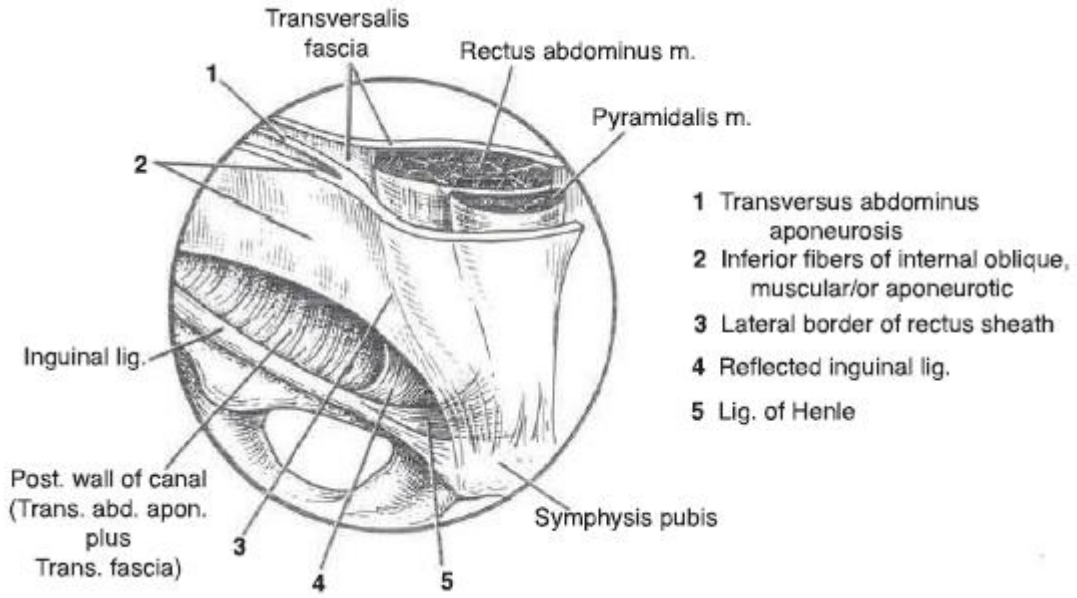

Fig 2 – Conjoined Area

Inguinal ligament (pouparts)

The Inguinal ligament is the thickened lower part of the external oblique aponeurosis from the anterior superior iliac spine laterally to the superior ramus of the pubis. The middle one third has a free edge. The lateral two-thirds are the underlying iliopsoas muscle and fascia

Ileopectineal arch

The ileopectineal arch is a medial thickening of the iliac fascia deep to the inguinal ligament. The arch extends from the ileopubic tract towards the anterior border of the femoral canal.

ileopubic Tract

The ileopubic tract is the aponeurotic band extending from the anterior inferior iliac spine to the pubic tubercle. It forms part of a deep musculoaponeurotic layer that reinforces the inguinal canal behind the transversus abdominis muscle and aponeurosis and the transversalis fascia. The tract passes medially contributing to the inferior border of the internal ring. It crosses the femoral vessels to form the anterior margin of the femoral sheath together with the transversalis fascia. The tract curves around the medial surface of the femoral sheath to attach to the pectineal ligament. It can be confused with the inguinal ligament.

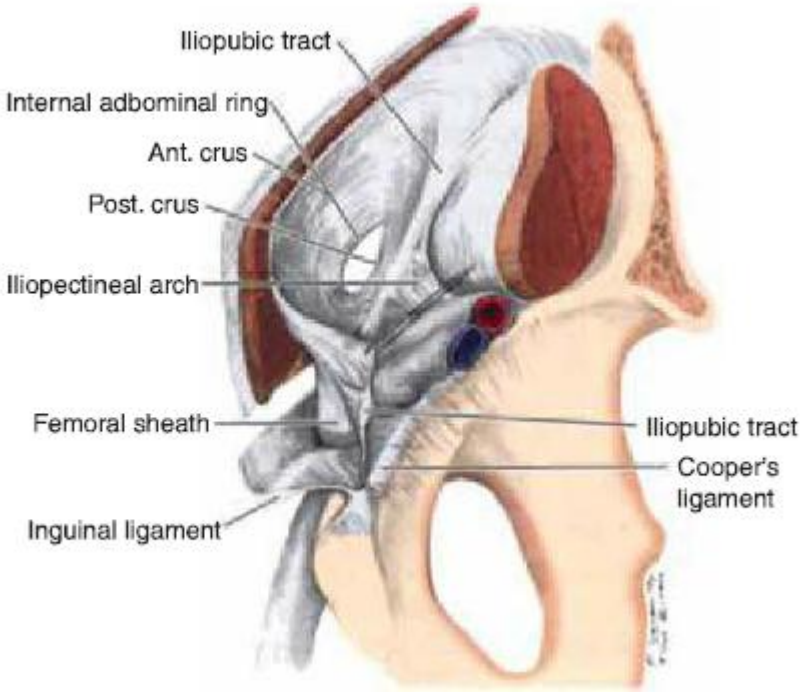

Fig 3- ileopubic tract and ileopubic arch

Lacunar Ligament (Gimbernats)

The lacunar ligament is the most inferior portion of the inguinal ligament. It *is* formed from external oblique fibers arising at the anterior superior iliac spine. Its fibers recurve through an angle <45 degrees before attaching to the pectineal ligament

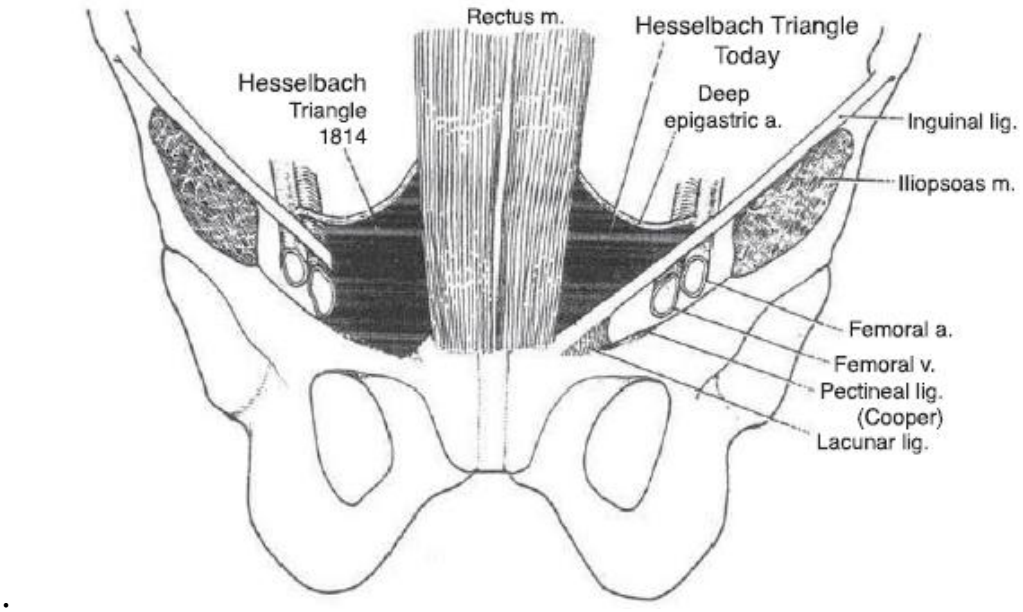

Fig 4 – Pectineal and Lacunar Ligament Relations

Pectineal Ligament (Cooper's)

It is regarded as a periosteal extension of the lacunar ligament along the pectineal line. The pectineal ligament is a thick, strong tendinous band formed principally by tendinous fibers of the lacunar ligament and aponeurotic fibers of the internal oblique, transversus abdominis, and pectineus muscles and with variation, the inguinal falx.

It covers the periosteum of the superior pubic ramus, the pectinate line and the upper part of the pectinate fascia. It is often used in surgical hernia repair because it is a firm anchor for muscular, tendinous and fascial layers of the groin.

Conjoined Tendon (Area)

By definition, the conjoined tendon *is* the fusion of the internal oblique aponeurosis with similar fibers from the aponeurosis of the transversus abdominis muscle just as they insert on the pubic tubercle. The pectineal ligament and the superior ramus of the pubis. This configuration has traditionally been referred to as the conjoined tendon.

As described. However this is rarely encountered. it is found in <5% of cases. The term “conjoined area" may be more appropriate. This usage has practical application to this region, as it also allows inclusion to this entity to the falx inguinalis (Henle's ligament).The inferiormedial fibers of the internal oblique, the reflected inguinal ligament, and the lateral border of the rectus sheath .

Falx lnguinalis (Henle's)

Henle's ligament is the lateral, vertical expansion of the rectus sheath that inserts on the pectin of the pubis. It is present in 30% to 50% of individuals and is fused with the transversus abdominis aponeurosis and transversalis fascia.

Reflected Inguinal Ligament (Colles)

Colles' ligament is formed by aponeurotic fibers from the lateral crus of the external ring & which pass medially and upwards, behind the medial crus to blend with the opposite external oblique aponeurosis.

Arch of the Transversus Abdominis

The inferior portion of the transversus abdominis becomes less muscular and more aponeurotic as it approaches the rectus sheath. Close to the deep ring it is covered by the more muscular arch of the internal oblique muscle.

Transversalis Fascia

Although the name transversalis fascia may be restricted to the internal fascia lining the transversus abdominis muscle. it is often applied to the entire connective tissue sheet lining the abdominal cavity. In the latter sense, it is a fascial layer covering muscles, aponeuroses, ligaments and bones. In the inguinal area, the transversalis fascia is bilaminar, enveloping the inferior epigastric vessels.

.**Retroinguinal (Extraperitoneal Space of Bogros)**

Related to the transversalis fascia is the space of Bogroe, which is a lateral extension of the retropubic space of Retzius (the medial separation of the transversalis fascia and peritoneum immediately superior to the bladder). It is located just beneath the posterior lamina of the transversalis fascia(membranous layer of preperitoneal tissue and above by the peritoneum. this is the space used for preperitoneal access to the fossae of the anteriolateral abdominal wall whereupon the groin hernias arise.

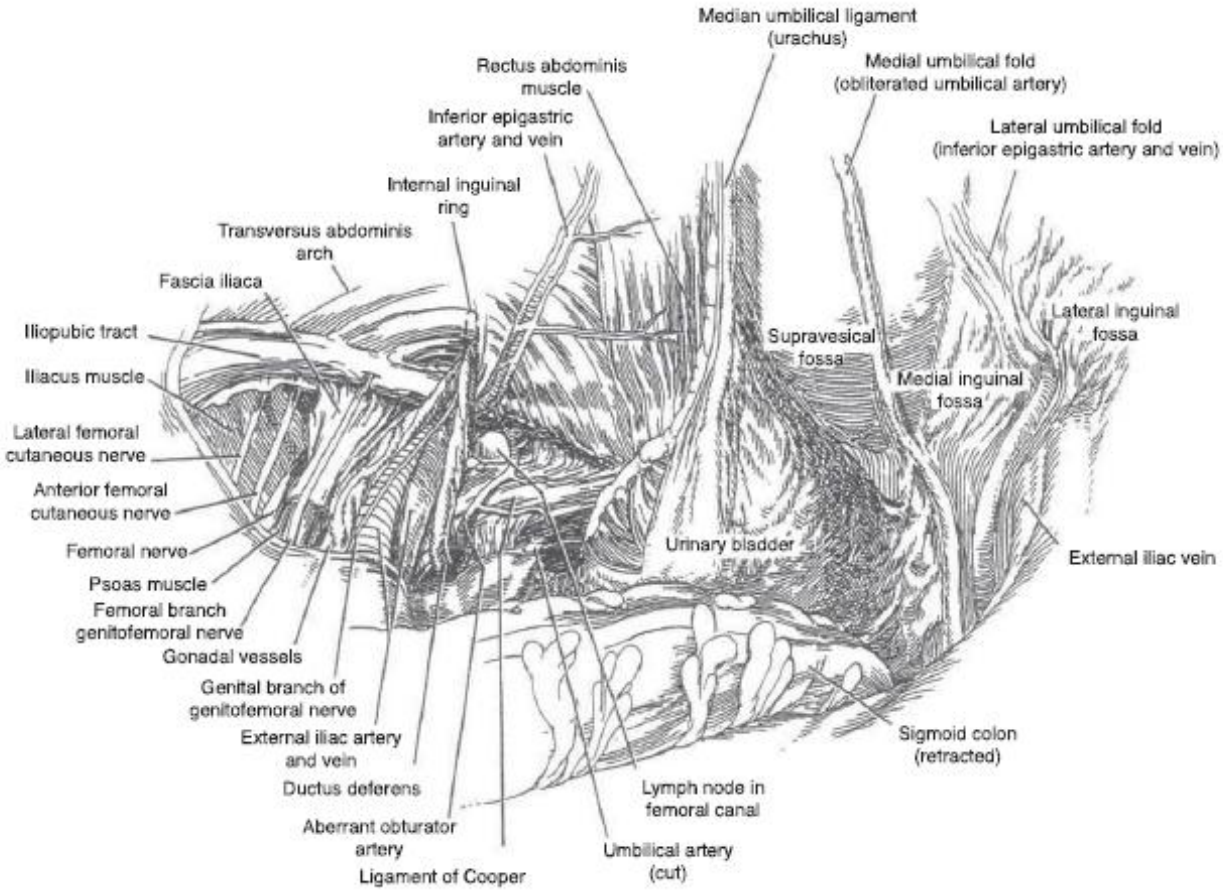

Fig 5 – panaromic view of the inguinal area.

Layers of the Extraperitoneal Tissue

In the lower anterior abdomen and pelvis to accommodate movement and expansion of extraperitoneal organs, there is an aggregation of extraperitoneal fascia to fill in spaces and to ensheathe and support these organs. This includes an outer membranous layer and an inner fatty layer. Which helps to delineate two important surgical planes in the extraperitoneal fascia.

1)The parietal plane

The parietal plane between the transverasalis fascia and the membranous layer of the extraperitoneal fascia contains the deep inferior epigastric arteries, the genital branch of the genitofemoral nerve and the deep inferior epigastric, iliopubic, rectusial, retropubic and communicating retusioepigastric veins.

2)The visceral plane.

The visceral *plane*, between the membranous layer of the extrraperitoneal fascia and the peritoneum contains the median and medial umbilical ligaments (MUL) The vas deferens/round ligament (RL), the gonadal vessels, and the ureter. Beneath these structures in the same plane are the venous plexus of the urinary bladder and the prostate.

This architecture of the extraperitoneal space is universal around the abdomen and pelvis. The membranous layer of the extraperitoneal tissue, and in several instances it condenses and forms the umbilical prevesical fascia, the Gerota's fascia around the kidney and the rectovesical fascia.

INGUINAL CANAL

The inguinal canal in adults is an oblique rift measuring 4cm in length.it contains either the spermatic cord (in males) or the RL of the uterus (in females). Boundaries of the Inguinal Canal

Anterior: The aponeurosis of the external oblique muscle and (more laterally) the internal oblique muscle, there are no external oblique muscle fibers in the inguinal area only aponeurotic fibers.

Posterior: In -75% of individuals, the posterior wall (floor) of the canal is formed laterally by the aponeurosis of the transversus abdominis muscle and the transversalis fascia in the remainder. The posterior wall is transversalis fascia only. Medially, the posterior wall is reinforced by the internal oblique aponeurosis.

Superior: The roof of the canal is formed by the arched fibers of the lower(roof) edge of the internal oblique muscle and by the transversus abdominis muscle and aponeurosis.

Inferior: the inferior wall of the canal is formed by the lower border of the inguinal ligament (Poupart) and the lacunar ligament (Gimbernat)

Hernial Rings of the Groin

Fruchaud viewed hernias not by their clinical presentation, but by their origin within the groin. He termed the area the myopectineal orifice. This area in the groin is bounded superiorly by the arch of the internal oblique muscle and the transversus abdominis muscle, laterally by the iliopsoas muscle, medially by the lateral border of the rectus muscle and its anterior lamina and inferiorly by the pubic pecten. The inguinal ligament spans and divides this framework

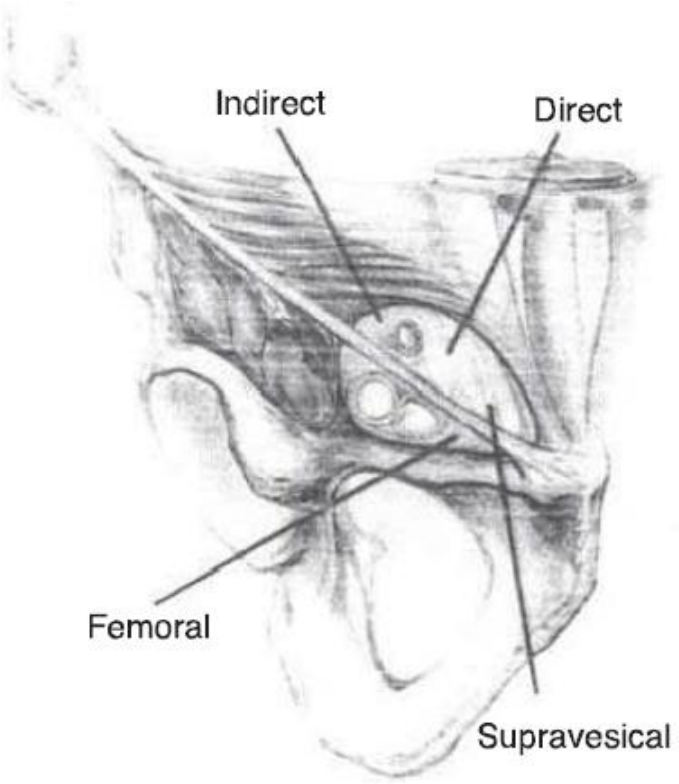

Fig 6 - Myopectineal orifice of frauchard.

Indirect Inguinal Hernia

An indirect hernia can be congenital or acquired. Herniation takes place through the deep (internal) rings. The sac follows the spermatic cord in males and the RL in females.

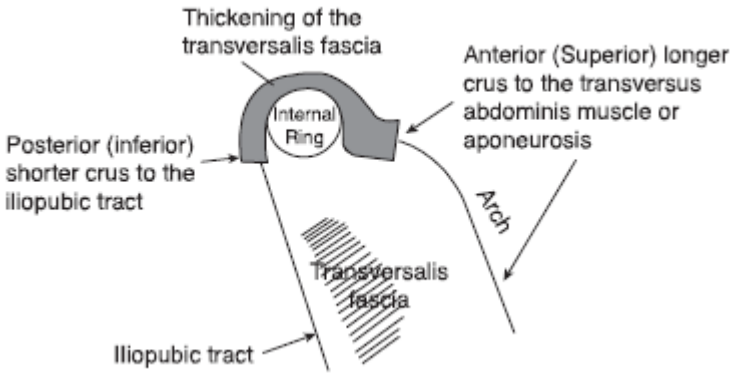

Fig 7 - Surgical anatomy of the deep ring

The Deep Ring

There is a normal defect in the transversalis fascia and transversus aponeurosis shaped like the uppercase Greek letter lambda (A). The anterior and posterior arms are a special thickening of the transversalis fascia, forming a sling.

However, the formation of the ring is not so simple. The inferior border is formed by another thickening of the transversalis fascia and transversus aponeurosis-the iliopubic tract-which is in some cases only weakly aponeurotic.

The anterior (superior) arm (crus) is formed by the transversus abdominis arch.The posterior (inferior) arm is formed by aponeurotic fibers from the illopubic tract.

When viewed from within the extraperitoneal space, the deep ring is formed superolaterally by the transversus abdominis arch extending from reflected inguinal ligament (Colles') off the ileopubic tract coursing inferolaterally.The pectineal ligament is situated medially to this arch. An aberrant obturator artery can be noted coursing over the pectineal ligament within this space allow for exposure of the secondary internal ring. At this level, the membranous layer is incised in *its* thicker area. The peritoneum is detached from the cord structures and a truly high ligation or inversion of the sac is performed.

The Secondary Deep (Internal)Inguinal Ring

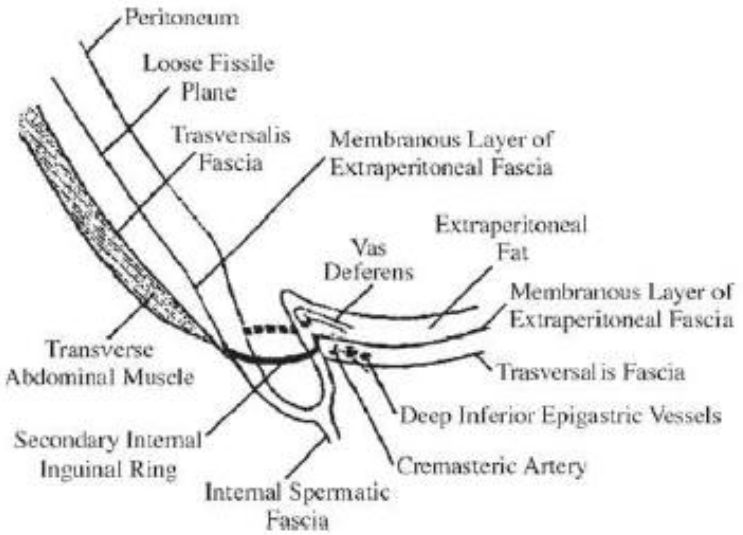

Fig 8 - Anatomy of the anterior abdominal wall through the secondary internal ring

The Superficial (External) Ring

The superficial ring is a triangular cleft in the aponeurosis of the external oblique. The base is related to the pubic crest. Its margins are formed by two crura, superior (medial) and inferior (lateral).

The superior crus is formed by the aponeurosis of the external oblique and the inferior crus by the inguinal ligament. To be more specific, the medial crus is attached to the lateral border of the rectus sheath and to the tendon of the rectus abdominis. The lateral crus is attached to the pubic tubercle.

Secondary Superficial Ring

In dissections by (Mirilas et al.), it has been rediscovered the second external inguinal Ring discovered by McGregor in 1929 and described by Martin in 1984-forgotten thereafter. The secondary external inguinal ring arises from the membranous layer of the superficial fascia of the anterior abdominal wall below the classic superficial ring.

It is a tube-like arrangement of Scarpa's fascia. Which constitutes the entrance into the scrotum. An examining finger can be easily inserted in the secondary external ring at the root of the scrotum and follows the spermatic cord until the external inguinal ring.

A similar ring-like arrangement of Scarpa's fascia also has been noted around the RL in female cadavers. The secondary external inguinal ring is implicated in several disorders of the inguinoscrotal area. Adhesive obstruction, under development or congenital absence of the secondary external ring has been considered responsible for some cases of incomplete hernia

Direct Inguinal Hernia

The ring of the direct hernia is located in the medial inguinal fossa within the triangle of Hasselbach. The hernial sac passes through the Floor of the inguinal canal.

External Supravesical Hernia

The external supravesical hernia is a herniation between the midline and the MUL(obliterated umbilical artery). it is a form of direct hernia occupying the medial part of the Hasselbach triangle (Skandalakis et al.1991).The hernial ring may be small or large, partially or totally occupying the supravesical fossa.

The defect may be small or it may involve into the triangle of Hasselbach extending to the median fold.

The hernial sac of the external supravesical hernia or of the direct hernia rarely travels through the external ring. If such pathology is present and incarceration occurs, the subcutaneous hernial ring should be treated as in indirect hernia

Hasselbach's triangle:

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

Structures passing through inguinal canal

Originates at the deep ring and consists of

a. Arteries: artery to vas, Testicular artery, cremasteric artery
b. Veins: Pampiniform plexus
c. Nerves: Genital branch of genitor femoral nerve and nerve to cremaster
d. Lymphatics of the testis
e. Vas deferens and areolar connective tissue.

Coverings of spermatic cord

From internal to external are processus vaginalis, internal spermatic fascia (derivative of Transversalis fascia), Cremasteric fascia (derivative of Internal oblique muscle and fascia), and External spermatic fascia (derivative of External oblique muscle and fascia).

Blood vessels:

The external iliac artery gives off 2 major branches before crossing beneath inguinal ligament, before it becomes the femoral artery. These branches, the deep circumflex iliac and the inferior epigastric vessels are not vital. The later serves as the medial border of the deep ring and the lateral

border of the direct triangle. The inferior epigastric artery gives off 2 branches near its origin, the external spermatic cremasteric artery and pubic branch. The main inferior epigastric artery runs vertically upward in the preperitoneal space to enter and anastamose within the rectus abdominis muscle, forming collaterals.

The cremaster vessel exits at the medial aspect of the deep inguinal ring and originally must be sacrificed artery. The pubic branch is originally small and lies on the iliopubic tract, running medially and then downward to join the obturator arising from the hypogastric artery. The testicular artery originates directly from the aorta to supply the testis. Clear visualization of the veins along the course of artery is essential to avoid trouble some bleeding during the repair of hernia.

Nerves:

The motor and sensory supply of the skin and musculoaponeurotic layers of the groin are primarily supplied by iliohypogastric nerves and ilioinguinal nerve. These nerves are derived from the first lumbar nerve but might also receive branches from the 12th thoracic nerve.

The spermatic cord and testis are supplied by the spermatic plexi, which consists of sympathetic and sensory fibers which enter the spinal cord through the posterior roots of 10^{th}, 11^{th}, 12^{th} thoracic and 1^{st} lumbar nerves. The pubic bone and periosteum are supplied by the 2^{nd} and 3^{rd} lumbar nerves. The genitor

femoral nerve, arising from the first and second lumbar nerves, supply the cremaster muscle, the scrotal skin and adjacent thigh.

APPROACH TO THE PREPERITONEAL SPACE OPEN

1. Cheatle - Henry approach (Infraumbilical midline incision)
2. Nyhus approach (Transverse incision above the inguinal ligament down to transversalis fascia)
3. Anterior inguinal (Oblique incision just above the inguinal ligament down to the posterior inguinal wall).
4. Transabdominal approach (Peritoneum opened)

LAPAROSCOPIC APPROACH

1. TAPP-Transabdominal preperitoneal (with formation of preperitoneal flap)
2. Intraperitoneal on lay mesh (Mesh fixed on the peritoneal surface)
3. TEP-Totally extra peritoneal (Balloon inflation of preperitoneal space)

CONTENTS OF PRE-PERITONEAL SPACE OF INGUINOFEMORAL REGION[16]

I. VASCULAR

1. Arteries

- Eternal iliac artery and branches
- Inferior epigastric artery
- Deep circumflex iliac artery

2. Veins

- External iliac vein
- Inferior epigastric vein
- Deep circumflex iliac vein
- The Bendavid circle

II NERVES

- Ileoinguinal nerve
- Femoral N
- Ileohypogastric nerve
- Genitofemoral N
- Lateral cutaneous N of thigh
- L1, L2 & L3 ventral rami
- Spermatic plexus (sympathetic/sensory)

CLASSIFICATION OF HERNIA[17-20]

Classification according to descent of the sac

Bubonocoele: The process vaginalis being obliterated at the superficial ring, the hernia is limited to the inguinal canal.

Funicular: In this type, the process vaginalis is closed only at its lower end, just above the epididymis.

Complete: The process vaginalis is patent throughout, at the base of the scrotum the testis appears to lie within the lower part of hernia.

CLINICAL CLASSIFICATION

Based on clinical presentation of hernia.

Reducible Hernia: In this contents of the hernia sac gets completely reduced into the peritoneal cavity on their own or on manipulation. cough impulse seen

Irreducible Hernia: When the content of the hernia sac cannot be completely. reduced from the sac. This can happen due to narrowing of the neck adhesions, or fixity of the contents of the sac.

Obstructed Hernia (Incarcerated hernia)**:** Irreducibility and Features of intestinal obstruction. The blood supply of the hernia sac contents is not compromised.

Strangulated Hernia: Irreducibility, Features of intestinal obstruction and compromise of blood supply to its contents leading to gangrene.

Nyhus Classification

Type I Indirect inguinal hernia, internal ring normal

Type II Indirect inguinal hernia, internal ring enlarged, posterior wall intact, sac does not extend to the scrotum

Type IIIA Direct hernia with a posterior wall defect only

Type IIIB Indirect hernia,internal ring enlarged,posterior wall defect

Type IIIC Femoral hernia

Type IV any Recurrent hernia, A-direct, B-indirect, C-femoral, D-combination of A, B, C

CLINICAL FEATURES[21,22]

Symptoms

Most hernias are asymptomatic until the patient notices a lump or swelling in the groin, some patients may describe a sudden pain and a swelling that occurred while weight lifting or straining. Most hernias are detected in the course of routine physical examination.

Some patients complain of a dragging sensation with indirect inguinal hernia, radiation of pain to the scrotum. As a hernia enlarges, it produces a sense of discomfort or dragging pain and the patient must lie down to reduce the hernia. Direct hernias produce few symptoms than indirect hernias and are less common to become incarcerated or strangulated. If the hernia happens to become painful and tender, then it probably has become a strangulated hernia. History of frequency of micturition, straining to pass urine, constipation may be there in cystocele, BPH respectively

Systemic Symptoms

If the hernia has become obstructed the patient complains of colicky pain, vomiting, abdominal distension and obstipation. In late cases, the hernia strangulates and gangrene sets in, patient presents with features of peritonitis if perforation of bowel has occurred.

Signs

On inspection in standing position a bulge or swelling will be seen in groin. This disappears on lying down if the hernia is reducible spontaneously. Impulse on coughing is present in reducible hernia. Loss of rugosities of scrotal wall in large inguino-scrotal hernias is present. Visible peristalsis is seen when the content of the sac is bowel (enterocele). Malgaigne's bulges are seen in a lax abdominal wall.

An indirect hernia is pear shaped and lies along the inguinal ligament. After the hernia is reduced it reappear from lateral side and and runs down above the inguinal ligament medially towards the scrotum. A direct hernia is rounded, more medial, bulges forward and infrequently goes down to the scrotum. After reduction of hernia it reappears in a forward direction.

Palpation

"taxis" is Reducing the hernia by manipulation and it is done in a lying down position of the patient. When the hernia reduces following features are noted:

a) Enterocele -Gurgling sound heard
b) First part take longer to reduce in an enterocele and later part takes longer in a omentocele.
c) Impulse on coughing felt.

Internal ring occlusion test:

After reduction of hernia, Internal ring is occluded with the thumb, patient in the standing position and asked to cough. If the swelling is seen then it is a direct hernia, the thumb is released and the patient asked to cough again, if the swelling appears now it is a 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 will fill from below in case of varicocele and lymphavarix.

Scrotal invagination test:

After reduction of hernia, patient in lying down position. The skin is invaginated from the bottom of the scrotum by the little finger, which is pushed gently up to the superficial inguinal ring. Normally the ring is a triangular slit, which allows only the tip of the index finger, patient is asked to cough, the finger will be squeezed by approximation of two pillars, there by patency of the external ring is assessed and a palpable cough impulse will be felt. As the finger enters the ring, it goes backwards in direct hernia and it goes upwards, backwards and laterally in an indirect hernia. The finger is rotated so that the pulp of the finger faces backwards. The patient is asked again to cough, if the impulse is felt on the pulp, the hernia is direct, if it is felt at the tip, then it is indirect hernia.

Three finger test or Zieman's technique:

After reducing the hernia, the index, middle and ring finger are placed over the deep ring, superficial ring and saphenous opening respectively. Right hand used for right side. The patient asked to stand up and cough. If impulse is felt on the index finger it is an indirect hernia, if impulse is felt on middle finger then it's a direct hernia, if impulse felt on the ring finger it is a femoral hernia.

Auscultation:

Bowel sounds is heard in an enterocele. Scrotum and external genitalia examined for thickened spermatic cord, whether both testis present. External meatus checked for pinhole meatus, any stricture urethra, phimosis. Per rectal examination is done for benign enlargement of prostate or any growth.

Abdominal Examination: For any abdominal mass, ascites and divarication of recti.

Respiratory System: To rule out COPD and respiratory illness.

DIFFERENTIAL DIAGNOSIS[23,24,25]

Differential diagnosis of groin hernia

- Malignancy
- Metastsis
- Lymphoma
- Retroperitoneal sarcoma
- Testicular tumor
- Primary testicular
- Epididymitis
- Varicocele
- Testicular torsion
- Hydrocele
- Femoral artery aneurysm or pseudo aneurysm
- Ectopic testicle
- Undescended testis
- Lymphnode
- Cyst of canal of nuck(female)
- Hidradenitis
- Saphenous varix
- Psoas abscess

LICHTENSTEINS PROLENE MESH HERNIOPLASTY[26,27]

A 5-to 6-cm skin incision which starts from the pubic tubercle and extends laterally within First noted by Lytle in 1945, and later defined correctly by Fowler in 1975.A second deep ring has been described.

In their recent review of this entity, Mirllas and colleagues note this arises from the membranous layer of the extraperitoneal fascia located immediately deep to the transversalis fascia. In males, the vas deferens hooks around the inferomedial lip of the secondary internal inguinal ring in order to enter the inguinal canal.

The gonadal vessels, which lie lateral to the vas deferens in the extraperitoneal fat and deep to the membranous layer, also traverse the secondary internal inguinal ring in order to become incorporated in the cord. This is readily appreciated when viewing the deep ring from a preperitoneal exposure and is sometimes mistaken for the transversalis fascia during anterior exposure of the groin.

The secondary internal inguinal ring has important applications to surgery of the inguinal canal. During the repair of an indirect inguinal hernia. The correct site of sac ligation lies at the level of the secondary internal inguinal ring. Either using the inguinal or the preperitoneal approach. The internal spermatic fascia should be incised to the Langer line gives an excellent exposure of the pubic tubercle and the internal ring. After skin incision the

external oblique aponeurosis is opened and its lower leaf is freed from the spermatic cord.

The upper leaf of the external oblique is then freed from the underlying internal oblique muscle until the internal oblique aponeurosis is exposed. The anatomic cleavage between these two layers is avascular and the dissection can be done rapidly and atraumatically. High separation of these layers has a dual benefit because it visualizes the ileohypogastric nerve and internal oblique aponeurosis and creates ample space for insertion of a sufficiently wide sheet of mesh that can overlap the internal oblique well above the upper margin of the inguinal floor.

The cord with its cremaster covering is separated from the floor of the inguinal canal and the pubic bone for a distance of approximately 2 cm beyond the pubic tubercle. The anatomic plane between the cremasteric muscle and attachment of rectus sheath to the pubic bone is avascular.so there is no risk of damaging the testicular blood flow. When lifting the cord, care should be taken to include the ileoinguinal nerve, the easily visible blue external spermatic vein (the blue line), and the genital nerve with the cord.

This ensures that the genital nerve, which is always in juxtaposition to the external Spermatic vessels is preserved. To explore the internal ring, for indirect hernia sacs, the cremasteric sheath is incised longitudinally at the level of the deep ring to access the cremasteric compartment.

Not removing the cremasteric muscle prevents the testicle from hanging low and also prevents dysfunction of the cremasteric muscle, which may lead to dry ejaculation. Complete stripping and resection of the cremasteric fibers is unnecessary and can result in direct exposure of the genital nerve, vas deferens and paravasal nerves to the mesh, resulting in chronic groin and testicular pain.

Indirect hernial sacs are freed from the cord to a point beyond the neck of the sac and are inverted into the preperitoneal space without ligation. Because of mechanical pressure and ischemic changes, ligation of the highly innervated peritoneal sac is a major cause of postoperative pain. It has been shown that nonligation of the indirect hernia sac does not increase the chance of recurrence.

To minimize the risk of postoperative ischemic orchitis. complete non sliding scrotal hernia sacs are transected at the midpoint of the canal leaving the distal section in place. However, the anterior wall of the distal sac is incised to prevent postoperative hydrocele formation. In the event of direct hernias if large, the direct sacs are inverted with an absorbable suture.

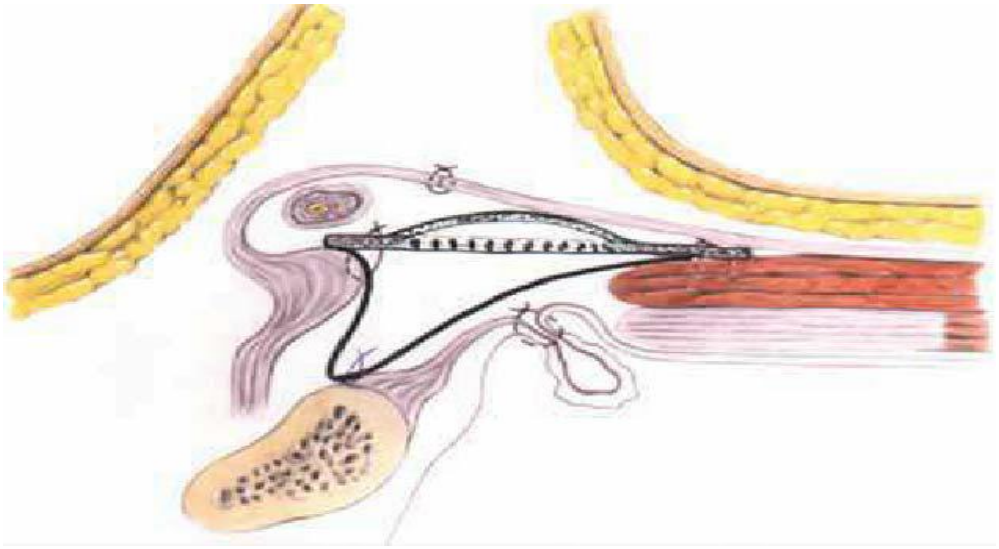

Fig 9

Cross section of the lichensteins repair with an inverted direct sac and showing the configuration of mesh placement for femoral hernia.

Dotted line-wrong mesh placement

A thorough exploration of the groin is necessary to rule out the coexisting intraparietal (interstitial), low lying spigelian or femoral hernias.

The femoral ring is routinely evaluated via the space of Bogros through a small opening in the canal floor. A sheet of 8 X 16 cm of mesh is used. We prefer monofilament macroporous polypropylene meshes because their monofilament structure does not perpetuate or harbour infection. The medial corner of the mesh is tailored to its standard shape. Which resembles the tracing of a footprint with a lower sharper angle to fit into the angle between the inguinal ligament and the rectus sheath and an upper wider angle to spread over the rectus sheath.

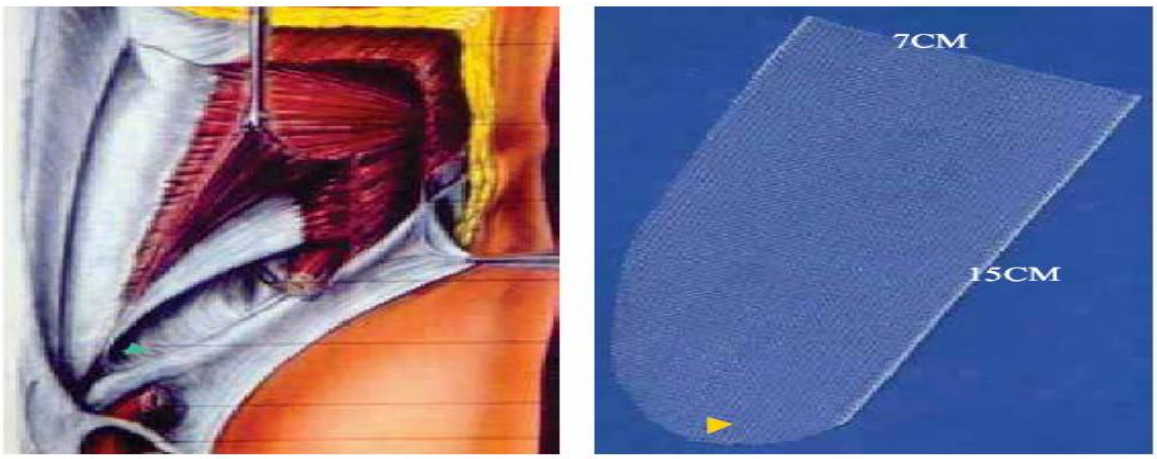

Fig 10

The standard shape of the mesh in a lichtensteins repair, the rounded corner of the mesh with the Arrow pointing fits in the space between inguinal ligament and rectus sheath, the wider part lies on the rectus

With the cord retracted upward. The sharper corner of the mesh is secured with a nonabsorbable monofilament suture to the insertion of the rectus sheath to the pubic bone overlapping the bone by 1 to 2 cm.

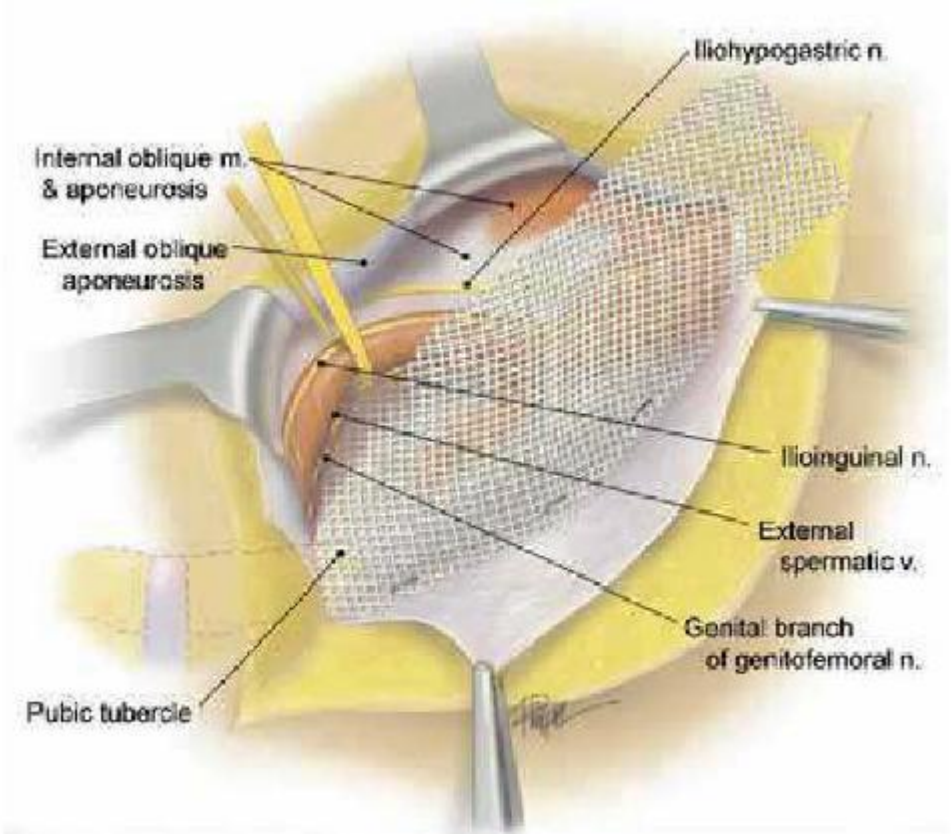

Fig 11 - Overlapping of the pubic bone by 1-2cm

This is a crucial step in the repair because failure to cover this bone with the mesh can result in recurrence of the hernia .The periosteum of the bone is avoided. This suture is continued (as a continuous suture with up to four passages) to attach the lower edge of the patch to the inguinal ligament up to a point just lateral to the internal ring. Suturing the mesh beyond this point is unnecessary and could injure the femoral nerve. If there is a concurrent femoral hernia. It can be fixed using manoeuvre in which the mesh is also sutured to the Cooper's ligament 1 to 2 cm below its External suture line with the inguinal ligament in order to close the femoral ring. Alternatively the mesh can be

tailored to have a triangular extension from its lower edge. The long side of the dropped down triangle is sutured to the Cooper's ligament and the body of the mesh is sutured to the inguinal ligament along the solid line.

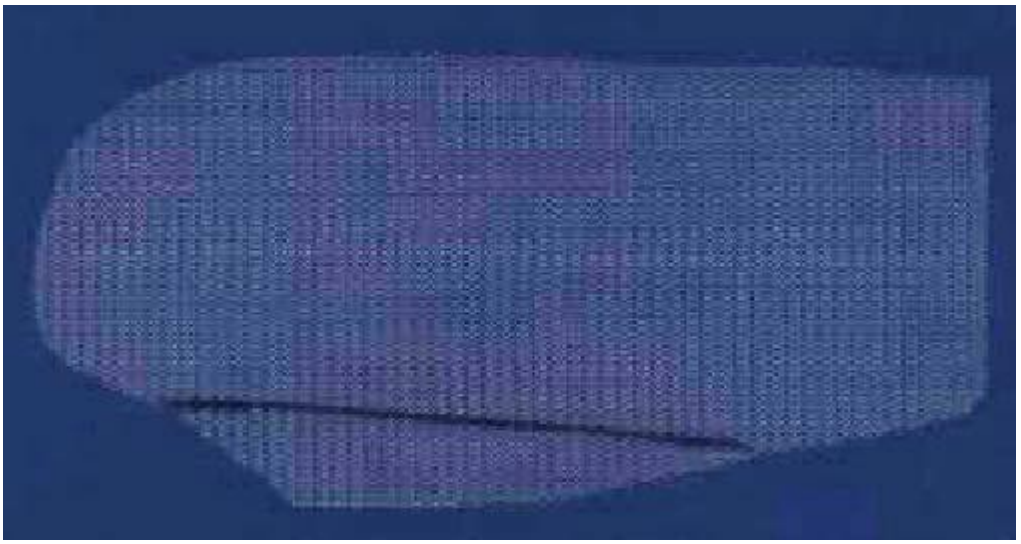

Fig 12 - An alternative configuration in case of a femoral hernia

A slit is made at the lateral end of mesh, creating two tails: a wide one (two thirds) above and a narrower one (one third) below. The wider upper tail is grasped with forceps and passed toward the head of the patient from underneath the spermatic cord, this positions the cord between the two tails of the mesh.

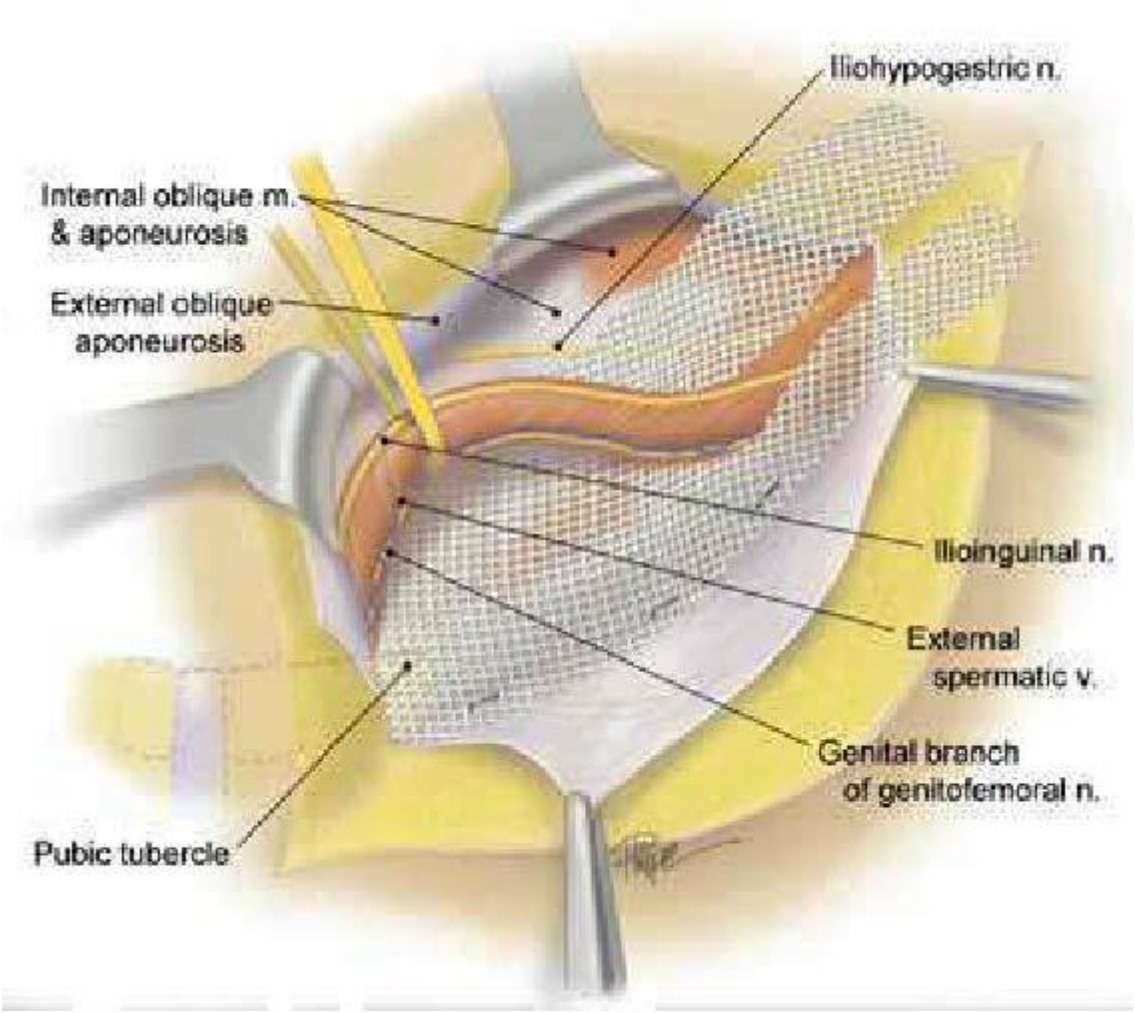

Fig 13 - A slit is made to accommodate the spermatic cord

The wider upper tail is grasped with forceps and passed toward the head of the patient from underneath the spermatic cord; this positions the cord between the two tails of the mesh.

The wider upper tail is crossed and placed over the one and held with a hemostat. With the cord retracted downward and the upper leaf of the external oblique aponeurosis retracted upward, the upper edge of the patch is sutured in

place with two interrupted absorbable sutures, one to the rectus sheath and the other to the internal oblique aponeurosis, just lateral to the internal ring.

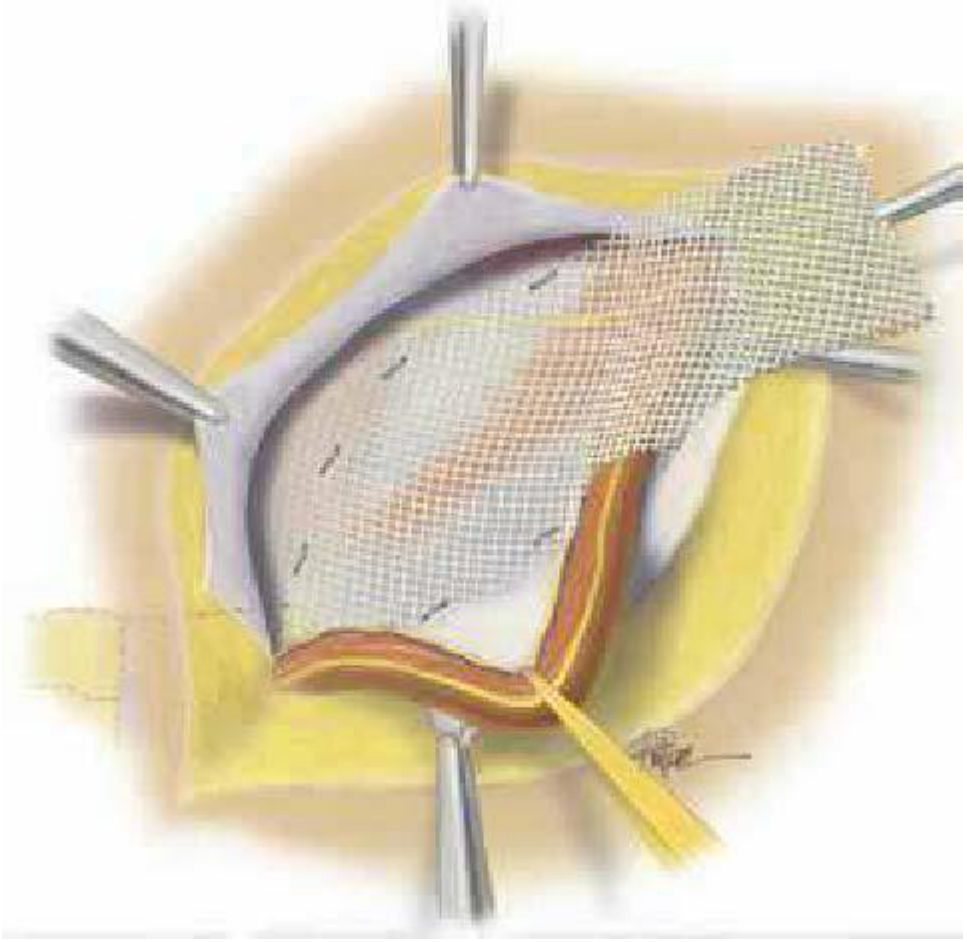

Fig 14 - The upper edge of the mesh is sutures with the internal oblique aponeurosis and the two tails are crossed.

Occasionally the ileohypogastric nerve has an abnormal course and stands against the upper edge of the mesh. In those instances, a slit in the mesh will accommodate the nerve. If in doubt, the nerve can be resected with proximal-end ligation (to prevent traumatic neuroma formation) and implantation within the fibers of the internal oblique muscle to keep the stump of the nerve away from future scarring of the operative field. Suturing the upper

edge of the mesh to the internal oblique muscle should be avoided to prevent injuring the intravascular segment of the ileohypogastric nerve. Using a single nonabsorbable monofilament suture, the lower edges of each of the two tails are fixed to the inguinal ligament just lateral to the completion knot of the lower running suture leaving adequate space for the passage of the spermatic cord.

The excess patch on the lateral side is trimmed, leaving at least 5 cm of mesh beyond the internal ring. This is tucked underneath the external oblique aponeurosis, which is then closed over the cord. The upper edge of the mesh is sutured to the internal oblique aponeurosis and the two tails of the mesh are crossed and fixed using a absorbable suture.

Fixation of the tails of the mesh to the internal oblique muscle, lateral to the internal ring is unnecessary and could result in entrapment of the ileoinguinal nerve with the fixation suture.

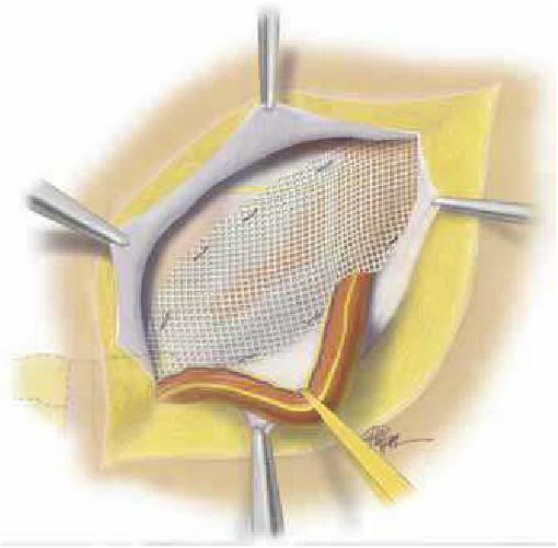

Fig 15 - The lower edges of the mesh is sutured to the inguinal ligament and the excess mesh lateral to the internal ring is tucked under external oblique aponeurois

TECHNICAL POINTS FOR MINIMIZING RECURRENCE AND POST HERNIA REPAIR CHRONIC PAIN[28]

There are five key elements of Lichtenstein tension-free hernioplasty based on

(I) The physiodynamic characteristics of the abdominal wall and intra-abdominal pressure gradient. which rises from 8 cm of water. With the subject supine, to more than 80 cm of water on physical exertion, resulting in forward protrusion of the transversalis fascia

(II) Shrinkage of the mesh *in Vivo* which according to laboratory and clinical studies (reported during the I995 Annual Meeting of the American College of Surgeons), published in 1997 and confirmed by other investigators, is approximately 20%.

1. Use a large sheet of mesh (7 X I5 cm),with the standard shape of the tracing of a footprint extending approximately 2 cm medial to the pubic tubercle 3 to 4 cm above the Hesselbach's triangle, and 5 to 6 cm lateral to the internal ring to account for mesh shrinkage.
2. Cross the tails of the mesh behind the spermatic cord to avoid recurrence lateral to the internal ring.
3. Secure the upper edge of the mesh to the rectus sheath and internal oblique aponeurosis with two interrupted sutures and the lower edge of the mesh to the inguinal ligament with one continuous suture to prevent folding and movement of the mesh in the mobile area of the groin. Non-

fixation or inadequate mesh fixation results in folding and wadding of the mesh (which elsewhere referred to as '"meshoma") which can cause chronic pain and recurrence of the hernia.

4. Keep the mesh in a slightly relaxed, tented up or sagittate configuration to counteract the forward protrusion of the transversalis fascia when the patient stands up. A mesh that is completely flat with laxity or ripple in a patient under sedation and in a recumbent position will be subject to tension when the patient strains or is in a standing position.
5. Visualize and protect the ileoinguina1, ileohypogastric, and genital nerves throughout the operation.

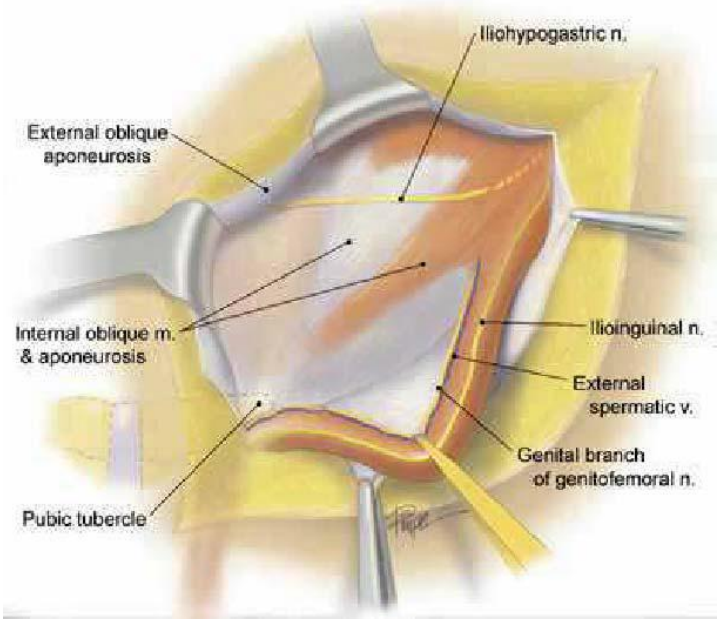

Fig 16

Anatomy of the peri-inguinal nerves

1)ileoinguinal nerve

2)ileohypogastric nerve

3)genital branch of genitofemoral nerve

The ileohypogastric nerve can be identified easily while the external oblique aponeurosis is being separated from the internal oblique layer to make room for the mesh. Because of a natural anatomic cleavage, separation of these two layers from each other is easy, fast, and bloodless. The most vulnerable part of the ileohypogastric nerve is its intramuscular segment, which runs along the lower edge of the internal oblique muscle (the so-called conjoint tendon).

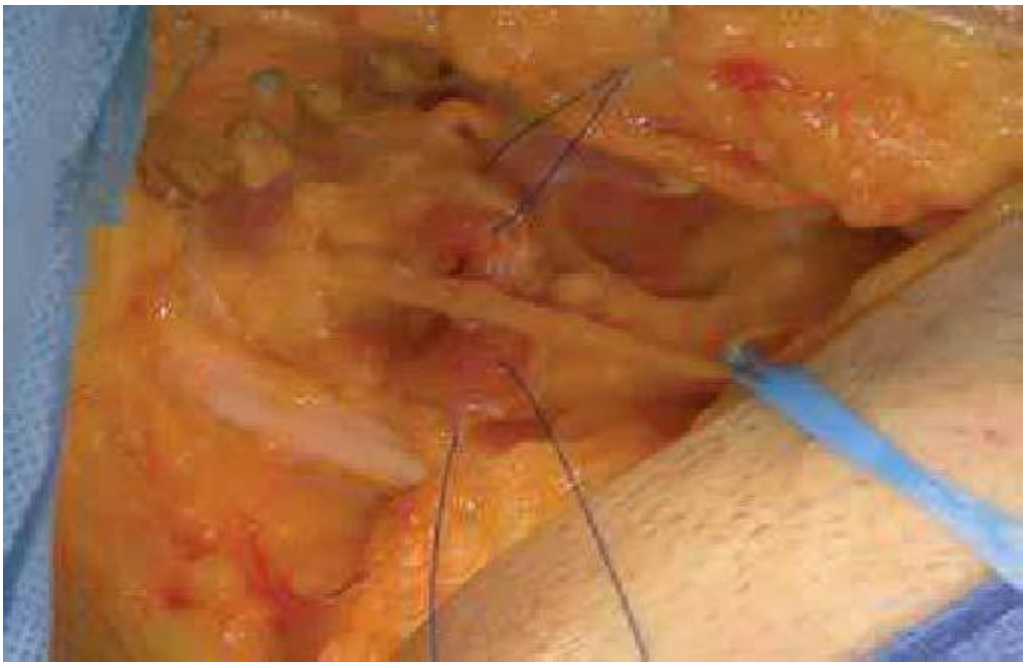

Fig 17 - Intramuscular component of ileohypogastric nerve

Passing a suture through the internal oblique muscle to approximate this layer to the inguinal ligament (during tissue approximation repairs) to a plug (during mesh plug repair) or to the upper edge of the mesh (during lichtenstein repair) is Liable to injure the intramuscular portion of the ileohypogastric nerve with the needle or En trap the nerve with the suture. The genital branch of the genitofemoral nerve is located under the cord, covered and protected from direct

contact with mesh by the deep cremasteric fascia. The cremasteric muscle should not be removed, as such manipulation taught by some in the past exposes the genital nerve to perineural scarring and neuropathy due to direct contact with mesh. Furthermore. it exposes the vas and paravasal nerves to direct contact with mesh that can potentially lead to chronic orchialgia and infertility. The ileoinguinal nerve is located over the spermatic cord. Covered and protected from the mesh by the investing fascia of the internal oblique muscle. This protective fascia should not be damaged by removing the nerve from its natural bed. Dissecting the ileoinguinal nerve from the cord and placing it below the inguinal ligament (a commonly employed technique) destroys the protecting fascia of the nerve and increases the risk of chronic pain due to perineural scarring and direct contact of the nerve with mesh.

COMPLICATIONS OF INGUINAL HERNIA SURGERY[29-34]

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

SURGICAL COMPLCIATIONS

Hemorrhage : can occur after injury to

a. Pubic branch of obturator artery.

b. Inferior deep epigastric

c. Deep circumflex iliac vessels

The damaged vessel is ligated. If External iliac vessels are injured, it must not be tied and haemostasis is achieved by applying compression.

Injury to spermatic cord: occurs due to unintentional accidental transaction during surgery. Fever, tenderness and swelling of the testis occurs in two third of the patients. But one third of patients won't exhibit any symptoms. Testicular atrophy or hydrocele occurs in up to one third of patients, routine orchidectomy is not indicated.

Injury to nerve: The nerves that are susceptible to injury are ileohypogastric, genital branch of genitofemoral nerve and ileoinguinal nerve

Ileoinguinal - sensory innervation to base of penis, upper scrotum and adjacent thigh.

Ileohypogastric - sensation to the supra public area.

The genitofemoral - motor innervation to cremastric muscle and sensory innervation to skin of the penis, scrotum.

Since there are cross innervations between these nerves, transaction if one of the nerves does not cause significant sensory deficit. Even if present in the immediate postoperative period, usually regress by sixth post-operative month. In cases of genitofemoral branch injury patient might complain of pain over the testis on the operated side.

Care should be taken to avoid entrapment of nerve during mesh fixation, especially the ileohypogastric nerve, this causes chronic neuralgia.

When a nerve is severed, the ends must be suture ligated to prevent neuroma formation and buried inside the muscle.

Injury to testicular artery: testicular artery or Internal spermatic arises as a direct branch from aorta. External spermatic artery a branch of inferior epigastric artery and supplies cremastric muscle. A rich collateral circulation is present at the upper end of testis between branches of vesicle, prostatic arteries, internal spermatic arteries, which anastomose to vessels of spermatic cord, external to the superficial inguinal ring.

Hence preservation of testicular blood supply is accomplished by not removing the testis from its scrotal attachment.

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injury to vas deferens: injury can be of transaction or obstruction. Transaction is nonintentional and accidental. When transaction has occurred, the vas must be reanastamosed using interrupted 3-0 chromic cat gut sutures with 0 prolene as a stent.

50% of these anastomosis are considered functional after repair. Injury often occurs in repair of recurrent hernias as vas is usually stuck to the posterior wall. Rough handling with forceps cause fibrosis and blockage post-surgery. Dysejaculation following hernioplasty is reported in 0.04% cases

Injury to bladder

Occurs mostly in sliding hernias, where the posterior wall of the hernia sac is formed by the bladder.

If injured the bladder must be repaired in 2 layers, using absorbable sutures and an indwelling catheter is left.

Hernia repair is done after the bladder injury has healed.

Post operative complications[33,34,35]

1. surgical site infection

Occurs in 1 – 2 % of patients undergoing hernioplasty, most often it's due to patient factors. [34]Prophylaxis with cefazolin, 1 to 2 g, given intravenously 30 to 60 minutes before the incision. Clindamycin, 600 mg intravenously, can be used for patients allergic to penicillin. Only a single dose of antibiotic is necessary Superficial surgical site infections are treated by opening the incision, local wound care, and healing by secondary intention. Some mesh infections will be manifested as a chronic

Draining sinus that tracks to the mesh or occur with extruded mesh. Deep surgical site infections usually involve the prosthetic mesh, which should be explanted. The risk for infection can be decreased by using proper operative technique, preoperative antiseptic skin preparation, and appropriate hair removal. There is an increased risk for infection for patients who have had prior hernia incision infections, chronic skin infections, or infection at a distant site. These infections are treated before elective surgery.

2. Ischemic Orchitis and Testicular Atrophy

Ischemic orchitis usually occurs from thrombosis of the small veins of the pampiniform plexus within the spermatic cord. This results in venous congestion of the testis, which becomes swollen and tender 2 to 5 days after surgery. The process may continue for an additional 6 to 12 weeks and usually results in testicular atrophy. Ischemic orchitis also can be caused by ligation of the testicular artery. It is treated with anti-inflammatory agents and analgesics. Orchiectomy is rarely necessary.

The incidence of ischemic orchitis can be minimized by avoiding unnecessary dissection within the spermatic cord. The incidence increases with dissection of the distal portion of a large hernia sac and in patients who have anterior operations for hernia recurrence or for spermatic cord disease. In these situations, the use of a posterior approach is preferred.

Testicular atrophy is a consequence of ischemic orchitis. It is more common after repair of recurrent hernias, particularly when an anterior approach is used. The incidence of ischemic orchitis increases by a factor of three or four with each subsequent hernia recurrence.

3. Hernia Recurrence

Hernia recurrences are usually caused by technical factors, such as excessive tension on the repair, missed hernias, failure to include an adequate musculoaponeurotic margin in the repair, and improper mesh size and placement. Recurrence also can result from failure to close a patulous internal inguinal ring, the size of which is always assessed at the conclusion of the primary surgery.

Other factors that can cause hernia recurrence are chronically elevated intra-abdominal pressure, a chronic cough, deep incisional infections, and poor collagen formation in the wound.

Recurrences are more common in patients with direct hernias and usually involve the floor of the inguinal canal near the pubic tubercle, where suture line tension is greatest. The use of a relaxing incision when there is excessive tension at the time of primary hernia repair is helpful to reduce recurrence. Recurrence is more common after repair of recurrent hernias and is directly related to the number of previous attempts at repair. Large population-based studies have reported a re-recurrence rate of 4% to 5% in the first 24 months, which increases to 7.5% at 5 years[35]

Other complications;

1. Urinary retention
2. Hematoma
3. Seroma
4. Sinus formation
5. Persistent post-operative pain
6. Numbness and paraesthesia, sexual dysfunction

MATERIALS AND METHODS

STUDY DESIGN – this is a prospective clinical study

SAMPLE SIZE – 213

SOURCE OF STUDY

General surgery units in Department of General Surgery, Tirunelveli Medical College and Hospital

STUDY PERIOD

From December 2017 to june 2019

INCLUSION CRITERIA

All uncomplicated inguinal hernia patients of both sex above 12 years

Elective surgical procedure only

EXCLUSION CRITERIA

Not willing for surgery

Not willing for follow up

Emergency surgical procedure for inguinal hernia

TECHNIQUE

After getting ethical committee clearance, all patients with inguinal hernia who came under the inclusion criteria were taken up for the study. Informed written consent were obtained. Patient details about age, sex, occupation, phone number were recorded. A detailed clinical examination was done and recorded. They underwent basic blood investigations required for anaesthesia assessment, ultra sonogram of inguinal region was taken for required patients. The patients were assessed and Lichtenstein's tension free prolene mesh hernioplasty was done in all patients in an elective setting. repair of posterior wall done for patients with a direct hernia along with mesh placement. The patient were observed for any intraoperative complication during the surgery and for any early postoperative complications during the post-operative period. The patients were discharged and reviewed after a week to check for postoperative wound status and suture removal. After 3 months, patients asked to come for follow up through phone call. When the patients came for follow up, a thorough physical examination done and history elicited regarding development of any late postoperative complications.

Of the 213 patients studied, 12 patients had benign prostatic enlargement, urologist advised conservative line of management for 8 patients and transurethral resection of prostate for 4 patients.

Of the 4 patients who underwent TURP, none had returned for surgical treatment of hernia.

Hence out of 213 patients, 207 underwent lichentensteins repair.

Out of the 213 patients, 37 patients did not come for follow up. Early postoperative complications were assessed in 209 patients and late post-operative complications were assessed in 172 patients.

RESULTS

STATISTICAL ANALYSIS AND INTERPRETATIONS

The continuous variables were described and analysed in terms averages and interpreted by student independent "t" test. The categorical variables were described by percentages and interpreted by χ^2 (Chi-square) test. The above statistical procedures were undertaken with the help of the statistical package namely IBM SPSS statistics -20. The P-vales less than or equal to 0.05 ($P \leq 0.05$) were treated as statistically significant.

Description of total subjects:

Table-1: Age and gender wise classification of total subjects (213):

Age group (Years)	Males		Females		Total	
	Frequency	%	Frequency	%	Frequency	%
<20	11	5.4	1	11.1	12	5.6
20-29	15	7.4	1	11.1	16	7.5
30-39	26	12.7	1	11.1	27	12.7
40-49	40	19.5	1	11.1	41	19.2
50-59	41	20.1	4	44.4	45	21.1
60-69	47	23.0	0	0.0	47	22.1
70-79	19	9.3	1	1.1	20	9.4
80-89	5	2.5	0	0.0	5	3.3
Total	204	100.0	9	100.0	213	100.0
Mean± SD	50.3±16.5		46.2±18.5		50.1±16.6	
Significance	"t"=0.715, df = 211, P=0.475				Range==13-85 years	

The table-1 states the age and gender wise distribution of total subjects. The mean ages of the males was 50.3±16.5 years and the females was 46.2±18.5 years. The difference of age between the gender was not statistically significant (P>0.05). The mean age of total subjects was 50.1±16.6 years with range of 13-85 years.

Fig-18: Age and gender wise distribution of total subjects **(%)**

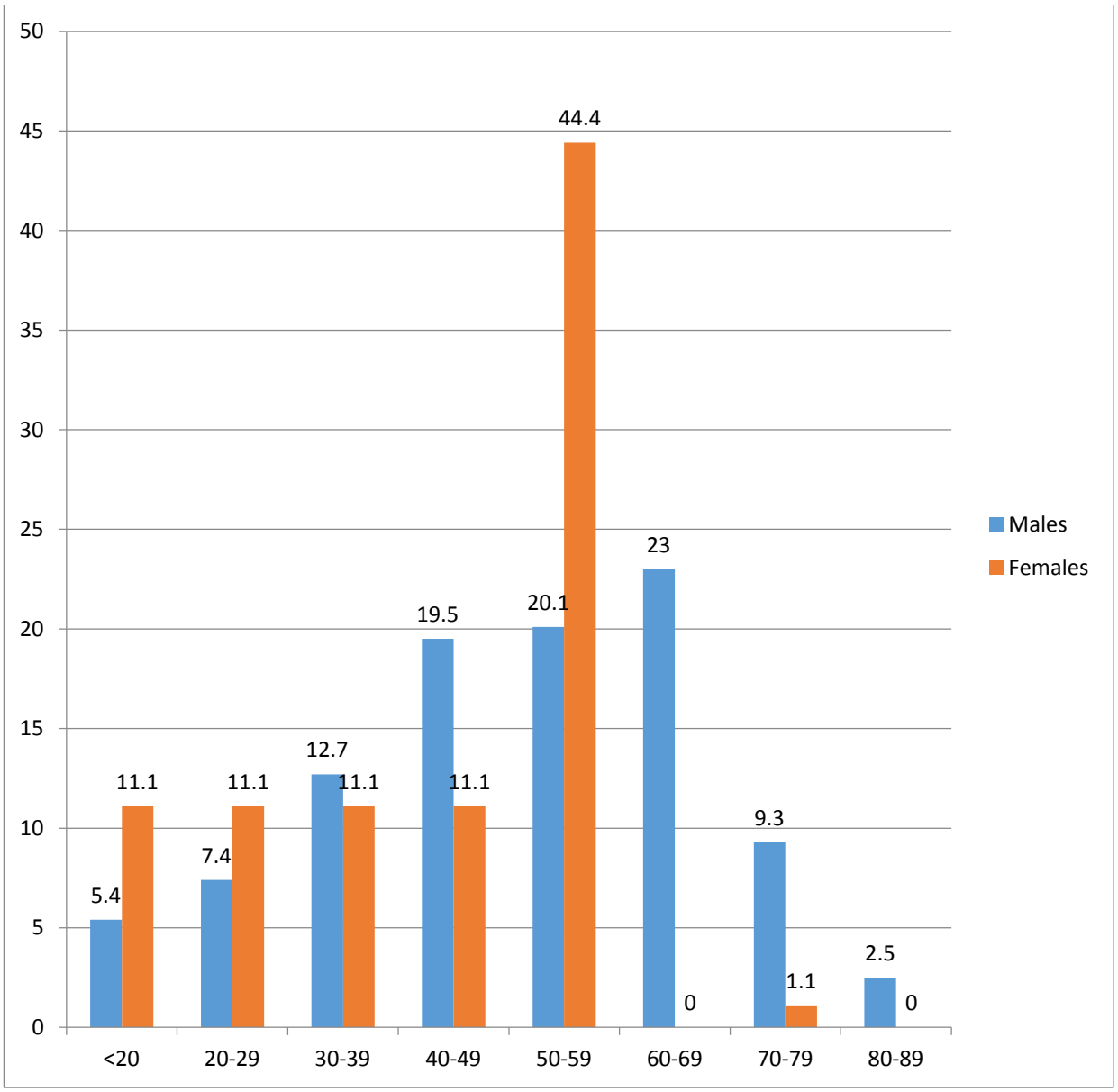


Table-2: Diagnosis of study subjects according to the gender**:**

Diagnosis	Males		Females		Total		Significance
	No	%	No	%	No	%	
B/L direct inguinal hernia	39	19.1	0	0.0	39	18.3	
B/L indirect inguinal hernia	33	16.2	1	11.1	34	16.0	
L direct inguinal hernia	21	10.3	3	33.3	24	11.3	
L indirect inguinal hernia	41	20.1	2	22.2	43	20.2	χ^2=5.777
L pantaloon hernia	1	0.5	0	0.0	1	0.5	df=0.449
R indirect inguinal hernia	51	25.0	2	22.2	53	24.9	P=0.449
R direct inguinal hernia	15	7.4	1	11.1	16	7.5	
R pantaloon hernia	3	1.5	0	0.0	3	1.4	
Total	204	100.0	9	100.0	213	100.0	

The above table-2 states the diagnosis of total subjects. The gender wise total diagnosis was not statistically significant (P>0.05).

Fig-19: Percentage of total diagnosis:

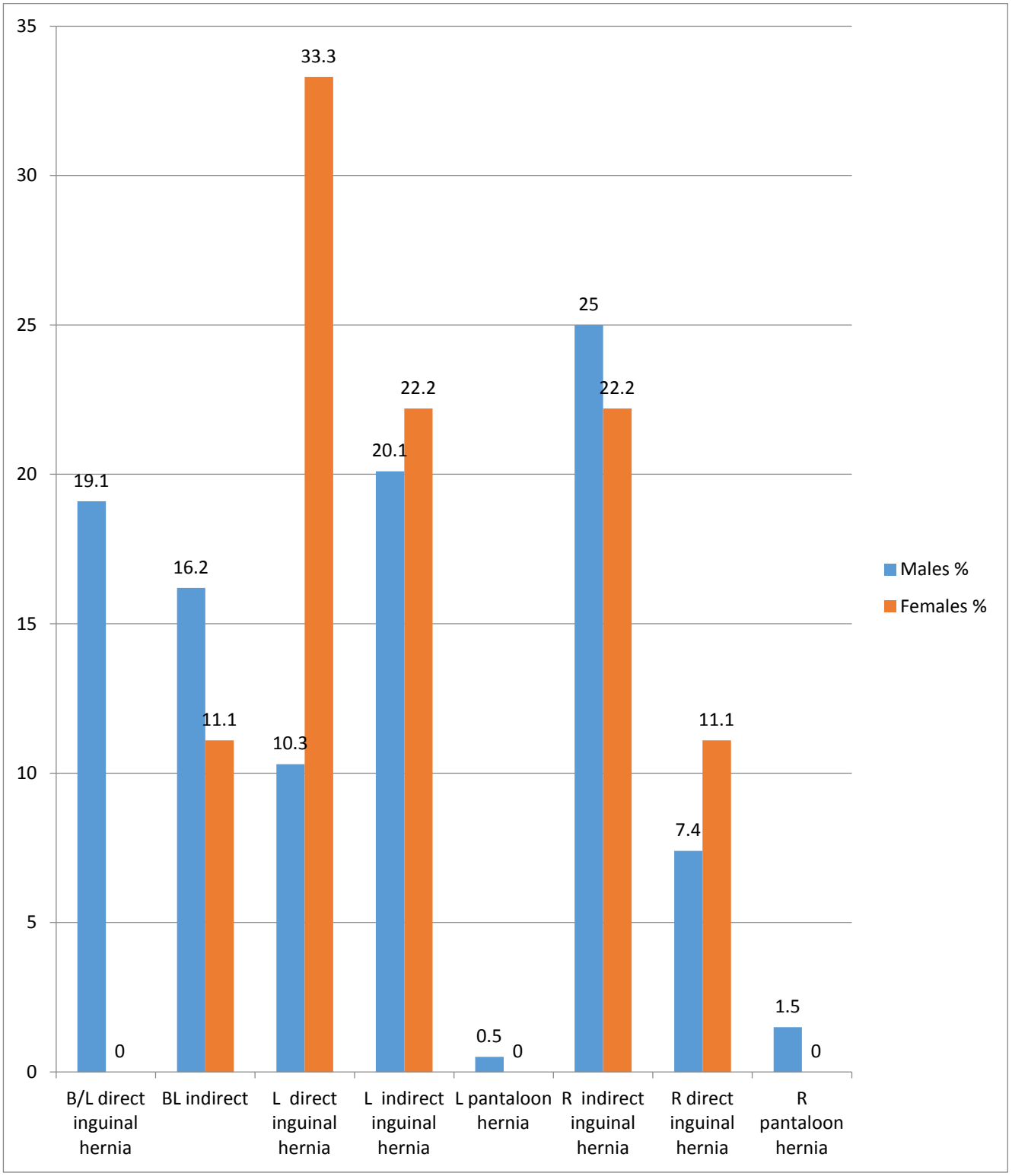


Table-3: Comparison of gender wise DM of the total Subjects:

DM	Males		Females		Total		Significance
	No	%	No	%	No	%	
Yes	18	8.8	3	33.3	21	9.9	χ^2=5.827
No	186	91.2	6	66.7	192	90.1	df=1
Total	204	100.0	9	100.0	213	100.0	P=0.016

The table-3: states the comparison of DM between the genders. The males were significantly more than the females (P<0.05)

Fig-20: DM of males and females

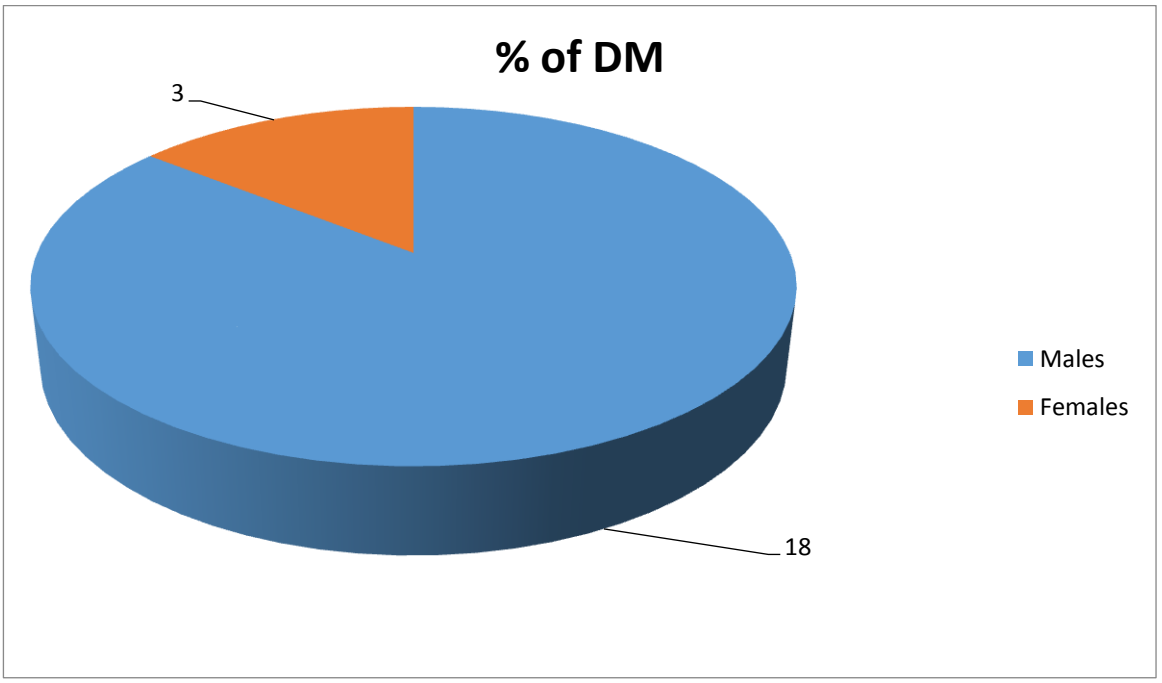


Table-4: Comparison of pulmonary TB between the genders:

Pulmonary TB	Males		Females		Total		Significance
	No	%	No	%	No	%	
Yes	9	4.4	0	0.0	9	4.2	χ^2=0.415
No	195	95.6	9	100.0	204	95.8	df=1
Total	204	100.0	9	100.0	213	100.0	P=0.520

The table-4 shows the comparison of pulmonary TB between the genders.

No significant difference between the genders (P>0.05).

Fig-21: Percentage of pulmonary TB among the total subjects.

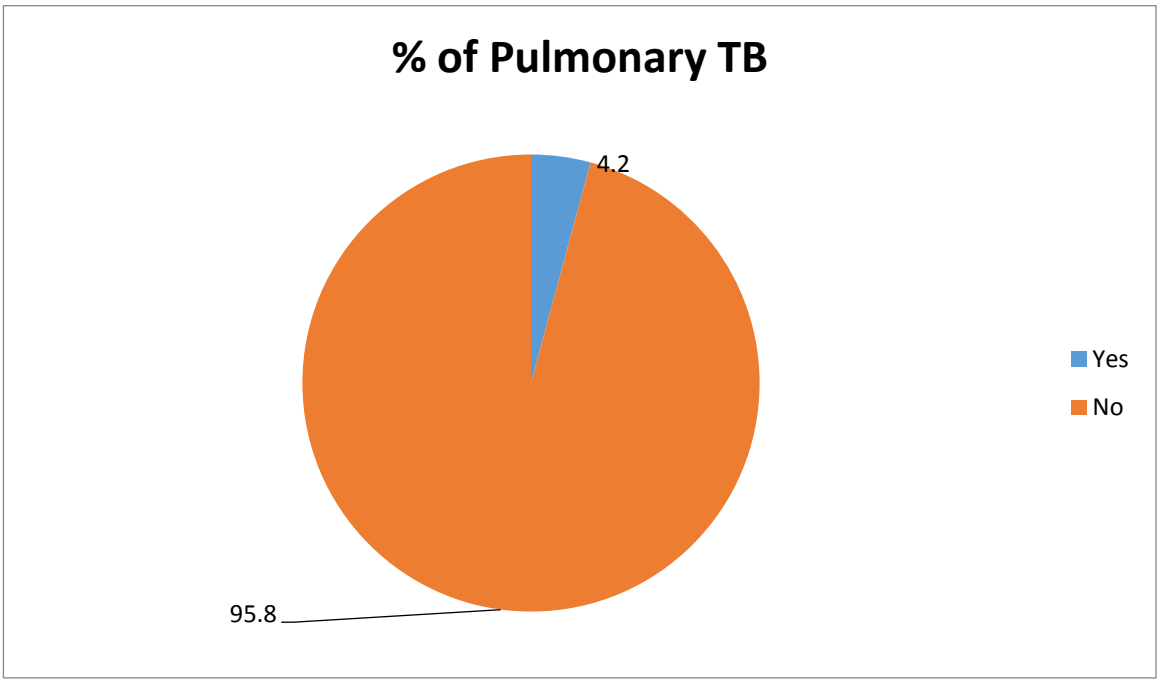


Table-5: Prevalence of BPH among the males

BPH	Frequency	%
Yes	12	5.9
No	192	94.1
Total	204	100.0

Fig-22: Prevalence of BPH among the male subjects

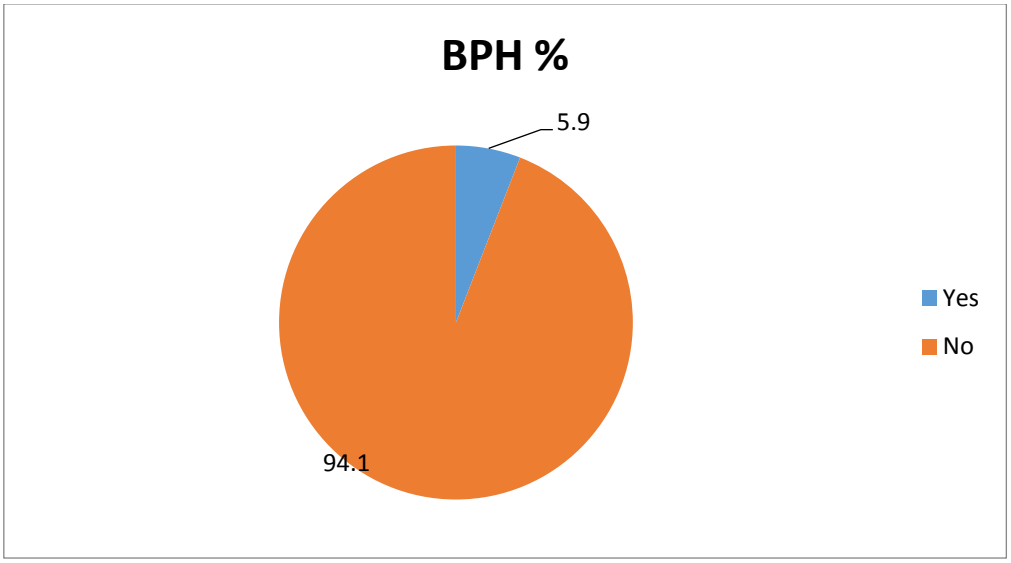


Fig 23: distribution of BPH according to age in males

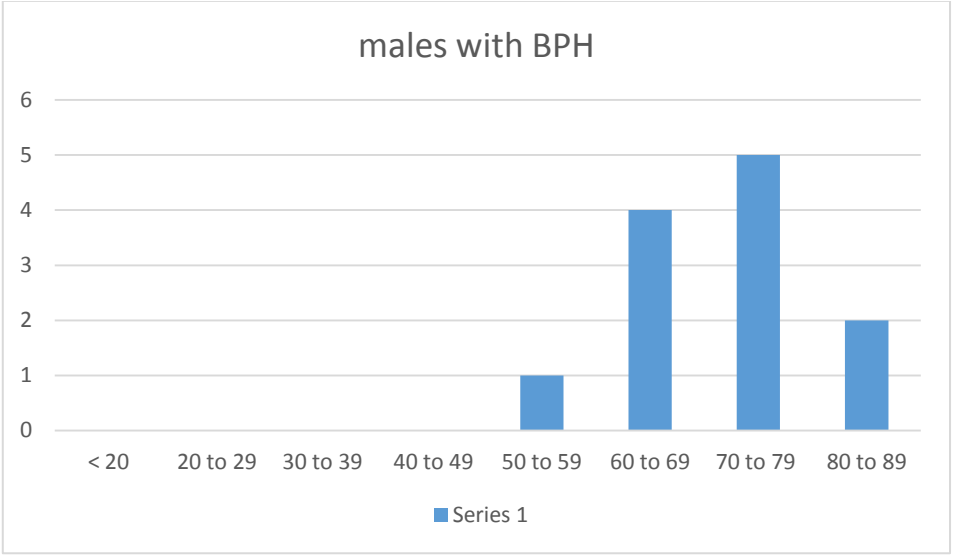


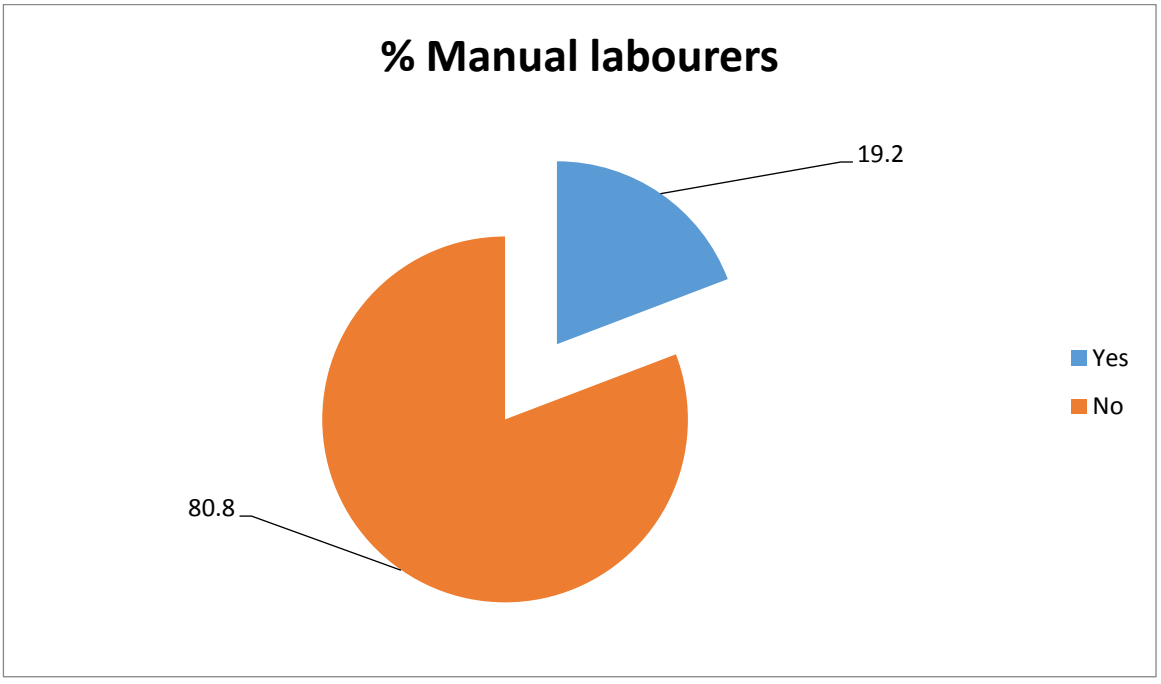
Table-6: Comparison of manual labourers between the gender:

manual laborers	Males		Females		Total		Significance
	No	%	No	%	No	%	
Yes	41	20.1	0	0.0	41	19.2	χ^2=2.248
No	163	79.9	9	100.0	172	80.8	df=1
Total	204	100.0	9	100.0	213	100.0	P=0.134

The table-6 shows the comparison of manual labour between the genders.

No significant difference between the genders (P>0.05).

Fig-24: percentage of manual labourers among the total subjects:



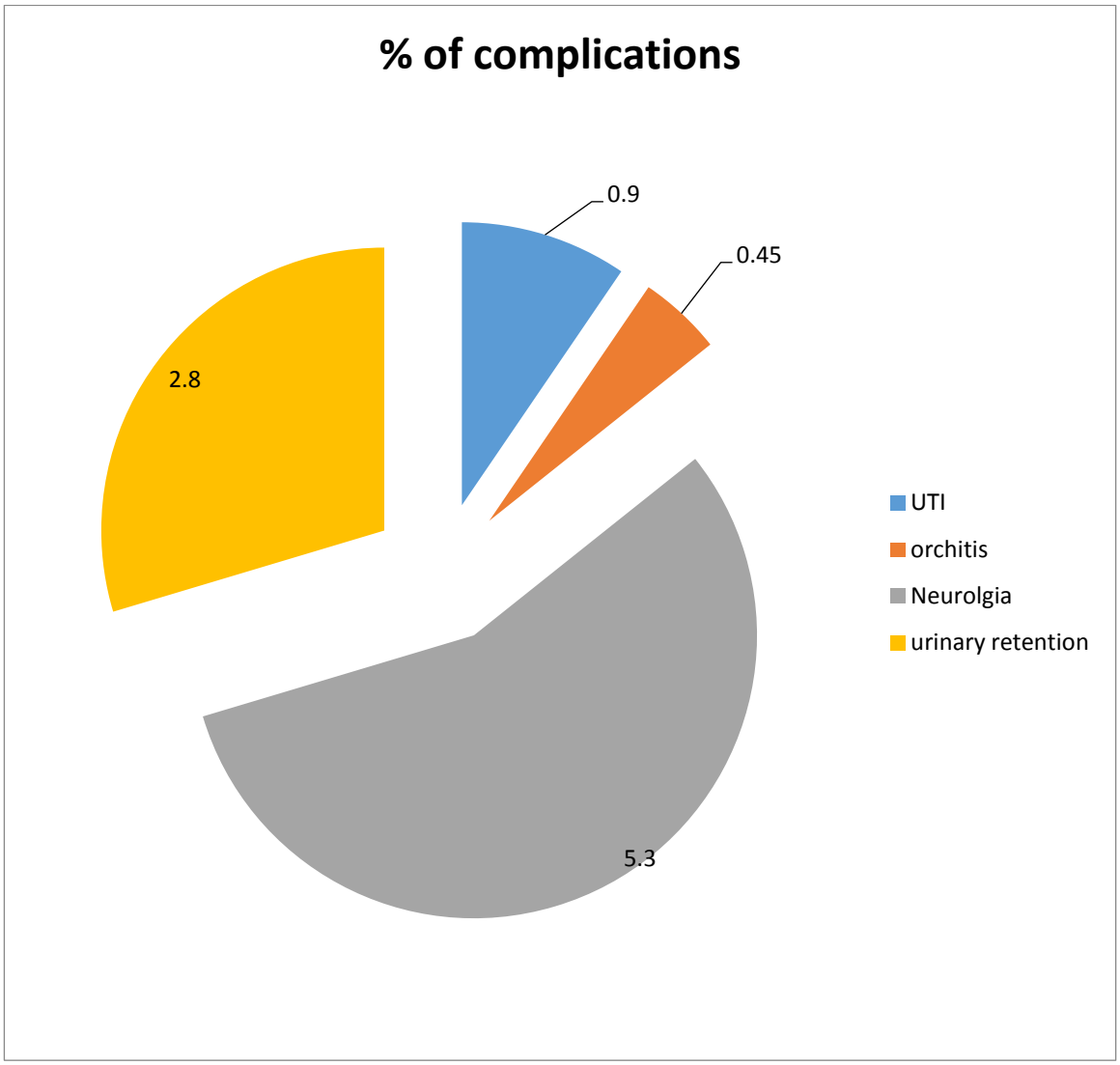
Operated Subjects: (209)

Table-7: Intra operative complications:

Si No	Complications	Yes		No	
		Frequency	%	Frequency	%
I	Intraoperative complications	0	0.0	0	0.0
II	Early post-operative complications	20	9.5	189	91.5
1	Urinary Retention	6	2.8	205	97.2
2	UTI	2	0.9	207	99.1
3	Orchitis	1	0.45	208	99.45
4	SSI	0	0.0	209	100.0
5	Neuralgia	11	5.3	198	94.7
6	Life Threatening	0	0.0	209	100.0

The above table -6 states the intra operative complications: No complications were, SSI and life threatening. The urinary retention was 2.8% The UTI was 0.9%, The Orchitis was 0.45% and Neuralgia was 5.3%.

Fig-25: Percentages of Intra operative complications:



Turned up for follow up = 172 (82.3%) among the operated.

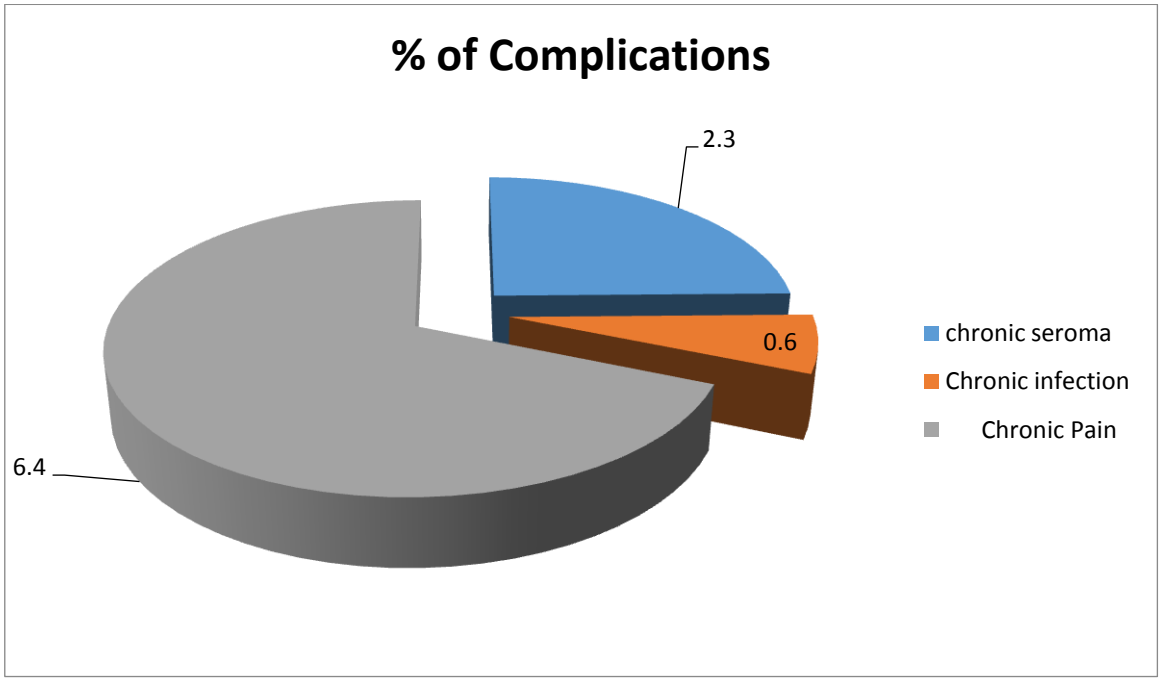
Table-8: Complications identified during follow up:

Sl No	Follow up Complications	Yes		No	
		Frequency	%	Frequency	%
1	Chronic Seroma	4	2.3	168	97.7
2	Chronic Orchitis	0	0.0	172	100.0
3	Chronic infection	1	0.6	171	99.4
4	Chronic Pain	11	6.4	161	93.6
5	Recurrence	0	0.0	172	100.0

The table-8 states the complications identified during follow up:

The Chronic Seroma was observed among 4(2.3%). Persons. No Chronic Orchitis were identified during follow up. Only one subjects had developed chronic infection during follow up. But, the chronic pain was observed among 11 (6.4%).

Fig-26: Complications identified during follow up:

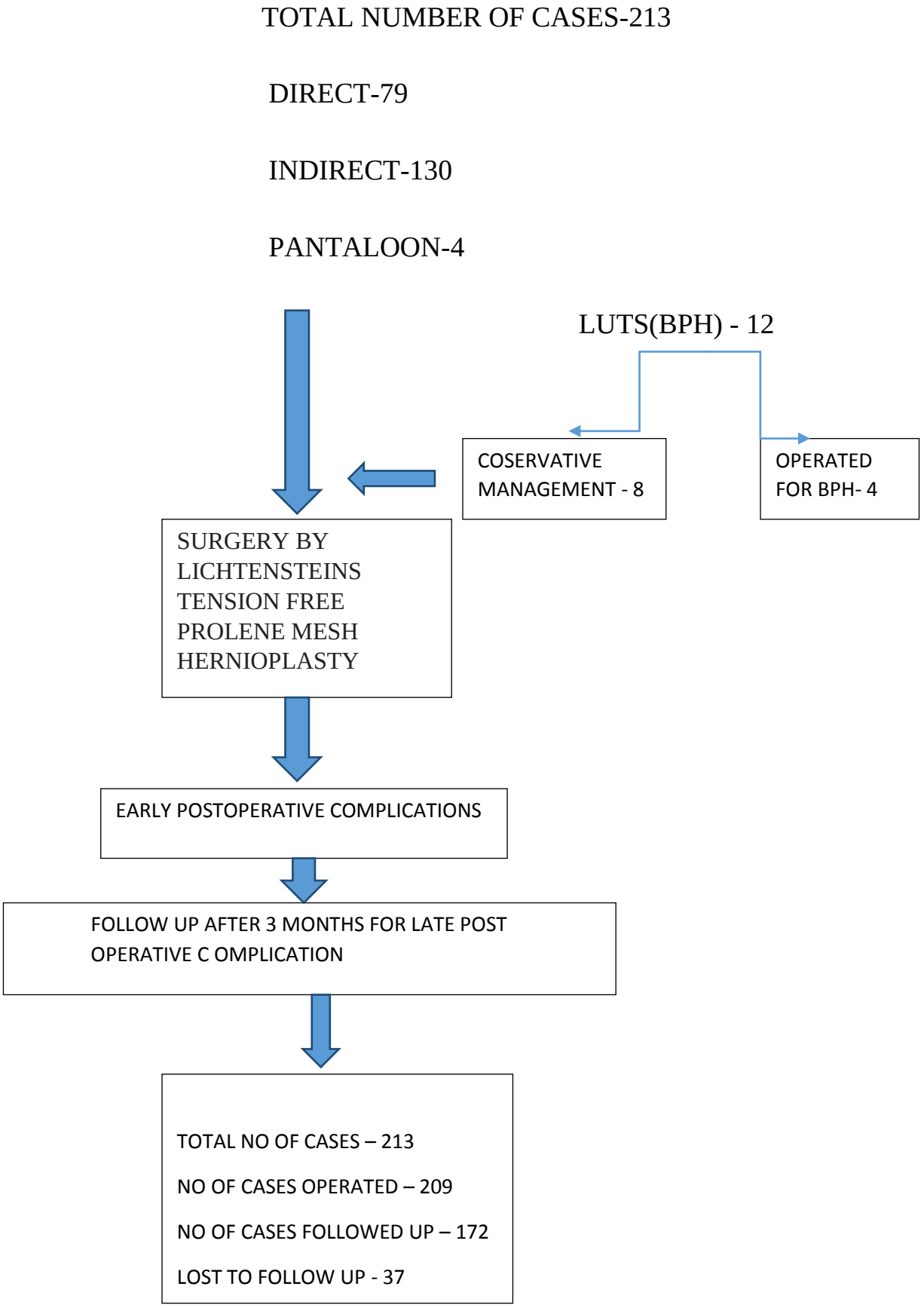


Discharge of the patients after surgery

Table 9: POD at which patients got discharged

DAYS	FREQUENCY	PERCENTAGE
3	21	10%
3-5	113	54%
>5	75	35.9%

Fig 27: STUDY ALGORITHM



DISCUSSION

In our study group the most common age group affected were between the ages of 40 to 70 and the maximum incidence between the ages of 50 to 60 years.

The male to female ratio was 22.6:1

The mean age of distribution for males was 50.3±16.5 years and the females was 46.2±18.5 year.

The mean age of total subjects was 50.1±16.6 years with range of 13-85 years.

The study showed a similar distribution of hernia cases compared to previous studies, suraj singh et al 2017[36], the highest number of cases presenting were males aged more than 45 years, in our study the maximum age group was between 40 to 70 years of age, 63.4 % of cases, and highest incidence in the age group of 60 to 69 (22.1 %) of cases.

The same results were seen in a study by louises and Wendell et al[39], where the most common age of presentation was between 51-60, with 27.4 % of patients of presenting in this age group.

Similar results were seen in a study by delving et al, but the most common age group in delvin et al[38] was >70 years, with 32% presenting in that age group.

The most common hernia noted was indirect type with 132 out of 213 cases presenting as indirect inguinal hernia.

Ie) 61 % of hernia that presented was of the indirect type. This is similar to the study done by Raymond c read et al[40], where the percentage of indirect hernia that presented was 63%.

This was followed by direct and pantaloons hernia respectively.

There was no statistical significance in the side of presentation, as right side and left side presented nearly equally on both sides. This is similar to the study done by delvin et al[38], where the indirect and direct hernias were noted at 55% and 45% respectively.

Previous studies done by Mohamed, Jeffrey et al[41] had an increased number of right sided cases compared to left sided cases but in my study the incidence of right and left side hernias were nearly equal with no preponderance to right side as shown in previous studies.

The most common predisposing factor noted was occupation with nearly 41 patients (19.2 %) working as manual labourers with a history of heavy weight lifting.

This was followed by patients with bladder outlet obstruction, who were diagnosed as benign prostatic hyperplasia (BPH). Out of the 12 cases diagnosed to have BPH, urology opinions were obtained, 8 out of the 12 cases were treated conservatively. 4 cases required surgical treatment with TURP (trans urethral resection of prostate).

The other etiological factors observed were COPD, 10 cases followed by pulmonary tuberculosis, 9 cases respectively.

The 4 patients who underwent TURP for BPH did not turn up for hernia surgery.

Hence out of the 213 patients, 209 patients were operated by lichtensteins repair and observed for intra operative and early post operative complications.

There were no intraoperative complications or any lethal complications during surgery.

The most common early complication observed was early post-operative pain, 11 patients (5.3 %) followed by urinary retention, 6 patients (2.8 %) and UTI, 2 patients (0.9%) and orchitis, 1 patients (0.45%).

There was no surgical site infection.

The incidence of early post-operative complication was 9.5 %

Most of the patients were discharged between post-operative day 3 to 5, 113 patients (54%) 75 patients (36%) were discharged after fifth POD. Only 21 patients (10%) had an early discharge within 3 days.

Of the 209 patients operated, 37 patients did not come for follow-up.

The most common late post-operative complication was chronic pain, 11 patients (6.4 %) , followed by Seroma, 4 patients (2.3%), and surgical site infection, 1 patient (0.5%).

There were no reported cases of chronic orchitis or recurrence.

The incidences of early and late postoperative complications were compared to previous study by neumayer et al (2004)[33] and was found to be lower than that.

Early post-operative complication (9.5%) and late post-operative complication (9.55%) is lower compared to neumayer et al[33], which had 19.4% and 17.4% respectively.

The incidence of UTI (0.9%) urinary retention (2.8%) and pain (5.26%) are higher than that noted by neumayer et al (2004)[33] which had UTI (0.4%), urinary retention (2.2%), and pain (3.6%) respectively.

CONCLUSION

The study showed a similar demographic distribution of cases as compared to previous studies.

There was no right or left preponderance as the incidence of right, left and bilateral hernias were nearly equal.

The total incidence of all early and late post-operative complications were lesser than the previous studies.

The incidence of UTI was found to be higher than other studies, this can be effectively prevented by adhering to strict asepsis during catheterization.

The incidence of early postoperative pain was higher when compared to previous studies, this can effectively be reduced by better postoperative analgesics.

Other early and late postoperative complications were similar to previous studies.

There were no reported cases of recurrences

BIIBLIOGRAPHY

1. Huff DS, Fenig DM. C8nning D.A. et al. Abnormal germ cell development in cryptorchidism. Horm Res2001;55:11-17.
2. Hutson JM, Balic A Nation T, et al. The developmental and biological basis of pediatric surgery. Cryptorchidism Semln Pediaitric surgery 19:215-224.
3. Nyhus Llyod M, Robert E. Condon: the preperitoneal approach and iliopubic tract repair of inguinal hernia,"Hernia" Philadelphia J.B. Lippincott Company 1995; 154- 188.
4. Skandalakis John et al: "embryologic and anatomic basis of inguinal herniorrhapy" in Surg clinics NA,Philadelphia: W.B.Sauders Co., 1993;73:799-834.
5. Skandalakis]E. Colborn GL, Gray SW. et aL The surgical anatomy of the inguinal area. Contemp Swg 1991;38:20 .
6. Skandalakis]E. Colborn GL, Weidman TA. et al, Skandalakis Surgical Anatomy: The Embryologic and Anatomic Basis of Modem Surgery. Athens,Greece: Paschalidis Medical Publications; 2004:393. 553, 1618.
7. irilas P, Mentesaidou A. skandalakis JE. Secondary internal inguinal ring and associated surgical planes: surgical anatomy; embryology; applications.Annals of Surgery 2008;206:561.
8. Askar Surgical anatomy of the aponeurotic expansions of the anterior abdominal wall. Annals of Royal College of SURGEONS .Bnf:/1977;59:313.

9. Ho1llnshead. WH. Anatomy for Sargeons, vol. 2. New York: Hoeber-Harper: 1956:239.
10. McGregor AI. DuPlessis DJ. A Synopsis of surgical anatomy lOth ed. Baltimore: Williams &Wilkins; 1969.
11. Anson BJ, McVay CB: Inguinal hernia: The anatomy of the region. Surg Gynecol Obstet 66:186–191, 1938.
12. Condon RE: Surgical anatomy of the transversus abdominis and transversalis fascia. Ann Surg 173:1–5, 1971.
13. Nyhus LM: An anatomic reappraisal of the posterior inguinal wall, with special consideration of the iliopubic tract and its relation to groin hernias. Surg Clin North Am 44:1305, 1960
14. Mc Minn RMH:Lasts Anatomy, regional and applied, 9th edition,Churchill Living stone, New york 1996.
15. Robert E. Condon: "The anatomy of Inguinal hernia and its relation to groin hernia" chapter 2 in Hernia, Nyhus Lloyd M. and Robert E.Condon: "Hernia" Philadelphia J.B. Lippincott Company 1995; 18-64.
16. Skandalakis John et al: "embryologic anatomy and surgical applications of preperitoneal space" in Surg clin NA, Philadelphia:W.B.Sauders Co., feb-2000; 80(1):1-22.
17. Robert M: Zollinger Jr. Classification systems of groin hernias. Rutkow IM,Hernia repair, Philadelphia , W.B. Saunders co. 2003;83(5):1053-65

18. Lichtenstein IL. Herniorrhapy: A Personal experience with 6321. Am J Surg 1987; 153:553-9.
19. Zollinger RM Jr. Classification of ventral and groin hernias, In:Fitzgibbons RJ Jr., Greenburg AG(eds). Nyhus and Condons Hernia,5th Ed, Philadelphia, Lippincott Williams and Wilkins, 2002; p71-79
20. Nyhus LM. Indiviualisation oh hernia repair. A new era, Surgery, 1993;114:102.
21. Das S. Examination of a case of hernia in a manual of clinical surgery chapter 38, Calcutta,S.Das 1996.p.428-440
22. Das Somen. Operations of Hernia in A practical guide to operative surgery Chapter 33, 1999; 421-436.
23. Kings North A and David H. Bennett. Hernia, umbilicus and abdominal wall Chapter 62, Bailey and Love's- Short practice of surgery,In:Williams NS, Bulstrode CJK, London A rnold publishers
24. Somen Das . A concise text book of surgery.1st Ed, 1994:1051-1068.
25. Abrahamson Jack: Hernias, Chapter 14, Maingot's Abdominal operations, In: Michael J. Zinner, Seymur I Schwartz Harold Ellis,USA,Appleton Lange, 1997: 479- 525
26. Amid PK Lichtenstein tension-:free hemioplasty: its inception. evolution. and principles. Hemla2004:8:1.

27. Amid PK causes, prevention and surgical treatment of post-herniorrhaphy neuropathic inguinodynia:triple neurectomy with proximal end implantation. Hem/a 2004:8:343.
28. Amid PK classification of biomaterials and their related complications in abdominal wall hernia, surgery,Hemla 1997;1:12
29. Das S. Examination of a case of hernia in a manual of clinical surgery chapter 38, Calcutta,S.Das 1996.p.428-440
30. Das Somen. Operations of Hernia in A practical guide to operative surgery Chapter 33, 1999; 421-436.
31. George E Wantz 1984. Complications of inguinal hernia repair.Surgical clinics of North America, Vol 64 ,no 2: 287-298.
32. Raymond Pollock : “strangulation external hernia” chapter 14 in Hernia, Nyhus Lloyd M , Robert E Codon Ed , J B Lippincott Co philadelphia 1995 : 273-283.
33. From Neumayer L, Giobbie-Hurder A, Jonassen O, et al: Open mesh versus laparoscopic mesh repair of inguinal hernias. N Engl J Med 350:1819–1827, 2004
34. Aufenacker TJ, van Geldere D, van Mesdag T, et al: The role of antibiotic prophylaxis in prevention of wound infection after Lichtenstein open mesh repair of primary inguinal hernia: A multicenter double-blind randomized controlled trial. Ann Surg 240:955–960, discussion 960–961, 2004.
35. Sevonius D, Gunnarsson U, Nordin P, et al: Repeated groin hernia recurrences. Ann Surg 249:516–518, 2009.

*36.*A clinical study of inguinal hernia with special reference to laparoscopic trans-abdominal pre peritoneal repair *Suraj Singh, Rajkumar Prakash, Vasundhara Singh*

37. Bholla Singh Sidhu et al 1999. Tension free Hernioplasty under local anaesthesia Gilbert repair. Indian journal of surgery Vol 61: 310-314.

38. Delvin H, Brenden: Management of abdominal hernias , London ; ButterWorths & company Ltd 1988,220p

39. Meier , Albert E . Surgical clinics of North America- symposium on surgery of hernia , Philadelphia , W B saunders Co 1971 Vol 51, 1249-1254.

40. Raymond C Read .Historical surgery of treatment of hernia. Chapter 1 hernia Nyhus Lloyd M , Robert E Codon Ed J B Lippincott Co philadelphia 1995 : 3-13.0

41. Mohamad Hammoud; Jeffrey Gerken

Treasure Island (FL): StatPearls Publishing; 2019 Jan-.

PROFORMA

Name: Age: Sex:

Address : Occupation :

I.P. No. : Unit / Ward:

Date of Admission:

Date of Surgery:

Date of Discharge:

Chief Complaints:

Past History:

General Examination:

Pulse Rate:

Blood Pressure:

CVS:

RS:

P/A:

CNS:

GCS:

Investigations:

Hb:

Urea: Serum Na+:

Serum K+:

WBC Count:

ECG:

USG:

L/E:

Right Inguinal region Left Inguinal region

Swelling

Right side	Test	Left side
+/-	Cough impulse	+/ -
+/-	Reducibility	+/ -
	Deep ring occlusion test	
	Three finger test	
	Finger invagination test	

Complications

Intraoperative

Postoperative

Urinary retention

Urinary tract infection

Orchitis

Surgical site infection

Neuralgia, pain

Life threatening

Long term(3 months)

Seroma

Orchitis

Infection

Chronic Pain

Recurrence

நோயாளிகளுக்கு அறிவிப்பு மற்றும் ஒப்புதல் படிவம்
(மருத்துவ ஆய்வில் பங்கேற்பத்திற்கு)

ஆய்வு செய்யப்படும் தலைப்பு:
பங்கு பெறுவரின் பெயர்:
பங்கு பெறுவரின் வயது:

		பங்கு பெறுவர் இதனை ✓ குறிக்கவும்
1.	நான் மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்களை படித்து புரிந்து கொண்டேன். என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டுள்ளது என அறிந்து கொண்டேன்.	☐
2.	நான் இவ்வாய்வில் தன்னிச்சையாக தான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த கட்டத்திலும், எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன்.	☐
3.	இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்து மேலும் ஆய்வு மேற்காள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். நான் ஆய்வில் இருந்து விலகிக் கொண்டாலும் இது பொருந்தும் என அறிகிறேன்.	☐
4.	இந்த ஆய்வின் மூலம் கிடைக்கும் தகவலையோ, முடிவையோ பயன்படுத்திக் கொள்ள மறுக்க மாட்டேன்.	☐
5.	இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக் கொள்கிறேன் எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின் படி நடந்து கொள்வதுடன், ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்று உறுதியளிக்கிறேன். என் உடல் நலம் பாதிக்கப்பட்டாலோ, அல்லது எதிர்பாராத, வழக்கத்திற்கு மாறான நோய்குறி தென்பட்டாலோ உடனே இதை மருத்துவ அணியிடம் தெரிவிப்பேன் என உறுதி அளிக்கிறேன்.	☐

பங்கேற்பவரின் கையொப்பம் / ..... இடம் .....
கட்டைவிரல் ரேகை
பங்கேற்பவரின் பெயர் மற்றும் விலாசம் .....
ஆய்வாளரின் கையொப்பம் /..... இடம் .....
ஆய்வாளரின் பெயர் .....
மையம் .....
கல்வியறிவு இல்லாதவற்கு (கைரேகை வைத்தவர்களுக்கு) இது அவசியம் தேவை
சாட்சியின் கையொப்பம் /..... இடம் .....
பெயர் மற்றும் விலாசம் .....