A Prospective Study Comparing The Desarda Technique Versus Lichtenstein Technique For Inguinal Hernia Treatment

by

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Dissertation submitted to

In partial fulfillment for the degree of

MASTER OF SURGERY

IN

GENERAL SURGERY

Under the guidance of

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2019

LIST OF ABBREVIATIONS USED

Cms	**Centimeter**
ECG	**Electrocardiogram**
Gms	**Grams**
H/O	**History of**
Hb%	**Haemoglobin 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: The inguinal hernia is one of the most common problems in the world. An ideal hernia repair is still elusive. Currently Lichtenstein mesh repair technique is widely followed for hernia repair. Desarda technique of inguinal hernia repair introduced in 2001 is still not considered standard tissue based hernia repair technique. The aim of the study was to compare the tissue based Desarda technique with standard Lichtenstein repair in treatment of primary inguinal hernia.

METHODS: 70 cases were allocated into 2 groups. Desarda (D Group) had 35 and Lichtenstein (M Group) had 35 patients. Primary outcome factors included operative time measured from skin incision to skin closure. Post operative pain scores was assessed on day 1,3,14 ,30 and 90 using Sheffield scale.Duration of hospital stay was noted. Ecchymosis, hematoma, seroma, surgical site infections,foreign body sensation etc. were evaluated as postoperative complications. A follow up examination was planned for 6 month to look for early recurrence(<6month) and chronic groin pain.

RESULTS: Mean age in desarda's group 43.71 ±12.79 years while Lichtenstein group was 49.89±14.31 years .The mean duration of surgery 41.69 min(D) vs 45.66 min(M). Duration of hospital stay 3.31 days(D) vs 4.03 days(M).Time taken to return to normal and work activities was significantly less in Desarda group (P = 0.001). There was no statistical difference in rates of post-operative complications among the two arms of the study. After 6-month mean follow up period 1 recurrence is noted in each arm (P = 1).

CONCLUSION: On comparison of Desarda technique with standard Lichtenstein repair. Desarda technique does not use a mesh. Patients after Desarda's operative procedure gets normal activity sooner as compared to the standard Lichtenstein mesh repair. complications

similar to standardized technique. We also found the use of Desarda technique in patients with indirect hernia is a technically sound option than Lichtenstein technique.

KEY WORDS:INGUINAL HERNIA,LICHTENSTEIN MESH REPAIR,DESARD'S REPAIR

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INTRODUCTION

Hernias may be generally defined as a " Abnormal Protrusion of a viscus or part of a viscus through an abnormal opening in the walls of its containing cavity'. [1]

"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.**

"A great surgeon performs operations by a single method: later he makes a statistical summary of deaths and recoveries, and he concludes from these statistics that the mortality law for this operation is two out of five. Well I say that this ratio means literally nothing scientifically and gives us no certainty in performing the next operation: for we do not know the next case will be among the recoveries or the deaths. What really should be done, instead of gathering facts empirically, is to study them more accurately, each in its special determinism." - Claude Bernard

These are the words describing the importance of research in surgery and surgical techniques. Every surgical techniques needs to be studied, its merits and demerits assessed; so that the patients in future may undergo the only best procedures. Thus research into newer techniques helps in improving the morbidity and mortality associated with the older standardized technique. As surgeons we need to reinvent ourselves everyday so that the patient will gain maximum benefit from our efforts.

The surgery for inguinal hernias has evolved through various stages to reach a modern era. It is said that the history of inguinal hernias is the history of surgery itself.[1] hernia repair is one of the most commonly performed general surgical procedures worldwide.[2] since the time

bassini described his technique the search for an ideal inguinal hernia repair is still on. An ideal inguinal hernia repair should be tension free, tissue based, with no potential damage to vital structures, no long term pain or complications and no recurrences.

Other tissue repairs like modified bassini, iliotibial tract repair, shouldice, nylon darn, halsted-taner, McVay and many others either require good surgical experience or are tension repairs with recurrences.

Shouldice method which closely compairs with the mesh repair rarely used probably because of complexity involved in tissue dissection and repair. Recurrences vary from surgeon to surgeon centre to centre owing to complexity of procedures.[5]

Though lichenstein prosthetic repair using prolene mesh has being popular lately it is not a tissue based repair and hence cannot be considered ideal. Though this method of hernia repair is simple and safe, at the slightest moment of the mesh from the sutured area is leading cause of failure of mesh repair of inguinal hernias.Prosthetic mesh works as a mechanical barrier itself. Mesh will not give mobile and physiologically posterior wall[3]. Moreover this technique is associated with chronic groin pain and testicular atrophy and infertility.[4]

Suture repair for inguinal hernia is still under development, and recently, Mohan desarda has described an operation where a 1-2 cm strip of external oblique aponeurosis lying over the inguinal canal is separated from the main muscle tissue and attached both medially and laterally. It is then sutured to the conjoint tendon and inguinal ligament, giving strength to the posterior wall of inguinal canal.On contraction of abdominal muscle, this strip of external oblique aponeurosis tightens to provide further physiological support to the posterior wall. This operation is currently being evaluated.[6] This new technique is theoretically closer to ideal hernia repair.it is based on the concept of providing a strong, mobile and physiologically dynamic posterior inguinal wall. The technique is simple, easy to learn and

do. It does not require complicated dissection or suturing. There is no tension on suture line. It does not require any foreign material and does not use weakened muscles or transversalis fascia for repair. The results are superior to those previously published in the field of hernia surgery.[7-9]

Success of groin hernia is measured primarily by permanence of operation, fewest complications, minimal cost, and earliest return to normal activities. To validate the use of Desarda's repair at large, its comparison to open mesh (Lichtenstein) – in these outcomes must be established. The purpose this study is to attempt to establish the influence of this new technique on early clinical outcomes of inguinal hernia repair, and limited study of long term outcomes. If proved to be effective it will be a basis for promotion of use globally.

AIMS & OBJECTIVES:

1.To study the short term outcome with respect to :

- Operating time(incision to closure of skin)
- Post operative pain
- Duration of stay in hospital
- Induration/redness of the operated site
- Post operative wound infection rate

Cost of procedure in total

2. Recurrence rate

- To look for any recurrence with regular follow ups on one month, three months and at six months

REVIW 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**

DEFINITION: 'Abnormal protrution of a viscous or a part of viscous through the wall of the cavity containing it'

''Area of weakness or disruption of the fibromuscular tissues of body wall''

Ancient Times [14,15]

The history of hernia, is replete with myths and facts, ideas and realities as well as with lot of transmutations and Shadows. The history of hernia *in toto* is as old as human race. Since 1500 BC Inguinal hernias are recorded by the ancient Greeks. The term hernia is derived from Greek meaning "offshoot, a budding or bulge."[14]

Hippocrates has barely mentioned about hernia in his writings (500 BC). Inguinal hernia most probably has been a disease ever since mankind existed.[12] The word hernia is derived from the Greek word "Hernios", meaning "Nad" or "Shoot". Shushruta in Vedic period had described hernia as "Antra-vriddi" and thought it to be an incurable disease. 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 for hernia has been conservative . The evolution of surgical treatment had closely paralleled that of surgery. About 3500 years ago, few Egyptian physicians reported that the management of inguinal hernia can be done by conservative means that

included the snugly fitting bandage for reduction and support. Around 3rd century BC,For hernia management Alexandrian medical scientists initiated surgery as a treatment of choice. They obtained preoperative sedation using a root extract of mandrake, they achieved haemostasis by using vascular ligatures.[13]

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

Figure-2. Aulus Celsus of Alexandria(50 AD)

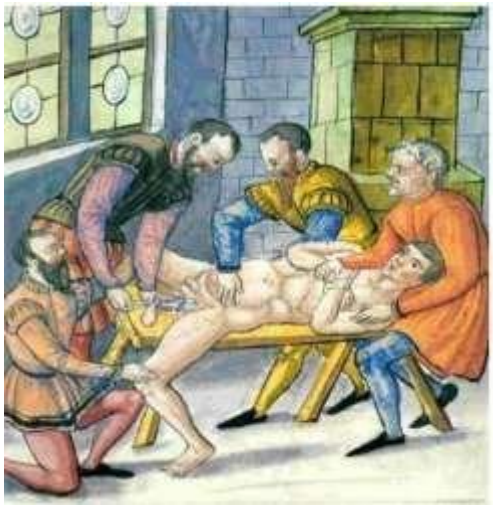


Figure-3. Middle Dark Ages (476-15th Century)

Figure-4. Ambrose Pare

The treatment for irreducible hernia by taxis had been traced back twenty four hundred years. The earliest mention of inguinal hernia was found in "Eber's papyrus" (1500BC), where the pre-Homeric physicians treated the inguinal hernia by conservative techniques.

Aulus Celsus, the Greek encyclopedist and surgeon documented (50 AD) the use of transillumination technique to distinguish between hydrocoeles and hernias and described taxis for strangulation. Trusses and bandages were used for the treatment ofreducible hernia. Around 700AD Incomplete hernias (Bubonocele) were distinguished from Complete (Scrotal) inguinal hernias by "Paul of Aegina".

Medieval Period [17]

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 were made in herniology. "Chirurgia Magna" a well known text, by Guy de Chauliac, from France (1363 AD) distinguished femoral hernias from inguinal hernias. Taxis for the treatment of incarcerated hernia, was developed by him who also recommended 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. Trendelenberg position in the management of hernias was recommended by Ronald, of Parma in around 1383AD. using fine linen.

Post- Renaissance Period [19, 20]

After the renaissance, autopsy and anatomic dissection techniques was in practice all over the Europe. In Bologna around 1200 AD knowledge about herniation started.[82]

In 1700AD Meckel"s diverticulum in hernial sac was first reported by Littre. In 1721, William Cheselden successfully operated on strangulated hernias. Heister (1724) in his

monograph distinguished indirect inguinal hernias from direct hernias.Congenital nature of some indirect inguinal hernia was pointed out by Hunter and Percival Pott of London . In1731 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'1 (1752-1832), in his treatise on hernia accurately described the sliding hernia based on autopsy studies.He described the intimate fusion of intestinal content with the peritoneal lining in a sliding hernia. Astley Patson Cooper1 (1768-1841) described for the first time the superior pubic ligament, which was later described by 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 Cloquet1 (1770-1883), dissected and sketched 345 cases of hernia.

Period of Aseptic Surgery/ The Listerian Era[15]

In 1867, a paper on antiseptic surgery performed under carbolic acid spray was presented for the first time in history of surgery byJoseph Lister, Professor of Orthopedic Surgery at Glasgow infirmary. 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, where he used carbolised catgut ligature. In 1877, Czerny demonstrated pulling the hernial sac through the superficial ring and excising it, such that the ligated neck to retract and return back at the deep ring[82]. Antisepsis was first introduced in France by Lucas-championniere. 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 one of the essential steps in the repair of inguinal hernia. He was also the first to describe, the trans-abdominal approach for the treatment of inguinal hernia. **Edoardo Bassini** [21](1844-1924) of Pavia, Italy was the one who revolutionized the treatment of inguinal hernia by the introduction of a novel 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 ligature 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 as well as with low recurrence rates.

He initiated the use of rectus sheath, transversalis fascia, and interrupted silk sutures. He used to do bilateral hernia repairs and surgery for cryptorchidisim 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[82].He emphasized closing the floor from below upwards to restore the valvelike 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[82]. Shouldice, Obney, Ryan 1950-1953 Performed multiple layer repair posterior inguinal wall under local anaesthesia which was later known as 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.

Patch Graft Repairs

Whenever the local tissues were weak and attenuated, approximation of tissues was under tension and so the sutures did not hold and the hernia recurred. So this forced the surgeons to think about 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 fragmented corroded and were rejected through chronic sinuses and lead to higher rate of recurrences post operatively. In 1940, Burke introduced tantalum metal sheets which was also not very successful as metal underwent fragmentation leading to hernia recurrence. Surgeons started getting sheets of natural tissue flaps from fascia of thigh. Rectus sheath or internal oblique or external oblique aponeurosis were turned downwards and sutured to the inguinal ligament. Skin graft was used by Mayr in 1943. 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.

Expended polytetrafluroethylene (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, an underlay patch which provides posterior mesh repair. Connector has the desirable attributes of the plug repair and an Onlay patch which covers the posterior wall up to internal inguinal ring. [22]

Figure- 5: Francis Usher

Figure- 6: Irving Lichtenstein

Pre-Peritoneal Repairs

Thomas Annandale of Edinburgh first presented the concept of the pre-peritoneal approach in 1876. In 1883 Lawson Tait of Birmingham, England 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.

Laparoscopic Inguinal Hernia Repair [24,25]

With the advent of computer chip technology, laparoscopic visualisation and treatmentof inguinal hernia got introduced in the surgical arena.[26]

Ger and his colleagues, in 1982, through laparoscope used Michel staple applied with a Kocher clamp to close peritoneal opening of the hernia sac.

Schultz and co-workers (1990) described plug and patch laproscopic inguinal herniorrhaphy.

Spaw & co-workers (1991) detailed the anatomy with respect to laparoscopic approach. Toy & Smoot (1991) described intra peritoneal on lay patch technique (IPOM)where a synthetic mesh is applied to the defective peritoneal wall.

Dion & Morin (1992) described transabdominal preperitoneal patch(TAPP) technique where an intra-peritoneal U-type incision in the peritoneal wall and inserting the mesh in a preperitoneal position.

Mc Kernan (1992) described totally pre peritoneal patch technique (TEP) which is a complete extraperitoneal insertion of the preperitoneal mesh.

Both TAPP and TEP techniques,continues to be used in the last 15 years, under advised as evidence based techniques, equal to Lichtenstein repair. However owing to higher cost and steep learning curve. These techniques were not popular. [18]

Desarda's techniques of inguinal hernia repair wars developed by pof.Desarda in 1990,is based on the concept of providing strong,mobile and physiologically dynamic posterior inguinal wall.it does not require complicated dissection or suturing.there is no tention on suture line.it does not require any prosthesis.the results are superior to those previously publish in the field of hernia surgery.[68]

Figure-7. Antonio Scarpa(1752–1832)

Figure-8. Astley Cooper (1768-1841)

Figure-9. August Richter (1742-1812) **Figure-10. Edoardo bassini (1844-1924)**

EMBRYOLOGY[21,27]

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 forms the scrotum in males and labia in females. The embryological entities between the skin and the peritoneum, permit the processes vaginalis which inturn penetrate them and forms the inguinal canal. The inguinal canal contains the spermatic cord in males and the round ligamentof the uterus in females.[2] 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 located on the posterior abdominal wall, at the level of the upper lumbar vertebrae. It lies medial to the mesonephros, where it is attached near the lower pole of the mesonephros by a fold of peritoneum called mesorchium. The descent of the testis into its corresponding scrotal chamber is accomplished by following the lead of the

fibromuscular band called gubernaculums testis. It arises mainly within the plica inguinalis – a peritoneal fold, which stretches from the inguinal region to the lower end of the mesonephros. The gubernaculum attains greatest development by about sixth month, when it becomes a stout thick cord. It 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 external oblique and internal oblique aponeurosis 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 [29,30, 31,32]

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) [28]

The groin is that portion of the anterior abdominal wall below the level of anterior superior iliac spines. The medial boundary is formed by pubis and superior pubic (Cooper's)

ligament. Laterally it is bounded by epigastric vessels and transversalis fascia condensation at the internal ring. The anterior femoral sheath, inguinal ligament and iliopubic tract lie inferiorly and the transverses abdominis aponeurosis and its arch are superiorly.

MYOPECTINEAL ORIFICE OF FRUCHAUD

Boundaries

Medially: Rectus muscle

Laterally: iliopsoas

Superior: Conjoint tendon

Inferior: Pectin pubis

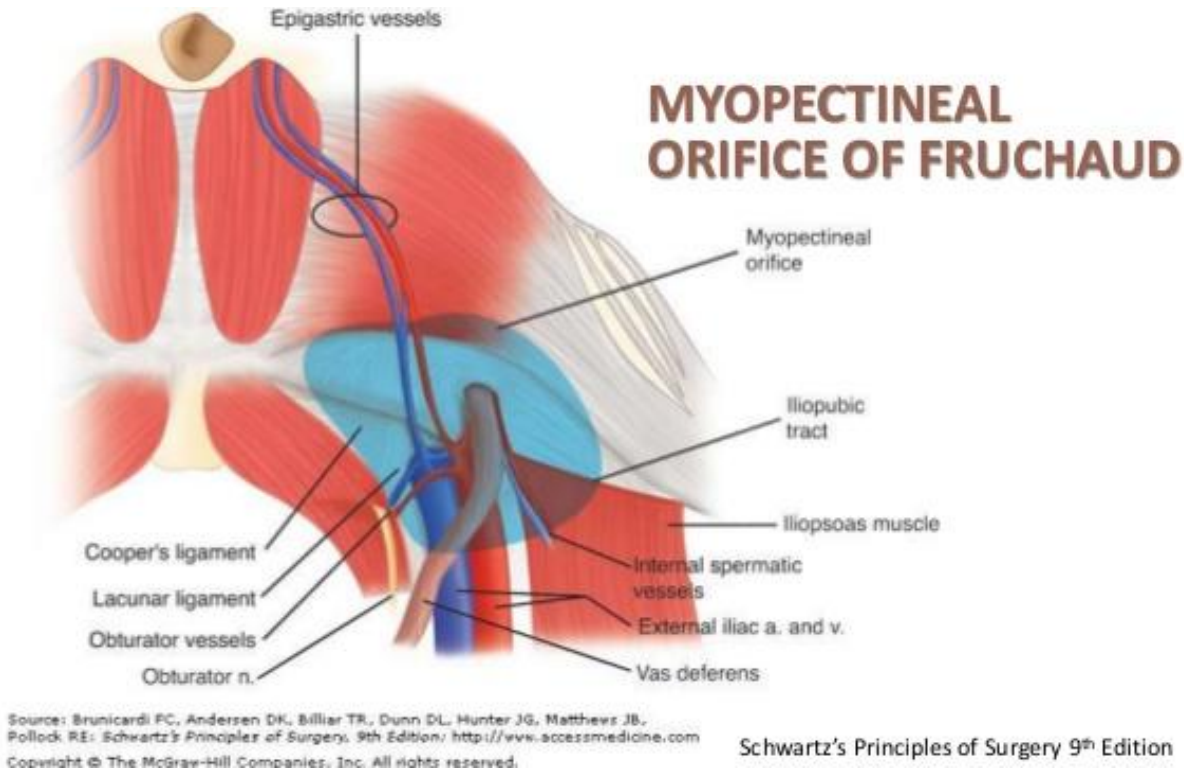


Figure - 11 Myopectineal orifice of fruchaud

Skin

Langer's lines are transverse lines in the groin with its convexity facing downwards. The anterior superior ileac spine of 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 inturn overlies the lateral aspect of the pubic tubercle. The deep inguinal 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 nerve supply is by the **ilioinguinal, iliohypogastric** and **genital branch of genitofemoral** nerves.

Subcutaneous Tissues of Groin

The subcutaneous tissue is divided into two strata - superficial fatty layer called as Camper's fascia and a deeper membranous layer called the Scarpa's fascia, which continues into perineum as the Colles fascia.

External Oblique Muscle and Aponeurosis

It orginates from the lower 8 ribs. Its fibers are directed downwards, forwards, and medially. From the anterior superior iliac spine to the pubic tubercle, the aponeurosis forms a free border which is called inguinal ligament or poupart's ligament. The muscle becomes totally aponeurotic in the groin with its fibers directed obliquely downwards. It becomes the external layer of the anterior rectus sheath and further inserts on the pubis. The lacunar ligament is the fan-shaped medial expansion of the inguinal ligament which inturn inserts into the pubis.[2]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. The spermatic cord exits the inguinal canal through the external inguinal ring.[2]

Internal Oblique Muscle and Aponeurosis

The internal abdominal oblique muscle lies between the external oblique and the transverses abdominis muscles.It forms the middle layer of the abdominal aponeurotic complex. 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 conjoined tendon. This is present only in 5% to 10% of the general population.[2] This is the most internal of the three flat muscles of the abdominal wall. It is oriented horizontally throughout most of its area. This is the key layer, because of its role in hernia repair. This muscle arises from the iliac fascia along the iliac crest and the inguinal ligament and from the lower six costal cartilages and ribs.[33] 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 and 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(also known as endabdominal 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. The component layers of rectus sheath vary according to the level of the sheath examined. The section of the sheath immediately inferior to the umbilicus is composed of external oblique aponeurosis ,anterior leaf of the internal oblique apponeurosis and transverses abdominis apponeurosis.[33]

Peritoneum

In the groin as elsewhere, the peritoneum is a thin elastic membrane. It serves only to provide a lubricating surface for its contained viscera. Because of the elastic character of the peritoneum it has no role in the prevention of hernia.

The Conjoint Tendon (Falx Inguinalis)

Falx inguinalis is derrieved from a latin word meaning “inguinal sickle”. The aponeurosis of the transverses abdominis and the internal oblique are fused some distance lateral to the rectus sheath to form the conjoined 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.

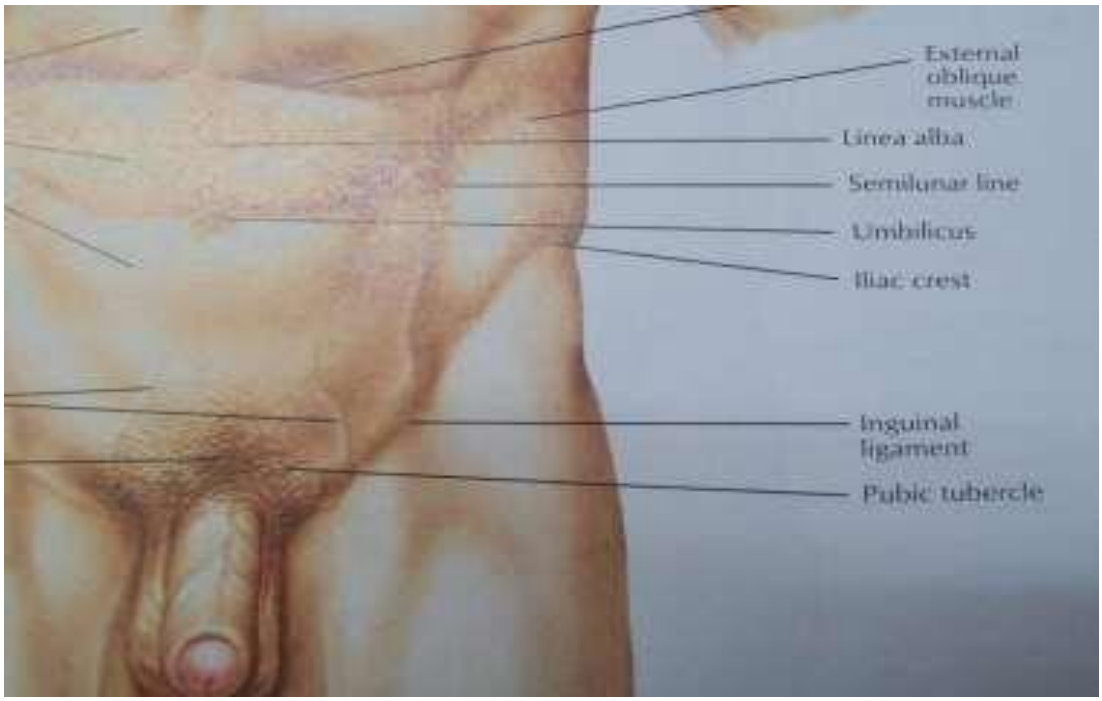


Figure-12. The left Groin

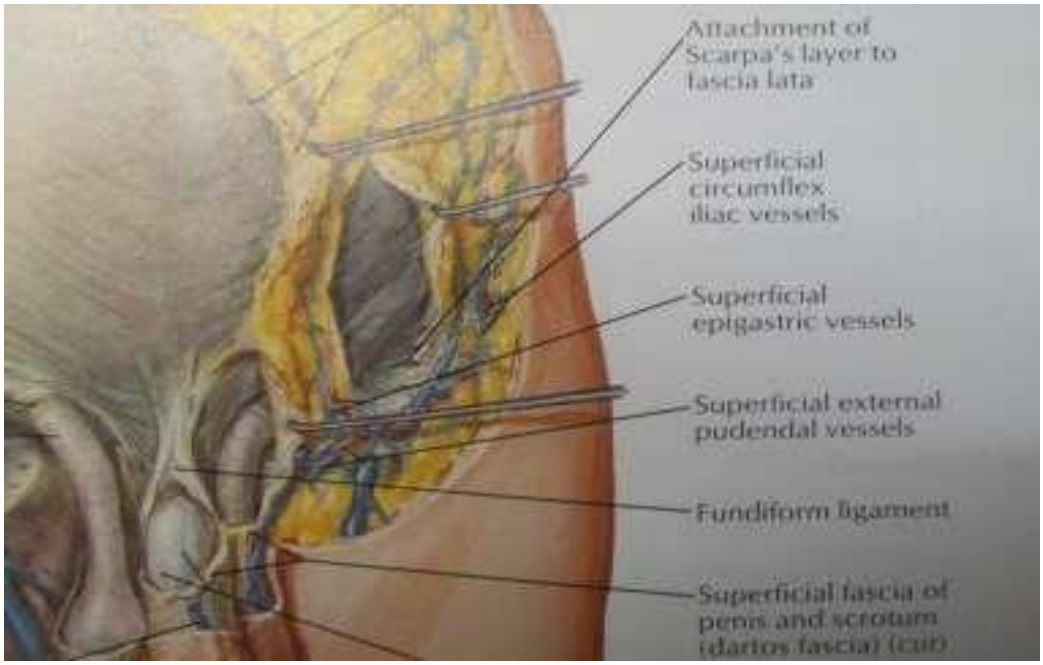


Figure -13. Subcutaneous tissues of Groin

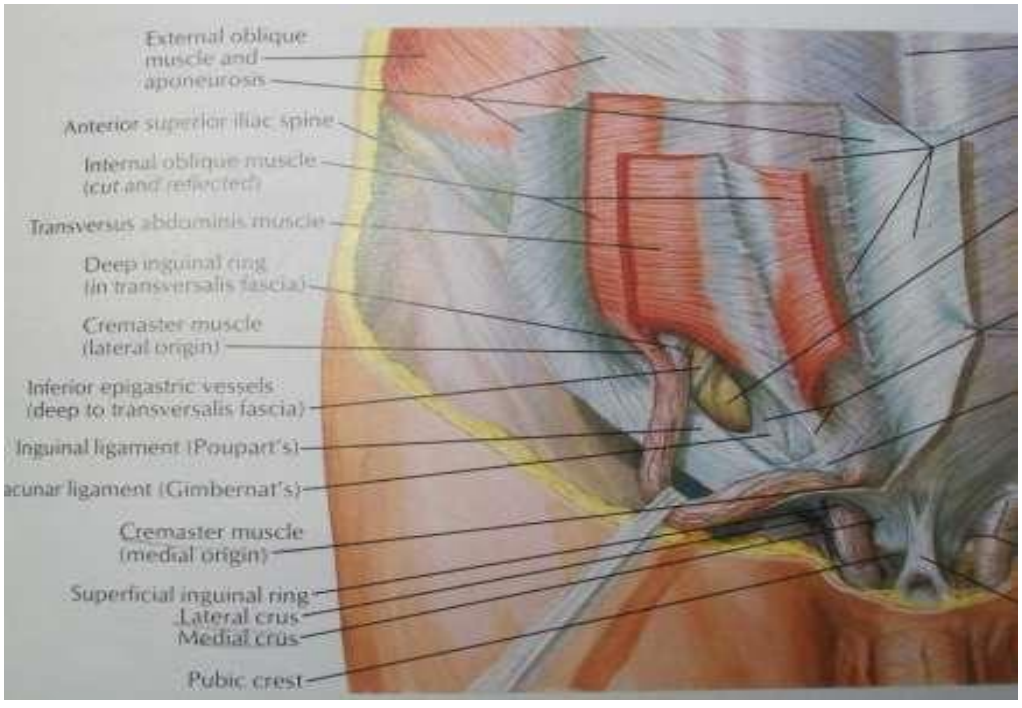


Figure -14. Deep ring and Superficial Inguinal ring

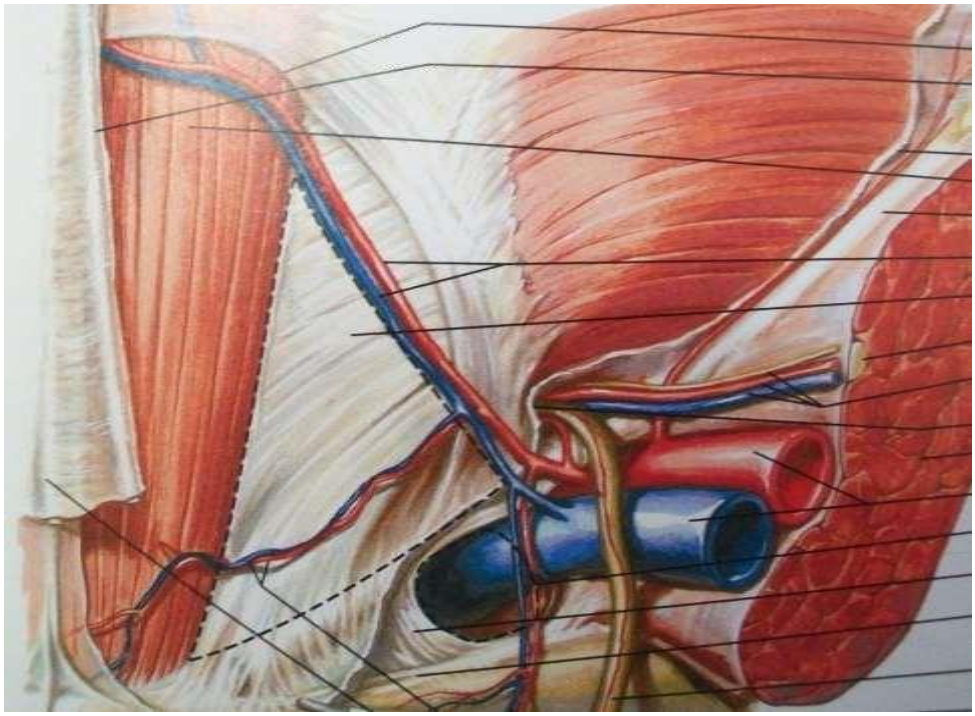


Figure-15.Hasselbach`sTriangle

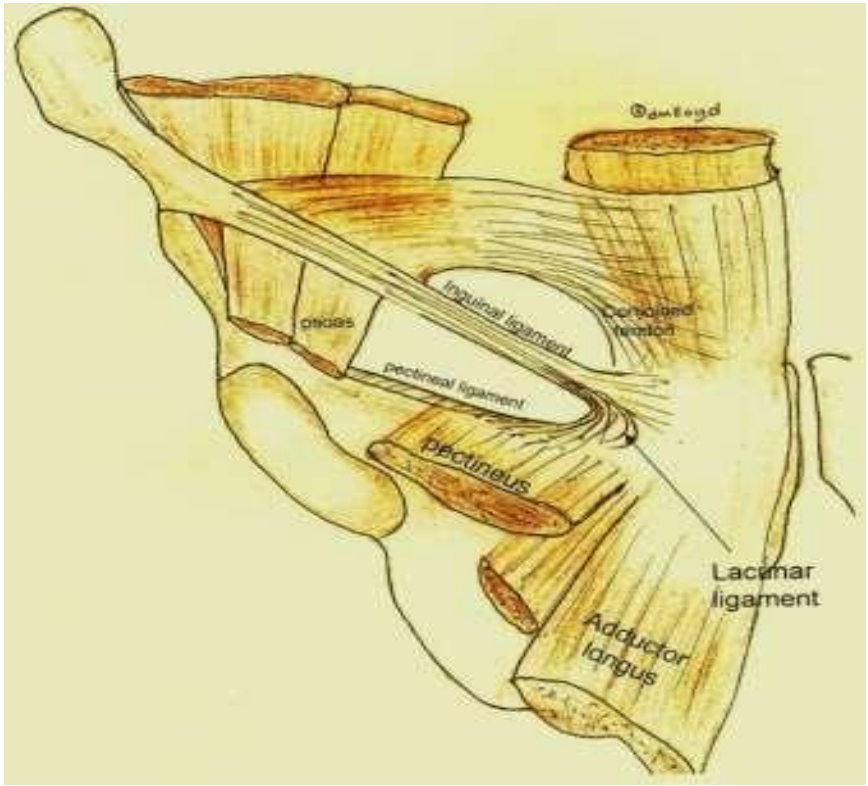


Fig- 16.Ligaments of the Inguinal region

Inguinal Ligament (Ligament of Poupart)

It is the lower, thickened portion of external oblique aponeurosis. It extends from the anterior superior iliac spine to the pubic tubercle. And its edge is rolled inwards to form a gutter. It forms a bridge over the iliopsoas muscle as well as neural and vascular structures as they pass out of the pelvis. 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 the inguinal ligament. Medially, the inguinal ligament gets inserted on the pubic tubercle and forms a fan shaped expansion downwards to the superior pubic ramus called 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 laterally meets the proximal end Cooper's ligament. It serves to broaden the attachment area for the inguinal ligament by fanning.

The Cremaster Muscle

The cremaster muscle 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 the 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 in males whereas in females the inguinal canal envelops the round ligament. 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, it is bounded by the skin, superficial fascia, external oblique aponeurosis and in its lateral one third by the muscular fibres of the internal oblique.
- Posteriorly, by the transversalis fascia, reinforced medially by the falx inguinalis
- (when present).
- Superiorly it is bounded by the arched fibers of internal oblique and transverses aponeurosis.
- Inferiorly the inguinal ligament and its continuation and lacunar ligament forms the boundary.

Hesselbach's Triangle

It is a weak area through which direct inguinal hernias pass and is bounded medially by the lateral border of the rectus sheath and falx inguinalis, laterally by the inferior epigastric vessels and below by the inguinal ligament.

Spermatic cord: Originates at the deep ring.

Contents of spermatic cord are

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.

a. 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 are the deep circumflex iliac and the inferior epigastric vessels and are not vital. The latter, serves as the medial border of the deep ring, or the lateral border of the direct triangle. The epigastric artery gives off two branches, the cremasteric and the pubic arteries. 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

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

1. Ilioinguinal nerve(T 12 – L 1)

It emerges from behind the psoas muscle along with or just inferior to the iliohypogastric 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, exciting 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.

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 and innervates the tranversus abdominus muscle. 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.

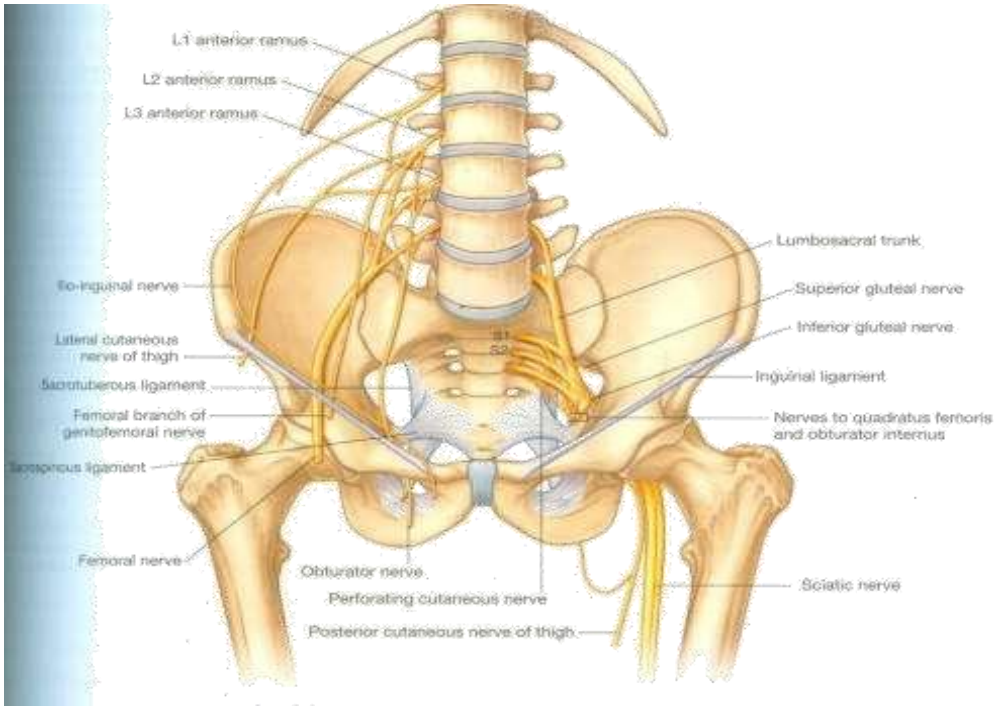


Figure-17. Lumbar Plexus

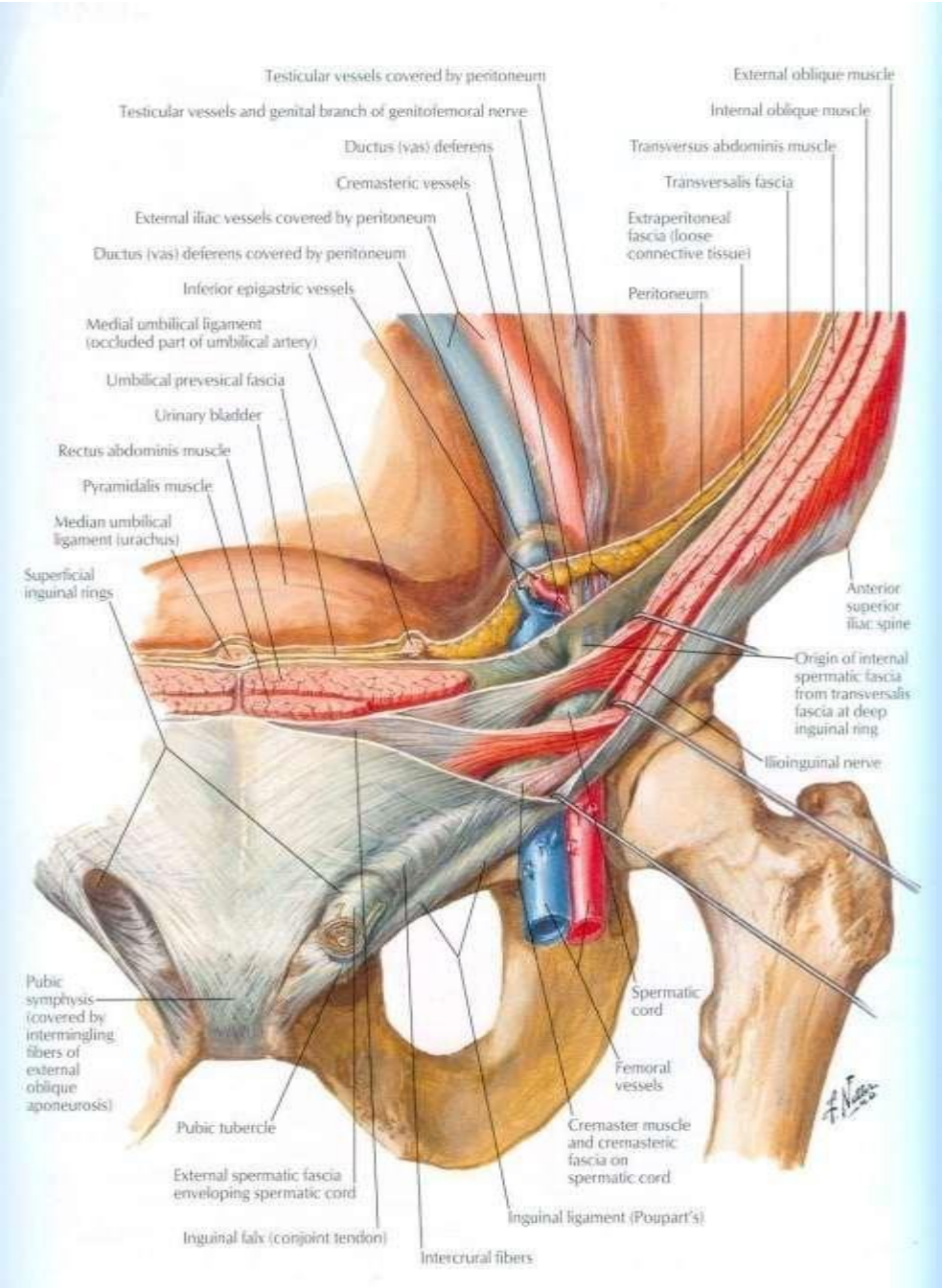


Figure-18. Layers of Abdominal wall forming the Inguinal canal and its contents

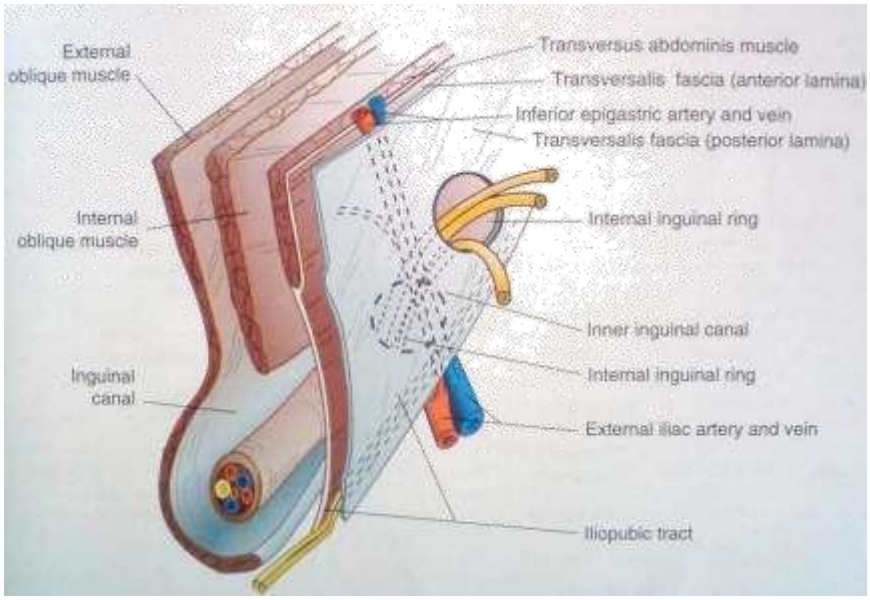


Figure -19. Inguinal canal and its contents

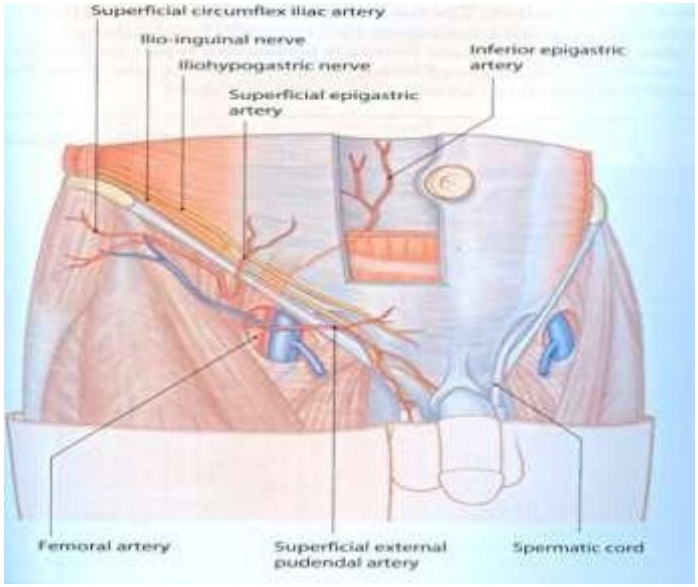


Figure -20. Nerves and Blood Vessels at Groin

EPIDEMIOLOGY, ETIOLOGY AND PATHOPHYSIOLOGY[35,36,37,38]

75% of all abdominal hernias are found in the groin; Of all groin hernias,95% are inguinal hernias with the remainder being femoral hernias. Inguinal hernias are 9 times more common in men than in women but still inguinal hernia is the most common hernia in women .The overall lifetime risk of developing a groin hernia is approximately 27% in males and less than 3% among females. Studies shows that 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 our country approximately 700,000 inguinal hernia repair are performed every year of inguinal hernia repairs, 90% performed in men and 10% in women.

There is a clearly an association between age and hernia diagnosis. The incidence of inguinal hernias in male as a bimodal distribution, with peaks before the first year of age and after age 40.Those age 25 to 34 years had a lifetime prevalence rate of 15%, where as those age 75 years and over had a rate of 47%.h20. The complications of hernias (incarceration, strangulation, and bowel obstruction) are found more common at extremes of age.

The most common subtype of growing hernia in men and women is the indirect inguinal hernia. Men are 25 times more likely to have a groin hernia than women, although femoral hernias are found more often in women, The inguinal hernia is still most common hernia in women.[21].Direct hernia is very uncommon in women. Both indirect inguinal and femoral hernias occur more commonly on right side. This is attributed to a delay in atrophy of the processes vaginalis after the normal slower descent of the right testis to the scrotum during fetal development. Strangulation, most common serious complication of the hernias, occurs in only 1% to 3% of groin hernias and is more common at the extremes of life. Most

strangulated hernias are indirect hernias .The approximate incident of inguinal hernia in India is 19,57, 850 cases per year across all age group and genders(Asia pacific hernia society).

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 intraabdominal 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 Acquired Factors

a. **Patent Processes Vaginalis**: 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 processes 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 significant factors are the number of aponeurotic fibers in the transversus aponeurosis which inturn determines the intrinsic strength of the layer.

3. General Contributing Factors

a. weakening of muscle and fascia by advancing age,

b. smoking, obesity ,ascitis.

c. multiple pregnancies.

d. Pulmonary diseases like COPD and asthma, bronchitis, TB,

e. chronic constipation, ano - rectal stricture .

f. Benign prostatic hypertrophy, urethral stricture,

g. strenuous work

h. previous surgery like Appendicectomy can cause direct hernia.

4. DEFENCE MECHANISM

A. The obliquity of the inguinal canal (flap valve mechanism): During sudden exertion increases the intra peritoneal pressure, compresses in the anterior and posterior walls of the canal there by occluding the canal.

B. slit valve mechanism: contraction of external oblique results in approximation of two crura of superficial inguinal ring (slit valve mechanism).the integrity of superficial inguinal ring is greatly helped by the inter crural fibers.

C .Ball valve mechanism: due to contraction of cremastric muscle which plugs to superficial ring.

D. Sling shutter mechanism : As the transversus abdomins muscle contracts during coughing or similar activity that raises the intra abdominal pressure,The crura of the transfertial facial sling would be drawn closed together and both crura would be drawn laterally, this motion being transmitted from the contracting transverses abdominis muscle to its inverting transversalis fascia.The approximation of the crura of the sling would partially close the internal inguainal ring, while the lateral sliding motion of the sling would flatten the cord structures against the abdominal wall,increasing the obliquety of there exits, the deep inguinal ring close during maximum increase in intra abdominal pressure,In much the same manner as the momentary action of camera shutter, providing additional protection to this vulnerable area from forces that might lead to hernia.

E. Shutter Mechanism[86]

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, the 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 and 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 internal ring from inside the abdomen.[86]

Contraction of the transverses 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 internal ring to close like a sphincter snugly around the cord.[86]

F.Hormones play an important role in maintaining the integrity of inguinal region.

THEORIES ON HERNIA FORMATION

1. Russell's theory- Preformed sac.
2. Reid's metastatic emphysema theory- due to smoking.
3. Cloquet's lipoma theory — pile drives action of fat.
4. Fruchand's theory- big opening present in the lower abdomen between the pubic bone and the conjoint tendon is divided into two by the inguinal ligament. Through the upper part passes the inguinal hemia and through the lower passes the femoml hernia.
5. Denervation theory- ilioinguinal nerve injury especially after appendectomy.
6. Oblique pelvis theory- high arch the internal oblique leads to inefficient shutter mechanism and are prone to inguinal hernia.
7. Wide female pelvis- lower arch of the internal oblique provides more efficient shutter mechanism. So indirect inguinal hemias are uncommon in female, results in wider femoral ring so femoral hernia are more common among females.
8. Uglavasky theory- due to chronic increased intra abdominal pressure.
9. Peacock's theory- defective collagen synthesis.
10. Walk's theory- weakness of abdominal wall at exit of neurovascular bundle.
11. Kith's theory- stress related degeneration a connective tissue especially in fascia transversalis.
12. Deficient insertion of the conjoint tendon seen in males especially among whites predisposes to direct inguinal hernia due to less support to post inguinal canal wall. Attachment is quite wide in females so direct hernias almost never occur in females.
13. Dr Desarda's theory —loss of strength and physiologically dynamic nature of the posterior wall of the inguinal canal, absent aponeurotic extension in the posterior wall

and loss of strength of cremasteric fascia and musculo-apneurotic structure around the inguinal canalis the cause of hernia formation.

Components of Inguinal Hernia[28]

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. It is most common site of obstruction.

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

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

- Enterocele: loop of intestine
- Omentocele (Synonym -Epiplocele): omentum.

3. Coverings[32]

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

a. extraperitoneal tissue
b. internal spermatic fascia
c. cremastric fascia
d. external spermatic fascia
e. skin

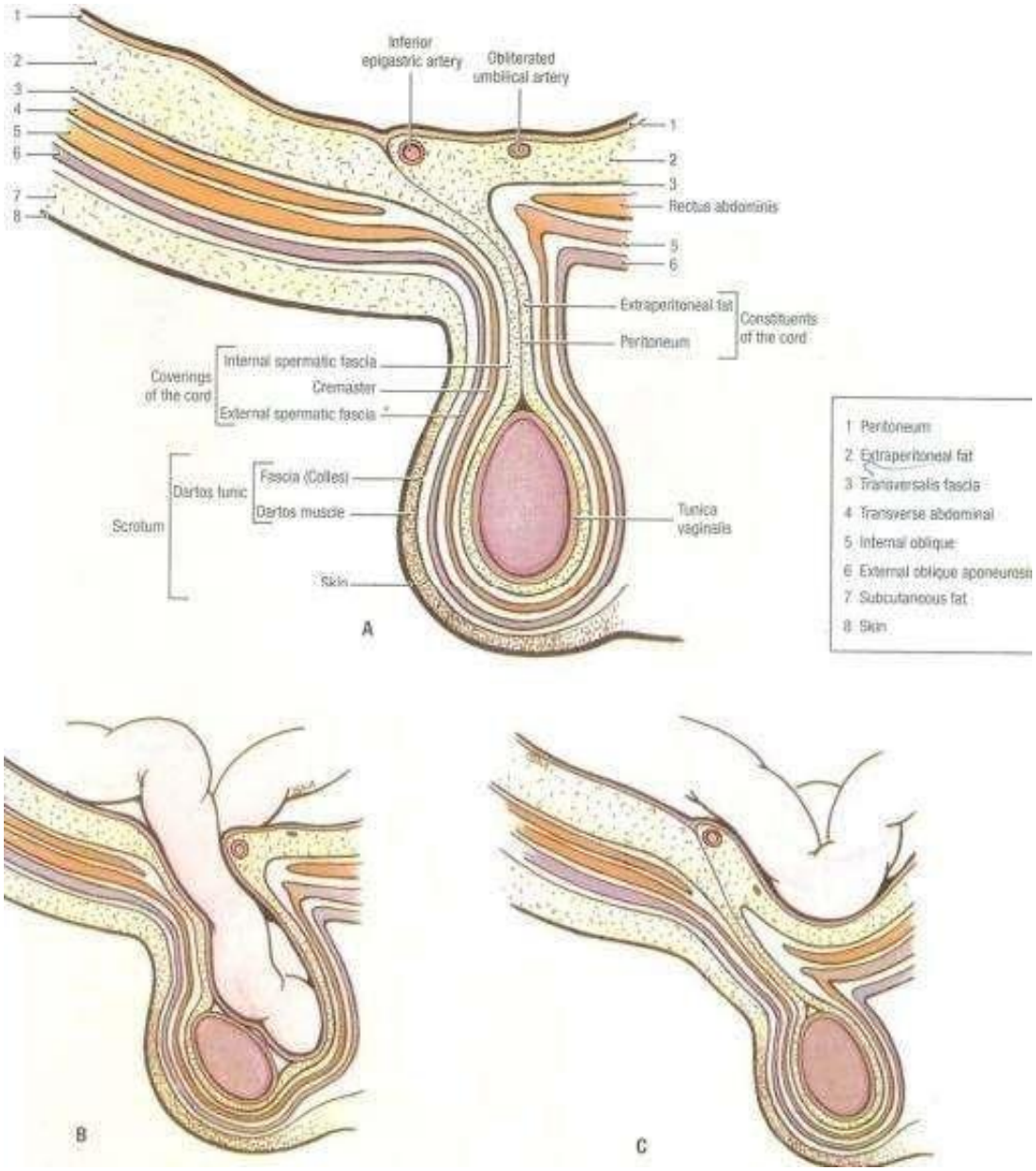


Figure-21. Coverings of inguinal hernia (A), Indirect (B), and Direct (C)

CLASSIFICATION OF INGUINAL HERNIAS [34,39]

Anatomical Classification

a. Direct hernia

b. Indirect hernia

c. Femoral hernia

Classification according to extent of the Sac

A. Bubonocele

B. Funicular

C. Complete

Classification according to contents of sac

a. omentocele

b. epiplocele

c. cystocele

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 in to 7 types. Type1, 2 and 3 were indirect hernias whereas type 4 and 5 were direct hernias.

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 criterias, focusing on functional state of posterior wall of the inguinal canal and the internal ring .

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

BENDAVID TSD CLASSIFICATION

TYPES

Anterolateral (indirect)

Anteromedial (direct)

Posteromedial (femoral)

Posterolateral (perivascular)

STAGES

I. Sac in canal

II. Sac outside external ring

III. Sac into scrotum

AACHEN CLASSIFICATION:

Grades:

I. Normal diameter of internal ring of upto 1.5 cms

II. Diameter of internal ring1.5cms to 3cms

III. Diameter of internal ring >3 cms

In combined hernia,total diameter of defects is considered.

Terms:

- M-Medial
- L-Lateral
- F-Femoral
- C-Combined

HALVERSON AND McVAY CLASSIFICATION

1. Small indirect inguinal hernia

2. Medium indirect inguinal hernia

3. Large indirect or direct inguinal hernia

4. Femoral hernia

PONKA'S CLASSIFICATION

1. INDIRECT INGUINAL HERNIA

-Uncomplicated indirect hernia

-Sliding inguinal hernia

2. DIRECT INGUINAL HERNIA

-Small defect on the medial aspect of the Hesselbach's triangle

-Diverticular hernia in the posterior wall with an otherwise intact inguinal floor.

-A large diffuse direct inguinal hernia of the entire floor of Hesselbach's triangle.

CASTEN'S CLASSIFICATION

Stage 1: An indirect hernia with a normal internal ring

Stage 2: An indirect hernia with enlarged internal ring

Stage 3: All direct or femoral hernias.

EHS(EUROPEAN HERNIA SOCIETY)

- Primary or Recurrent(P or R);
- Lateral, Medial or Femoral(L,M or F);
- Defect size in finger breadths assumed to be 1.5cm.

RARE VARIETIES OF HERNIA

- Richter's hernia : A portion of the circumference of the intestine.
- Ovary with or without the corresponding Fallopian tube.
- Littre's Hernia Meckel's diverticulum .
- Maydl's hernia :Two loops of intestine in the manner of W
- Rarely some times stomach, spleen or caecum may be found within the sac.

- Sliding or Hernia-en-Glissade (Contents - Caecum, Urinary bladder).

- AMYAND'S Hernia; appendix as its content..

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

CLINICAL FEATURES OF INGUINAL HERNIA [40 ,41]

History

Age: Inguinal hernias occur at all ages. They may be present at birth or may 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. Young individuals usually present with indirect inguinal hernias where as direct are seen in elderly.

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

Occupation: Heavy work, especially lifting increases the risk of inguinal hernias as this 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, weight lifters and sportsmen are more prone.

Associated diseases:

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

Local symptoms:

Pain : patient complains of discomfort, heaviness and pain in the initial stages. The patient complains of a dragging type of pain or an aching sensation in the groin, which gets worse as the day passes. So pain may appears long before the lump is noticed. pain continues to long as the hernia is progressing, but ceases when it fully formed.

Lump : A lump in the groin is the second most common complaint. This may be a small lump of about 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 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 the gangrene has set in, patient can present with features of peritonitis, more so if perforation of bowel has occurred.

Associated symptoms- persistent coughing, constipation, dysuria due to be bening enlargement of prostate or stricture urethra.

SIGNS:

ON LOCAL EXAMINATION

Inspection: In standing and supine position, a bulge or swelling will be seen in groin. This might disappear on lying down, if the hernia is reducible spontaneously as in direct hernia. Impulse on coughing is present in reducible hernias. In large inguino-scrotal hernias loss of rugosities of scrotal skin is seen. Visible peristalsis is seen in enterocele.

Malgaigne's bulges are seen in patients with lax abdominal wall. An indirect hernia is usually sausage or pear shaped and lies parallel to the inguinal ligament. After reduction it reappears more laterally and runs downwords 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.

ON PALPATION: Reducing the hernia by manipulation is called taxis .This is isually 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.

Getting above the swelling: Differentiates a scrotal swelling from an inguino-scrotal swelling, by palpating the root of the scrotum between the thumb and the other fingers it is not possible to get above the swelling in an inguinal hernia.

Relation of swelling to the testis and spermatic cord: scrotal the cord will be felt behind the swelling in case of indirect hernia, while it will be felt in front and external to the swelling in direct hernia. In congenital hernias testis lies within the swelling and felt behind the swelling. In acquired and funicular hernia the swelling stops at the upper pole of the testis.

Impulse on coughing: This test is performed with the patient standing with his /her legs apart and looking at ceiling. If there is no apperant swelling, a finger is kept over the external ring and the root of the scrotum is held between the thumb and index finger and the patient is asked to cough. this will force out the content of the hernia through the external ring and separate the thumb and the index finger kept at the root of the scrotum. This is called an ‘expansile cough impulse’. It is absent in strangulated and incarcerated hernia.

Reducibility: In the early stages, hernia appears when the patient stands and reduces when he lies down. As it grows larger it may not reduce spontaneously when he is lying down and the

patient learns to reduce it manually. In enterocele, first part is difficult to reduce but the last part slips in easily. In omentocele, it is easy to reduce the first part but difficult to reduce the last part.

Zieman's technique : Internal ring when there is no obvious swelling or after the has been reduced, the examiner places his corresponding index, middle and ring fingers on the indirect, direct and femoral hernia sites. The patient is asked to hold nose and blow out. A peculiar gliding motion of the walls of an empty sac or typical pushing sensation will be felt beneath the fingers, if a hernia is present in any one of these corresponding sites.

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 inguinal hernia, if not an indirect hernia.

External Ring Occlusion Test: After complete reduction, 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.

DIFFERENCE BETWEEN DIRECT AND INDIRECT HERNIA[44]

TABLE NO 1

FEATURES	**INDIRECT**	**DIRECT**
Age	Can occur in any age from childhood to adult	Common in elderly
Development	Occurs in a preexisting sac	Acquired
Site	Unilateral can be bilateral	Usually bilateral
Shape	Pyriform / oval(pear like)	Globular(apple like)

Internal ring occlusion	swelling does not appear	Swelling appears medial to occluding finger
Zieman's technique	Impulse felt at index finger	Impulse felt at middle finger
Finger invagination test	Felt in the tip of finger	Felt at pulp of fingers
Malgaigne's bulges	Usually absent	Usually present
descends into scrotum	common	Rare
Obstruction and strangulation	common	Rare
Relation of sac to cord	Anterolateral	Posterior

Differential Diagnosis of Inguinal Hernia

a. Femoral hernia.

b. Enlarged Inguinal Lymph Nodes.

c. Lymph Varix:

d. Femoral Aneurysm.

e. Lipoma of the Cord.

f. Hydrocele: infantile, Encysted Hydrocele of the Cord, large vaginal, bilocular hydrocele

g. Undescended or Ectopic Testis.

h. Groin Abscesses

COMPLICATIONS OF GROIN HERNIA [42]

Certain complications are well recognized.

Irreducibility

Incarceration

Reduction-en-masse

Strangulation

Gangrene

Peritonitis due to perforation of the intestinal wall and

Malignant mesothelioma (very rarely).

INVESTIGATIONS 43 ,44 ,45

The Laboratory and radiological aids are of limited use in the diagnosis of inguinal hernias.

1. Chest x-ray to find pulmonary pathology.
2. X-ray examination of the abdomen (Plain x-ray erect abdomen) may reveal the patterns characteristic of intestinal obstruction with air and fluid filled loops of intestine as in inguinal hernias.
3. Ultrasound of the abdomen to know the obstructive urinary outflow diseases. .
4. Routine laboratory investigations like Hemoglobin, urine routine, blood urea and serum Creatinine will aid in the search of normal parameters before taking the patient for Surgery.
5. Other investigations to rule out precipitating causes.

Herniography:

According to the literature, herniography is used primarily in patients with unexplained groin pain, or to find non-palpable, 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 inside into the lesser pelvis and 50 to 80 ml of contrast medium is injected. As soon as the patients turns form side to side in

the prone position, the contrast medium pools into the inguinal region. The techniques which are now available, we believe that there is no indication for herniography, even if the complication rate is low.

TREATMENT OF INGUINAL HERNIAS [46,47,48]

The main 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 most 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.

CONSERVATIVE MANAGEMENT:

Truss used in elderly people who are not fit for surgery. due its complications use should be discouraged.

TYPES OF SURGICAL TREATMENTS FOR INGUINAL HERNIA

REPAIR

1.PURE TISSUE REPAIR: Desarda, should ice, MacVay, Modified Bassini's

2.PROSTHETIC REPAIR: Lichtenstein, Rives, Gilbert, Stoppas, TEP, TAPP

APPROACH FOR REPAIR:

1.ANTERIOR:

Bassini's,Desarda,Shouldice,MacVay,Andrew's,Rives,cooper's,Wilkinson's,Lichtenstein

2.POSTERIOR

Nyhus, Stoppas, Kugel's, TEP, TAPP

Herniotomy: 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 Adults in whom the internal ring is stretched.

2. 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.[86]

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. Nonabsorbable 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.

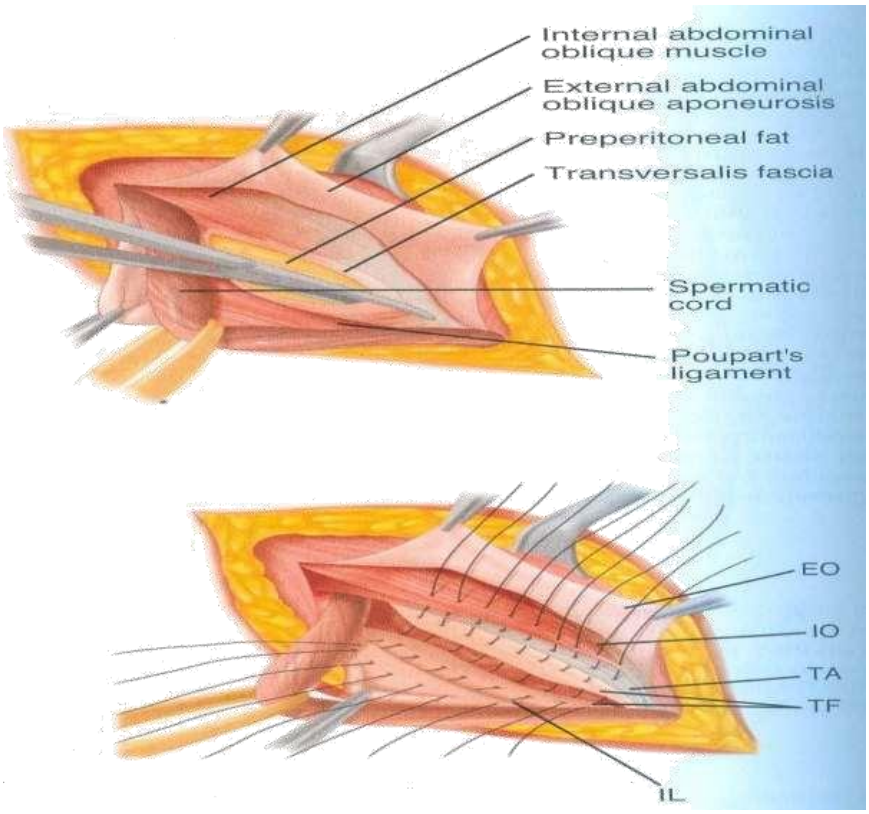


Figure -22. Bassinis Repair

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

Shouldice operation : 42,49,50

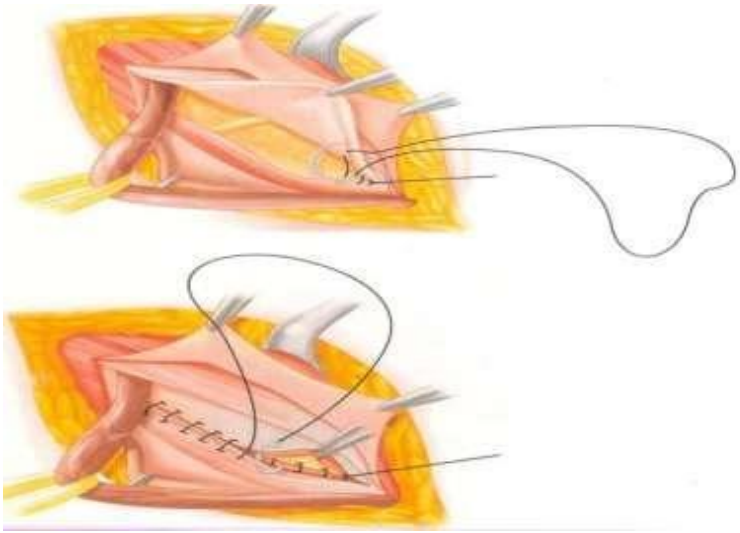
The classical Shouldice method of hernial repair was described by Shouldice of Toronto (1908-1965). It is the most popular of those, using only local tissues. It is basically a multilayered Bassini's operation.In Shouldice hospital all operations are done under local anesthesia. After opening the inguinal 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.



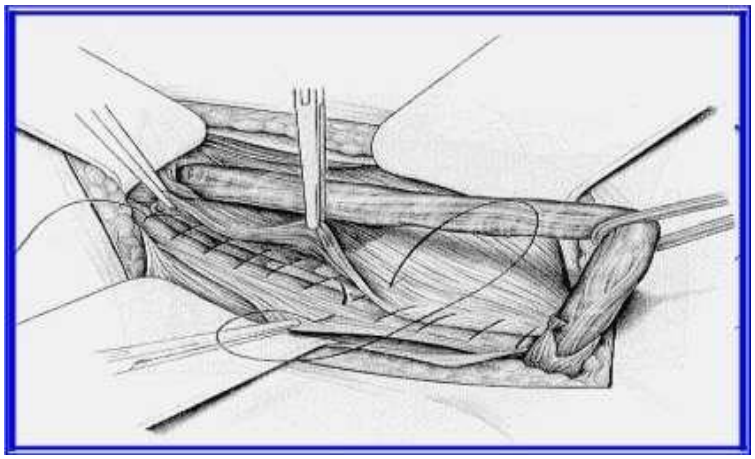


Figure -23. Shouldice Repair (A and B)

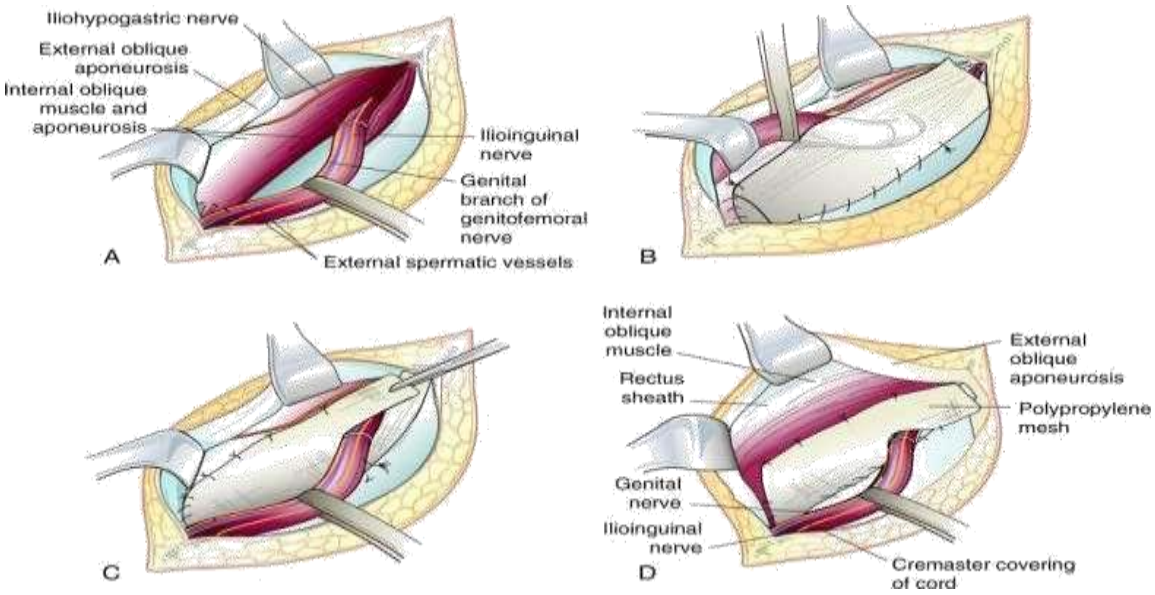


Figure -24. Lichtenstein Tension free Mesh Repair

Figure- 25. Polypropylene mesh

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.[87]

Operative technique[87]: 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, where as the mouth of distal portion is left undissected, but wide open[87].

Onlay mesh:[52,53] 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. [54]

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)[55]

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)[85]

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 suture less and tension-free repair[85].

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[85].The recurrent rate of primary inguinal hernia is 0.7% and for recurrent inguinal hernia 0.8%

Laparoscopic Inguinal Hernia Surgery[9,10,43]

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 anaesthesia and the cost of the procedure. For some patients general anaesthesia is contraindicated. For others, laproscopic procedure 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 hernia defect and a complete dissection of pre-peritoneal space is accomplished using instruments placed intra abdominally via accessory ports. During the course of preperitoneal 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. Laparoscopically we have to look for two important triangles

TRIANGLE OF PAIN: A ‘V’ Shaped area with its apex at the internal inguinal ring.

Anteriorly: iliopubic tract

Medially: testicular vessels

Laterally: peritoneal reflection

This triangle contains femoral branch genitifemoral nerve,anterior and lateral femoral cutaneous nerves.

TRIANGLE OF DOOM: Is an Inverted V shape

Medially: vas deferens

Laterally: spermatic vessels

Inferiorly: peritoneal fold

This triangle contains external iliac artery and vein,deep circumflex iliac vein,genital branch of genitofemoral nerve and femoral nerve.In this area surgical staples should be avoided.

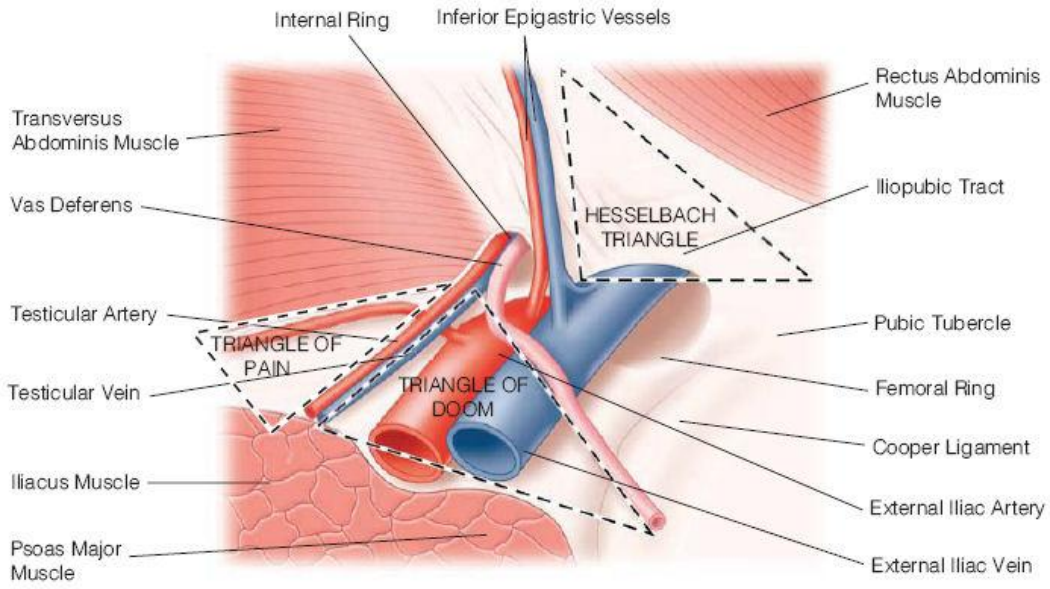


Fig – 26. Triangle of pain and triangle of doom

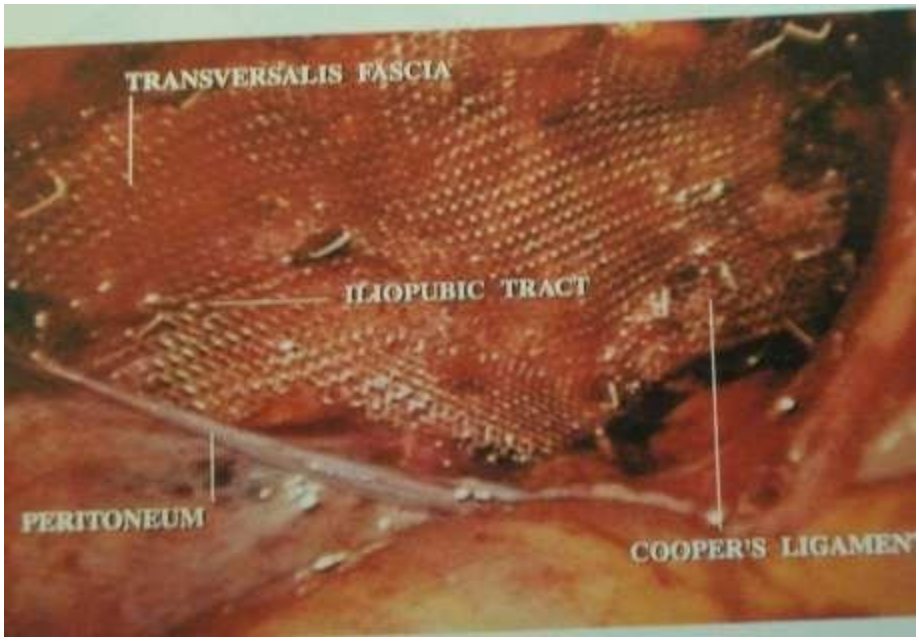


Figure-27. Laparoscopic Hernia Repair (TAPP)

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 preperitoneal 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 -28. Laparoscopic Hernia Repair (TEP)

Dr. DESARDA'S HERNIORAPPHY WITHOUT MESH .[7,9,83,84]:

Many operations developed to date deal only with anatomical aspects of the repair. Any failure in these operations is because of the physiological aspects have not been considered while developing a new operating technique. A new technique of pure tissue repair of any type of inguinal hernia without a mesh,based on the concept of constructing a strong and

physiologically dynamic posterior wall to inguinal canal with the help of the external oblique muscle and its aponeurosis[83].

A strip of external oblique apponeurosis gives replacaement to the absent apponeurotic extentions in the posterior wall, making it strong,and the additional strength of external oblique muscle to the weakened internal oblique and transverse abdominis muscle keeps it physiologically dynamic.

DESCRIPTION OF THE PROCEDURE STEP BY STEP[83,84]:

1. Skin and fascia are incised through a regular oblique inguinal incision to expose the external oblique aponeurosis. The filmy, thin fascial layer covering it is kept undisturbed as far as possible and an assessment made about the strength of it and its thinned-out portion. Most of the time thinned out portion is usually seen at the top of the hernia swelling, extending and fanning out to the lower crux of the superficial ring.

2. The external oblique is cut in line with the upper crux of the superficial ring, which leaves the thinned out portion in the lower leaf so a good strip can be taken from the upper leaf. The external oblique, is thinned out as a result of aging or long standing large hernias, can also be used for repair if it is able to hold the interrupted sutures.

3. The cremasteric muscle is incised for the herniotomy and the spermatic cord together with the cremasteric muscle is separated from the inguinal floor. The sac is excised in all indirect hernia cases except in small direct hernias where it is inverted.

4. The medial leaf of the external oblique aponeurosis is sutured with the inguinal ligament from the pubic tubercle to the abdominal ring using No1 PROLENE

continuous sutures. The first two sutures As to be taken in the anterior rectus sheath where it joins the external oblique aponeurosis. The last suture is taken so as to narrow the internal ring sufficiently without constricting the spermatic cord. Each suture is passed first through the inguinal ligament, and then the transversalis fascia, and then the external oblique. The index finger of the left hand is always used to protect the femoral vessels and retract the cord structures laterally while taking in lateral sutures.

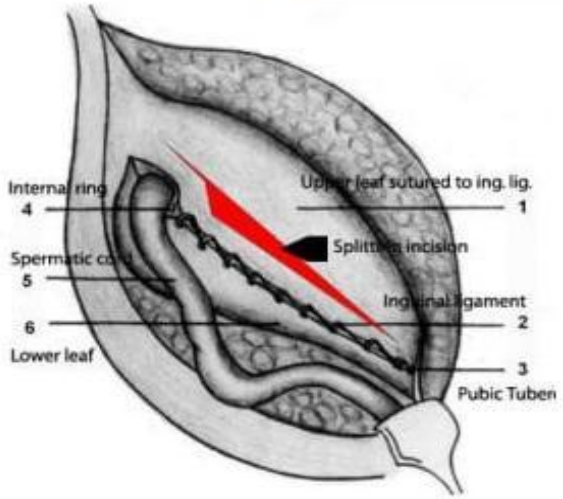
5. A splitting incision is made in this sutured medial leaf, partially separating a strip with a width equivalent to the gap between the muscle arch and the inguinal ligament but not more than 2 cms. This splitting incision is extended medially up to the pubic symphisis and laterally 1 to 2 cms beyond the internal ring. The medial insertion and lateral continuation of strip is kept intact. A strip of the external oblique, is now available, the lower border of which is already sutured to the inguinal ligament. The upper free border of the strip is now sutured to the internal oblique or conjoined muscle lying close to it with NO 1 PROLENE. The aponeurotic portion of the internal oblique muscle is used for suturing to this strip wherever and whenever possible to avoid tension; otherwise, it is not a must for the success of the operation. This result in the strip of the external oblique being placed behind the cord to form a new posterior wall of the inguinal canal.

6. The spermatic cord is placed in the inguinal canal and the lateral leaf of the external oblique is sutured to the newly formed medial leaf of the external oblique in front of the cord, as usual, again using NO 1 PROLENE continuous sutures. Undermining of the newly formed medial leaf on both of its surfaces facilitate its approximation to the lateral leaf. The first stitch is taken between the lateral corner of the splitting incision

and lateral leaf of the external oblique. Followed by closure of the superfacial fascia and the skin as usual.

MECHANISM OF ACTION[83,84]:

Contraction the external oblique muscle creates lateral tension in this stripe while contraction the internal oblique /conjoint muscle pulls this strip upwards and laterally creating tension above and laterally , making the strip a shield to prevent any herniation. This additional strength given by the external oblique muscle to the weakened conjoint muscle to create tension in the strip and prevent re herniation, is the essence of the operation. Tension created in the strip is graded as per the force of the muscle contraction. Stronger intra abdominal blows result in stronger abdominal muscle contractions and stronger contractions results in increased tension in this strip to give graded protection. A strong and physiologically active posterior wall is prepared in this operation[83]. The transversalis fascia acts a barrier to prevent hernia simply because it is supported in the posterior wall of the inguinal canal by aponeurotic extension from the muscle arch if those aponeurotic extensions are absent and the transversalis fscia is weak then use of such transversalis fascia in any stage of repair should be redundant. In this operation ,the weakened transversalis fascia is supported by the shielding action of the strip of the external oblique on the posterior wall of the inguinal canal in place of absent aponeurotic extension. Moreover , there is minimal or more fibrosis and posterior wall remains mobile.[84]



STEP 1 : The medial leaf of the external oblique aponeurosis is sutured to the Inguinal ligament And a splitting incision is taken 2cm above and parallel to the suture line

STEP 2 : Undetached strip of external oblique aponeurosis forming the posterior wall of inguinal canal by suturing it to the conjoined tendon and the reflected upperleaf is sutured to the lower leaf of external oblique to close the inguinal canal with the cord structures inside it.

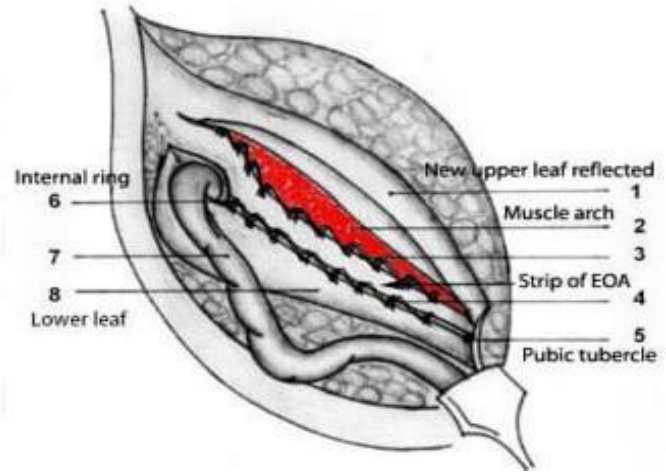


Fig-29. DESARDA'S REPAIR

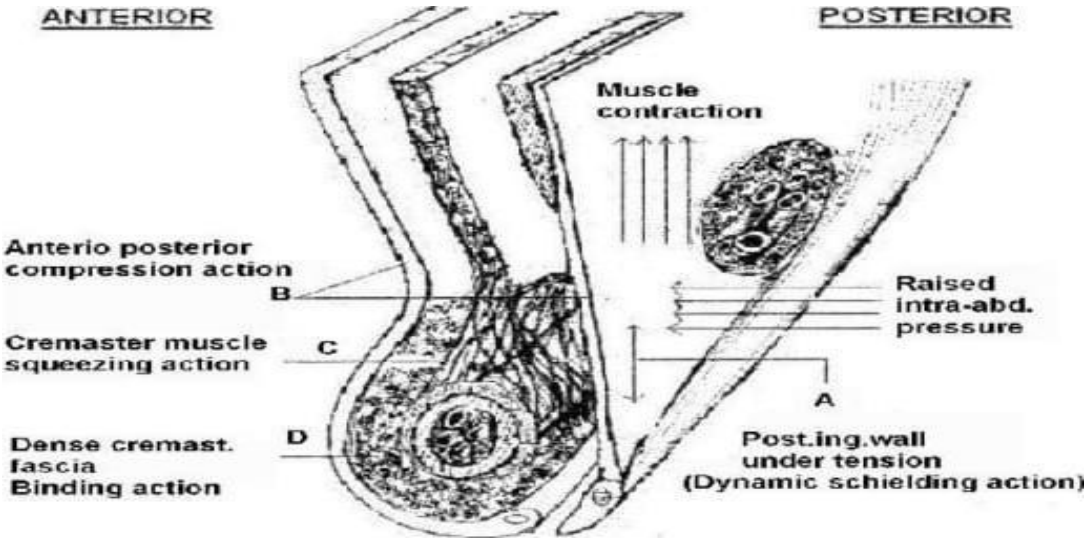


Fig-30. Mechanism of Action of desarda's repair

COMPLICATIONS OF INGUINAL HERNIA SURGERY[59,60]

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. Complications as follows

Hemorrhage

Injury to bowel and bladder

Hematoma

Seroma

Hematocele

lymphocele

Surgical site infection

Ostitis pubis

Post herniorraphy hydrocele

Testicular atrophy

Pampiform plexus thrombosis

Hyperesthesia over the medial side of inguinal region due to iliohypogasric nerve

Chronic groin pain

Chronic post-herniorrhaphy groin pain, defined as pain lasting more than 3 months, occurs with greater frequency. The incidence ranges from 0-10%.

Various groin pain syndromes may develop usually from scar tissue, reaction to prosthetic material, or involvement of a nerve in staples, or suture material during repair of the hernia.

Prosthetic complications

Mesh infection and mesh migration

Laparoscopic complications

Vascular injury

- Intra abdominal
- Retroperitoneal
- Abdominal wall
- Gas embolism

Visceral injury

- Bowel perforation
- Bladder perforation

Trocar Site complications

- Haematoma
- Hernia
- Wound infection
- Keloid

Bowel Obstruction

- Adhesion

Miscellaneous

- Diaphragmatic dysfunction
- Hypercarbia

Recurrence

Incidence of recurrence is 1%. These are common with tissue repairs due to repair under tension. It is less with tensionless mesh repair. Recurrence is commonly due to the technical failure. Causes for recurrence are

PRE OPERATIVE;

Smoking

Chronic cough

Constipation

Old age

Anemia

Hypoprotenemia

Straining, increased intra abdominal pressure

Ascitis

OPERATIVE

Tension in the sutures

Improper technique

Weak anterior abdominal wall

POST OPERATIVE

Infection

Hematoma

Retained sac pantaloon

Straining

Figure -31. Bilateral direct Inguinal Hernia

Figure -32. Left sided Indirect Inguinal Hernia

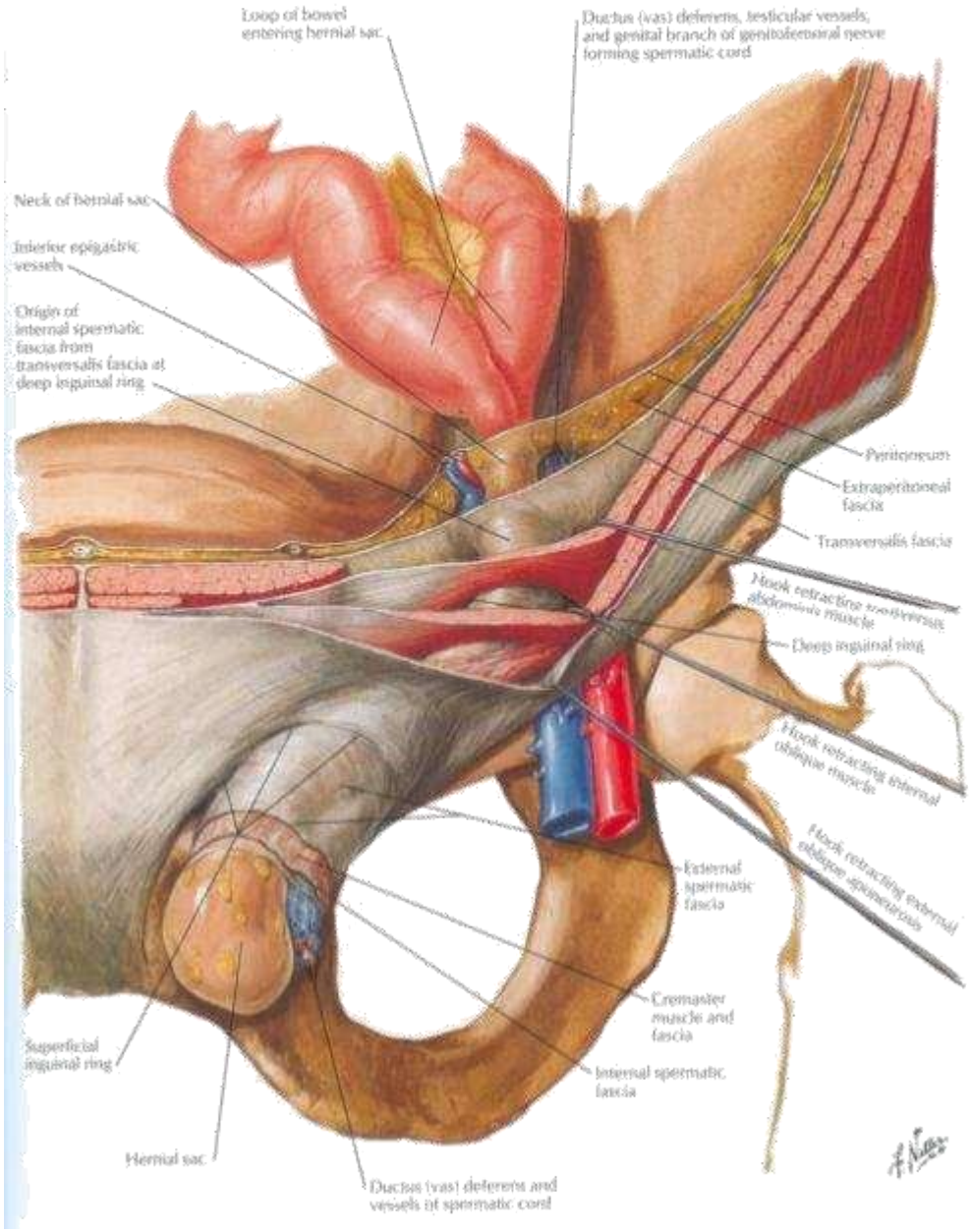


Figure -33. Hernial sac with Indirect Component

METHODOLOGY

Detailed history will be taken and patients will be examined thoroughly.

Patients will undergo necessary investigations including blood routine including Heamoglobin, Total count, Differential count, Platelet count ,Bleeding time, Cloting time and Biochemical routine including Blood Urea, Serum creatinine and urine analysis. Chest Xray and Electrocardiography if required.

Any other investigations will be done if required based on history and other complaints

Written informed consent will be obtained from all the patient with detailed explanation of the procedure going to be performed on them the risks and complications involved and the advantages and disadvantages of the same and patient will be given a choice of which procedure he wants to undergo.

Primary outcome is post operative pain was calculated at post op 3rd, 14th day, 1month, 3month by **Sheffield scale for pain.**

Grade 0-*no pain,*

Grade 1-*no pain at rest but appears during movement*

Grade 2-*temporary pain at rest and during movement*

Grade 3-*constant pain at rest and severe during movement.*

Patient will be asked to fill a proforma detailing all the study aims and objectives.

STUDY DESIGN

Prospective comparative study.

SAMPLE SIZE

Samlpe size calculation

A study conducted by Szopinski J, Dabrowiecki S, Pierscinski S, Jackowski M, Jaworski M, Szuflet Z titled Desarda versus Lichtenstein technique for primary inguinal hernia treatment: 3-year results of a randomized clinical trial published in 2012[81] is taken as reference for our study group

With Anticipated Mean Difference of Post operative pain (Sheffield scale) between the two study groups as 1.2 and Anticipated SD as 1.4, the minimum sample size per group is 35 With 90% power and 5% level of significance.

By using the formula:

$$n = \frac{(z_\alpha + z_\beta)^2 \, 2 \, SD^2}{MD^2}$$

Where Z= Z statistic at a level of significance

MD= Anticipated mean difference

SD= Anticipated Standard deviation

Statistical analysis

Data will be represented using Mean ±SD, and analyzed by Chi square test for association, comparison of means using t test, ANOVA and diagrammatic presentation.

CRITERIA FOR SAMPLING

a) INCLUSION CRITERIA

All cases of inguinal hernia admitted for surgery

1. Above 18 years of age.

2. With a primary, reducible inguinal or inguino-scrotal hernia; unilateral or bilateral hernia.

b)EXCLUSION CRITERIA

Patients with:

1. Old and debilitated patients of poor general condition as they will be unable to give an accurate assessment of the key outcomes of the operation.

2. Recurrent Hernias.

3. Intra operative finding of separated, thin and/or weak external oblique aponeurosis

TOOLS FOR DATA COLLECTION

Patient will be given a proforma to fill up and the objectives will be studied in detail by following up the patient for one year with periodical follow up.

TIME AND DURATION OF THE STUDY

First 18 months is utilized for taking patient into study group and last 6 month for follow up and analysis of data from November 2017-April 2019

RESULTS

The present study was carried out at Department of General Surgery ,SHRI B.M PATIL MEDICAL COLLEGE ,VIJAYAPURA

STUDY DESIGN: Single Centre, Single Blind, Randomized two group comparative Surgical Study.

TOTAL SUBJESTS: A Total of 70 patients were enrolled in this study. They were randomised into two groups desarda and mesh

DESARDA: This group included 35 patients in whom underwent repair using EXTERNAL OBLIQUE APONEUROSIS –DESARDA'S Repair.

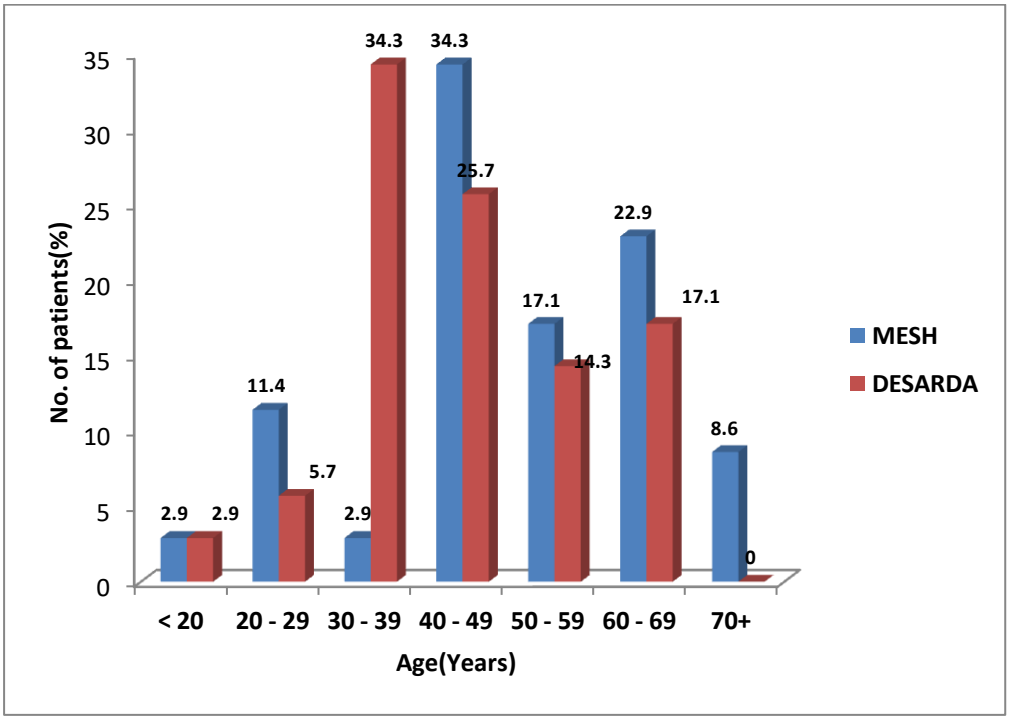
MESH : This group include 35 patients in whom Prolene MESH was used i.e Underwent Lichtenstein's Procedure.

Evaluation of all patients included in the study with respect to history, physical findings, operative findings and postoperative complications in line with the predetermined objectives was done. Thirty six patients underwent Desarda's repair and thirty six patients underwent Lichtenstein mesh repair. All the patients in both groups were followed for a period of 6 months. The patients are followed up at one monthly, three monthly and six monthly intervals for any complications or recurrence. Any recurrence of hernia or death of patient was regarded an end point.

The Observations made during the course of the study were as follows.

Table 2: Distribution of patients according to Age (Years)

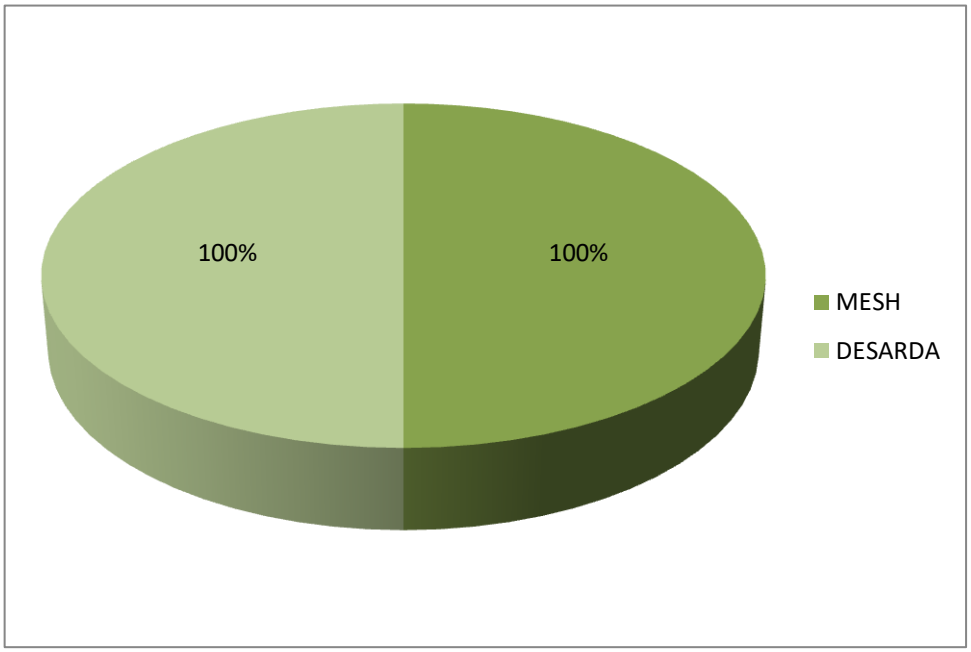
Age(Years)	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
< 20	1	2.9	1	2.9	X^2=13.780	P=0.032
20 - 29	4	11.4	2	5.7		
30 - 39	1	2.9	12	34.3		
40 - 49	12	34.3	9	25.7		
50 - 59	6	17.1	5	14.3		
60 - 69	8	22.9	6	17.1		
70+	3	8.6	0	0		
Total	35	100.0	35	100.0		



Age ranged between 19 to 70 years among patients undergoing Desarda's repair and 19 to72 years in Lichtenstein repair.With the mean age of presentation between and Lichtenstein mesh vs and Desarda group is 49.89 and 43.71 years respectively. p value between mesh and desarda group is 0.032. There was no significance difference in the age in both the groups.

Table 3: Distribution of patients according to Gender

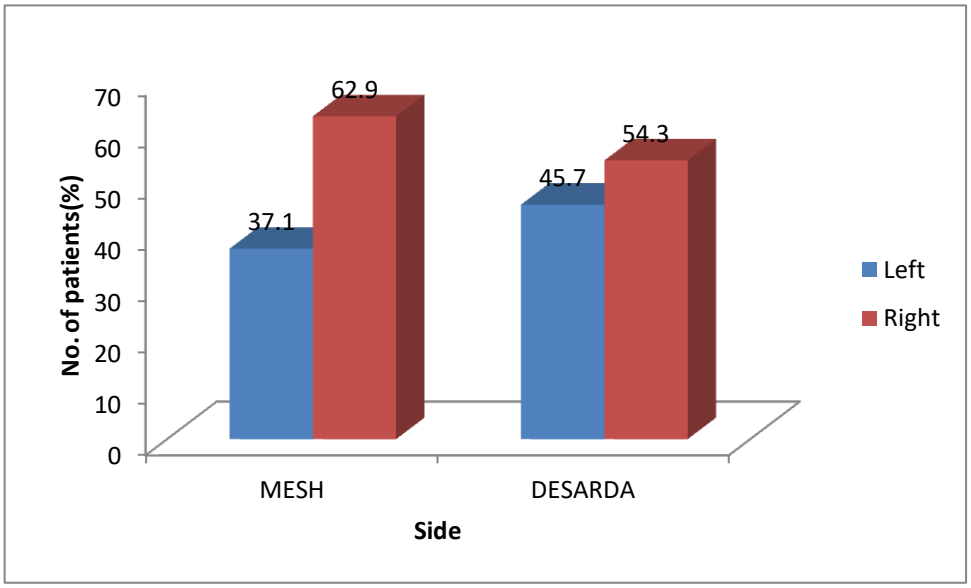
Gender	MESH		DESARDA	
	No. of patients	Percentage	No. of patients	Percentage
Male	35	100.0	35	100.0
Total	35	100.0	35	100.0



In this study all the patients included were male .35patients in both in Desarda's group and Lichtenstein group .No females were included in the study.

Table 4: Distribution of patients according to Side

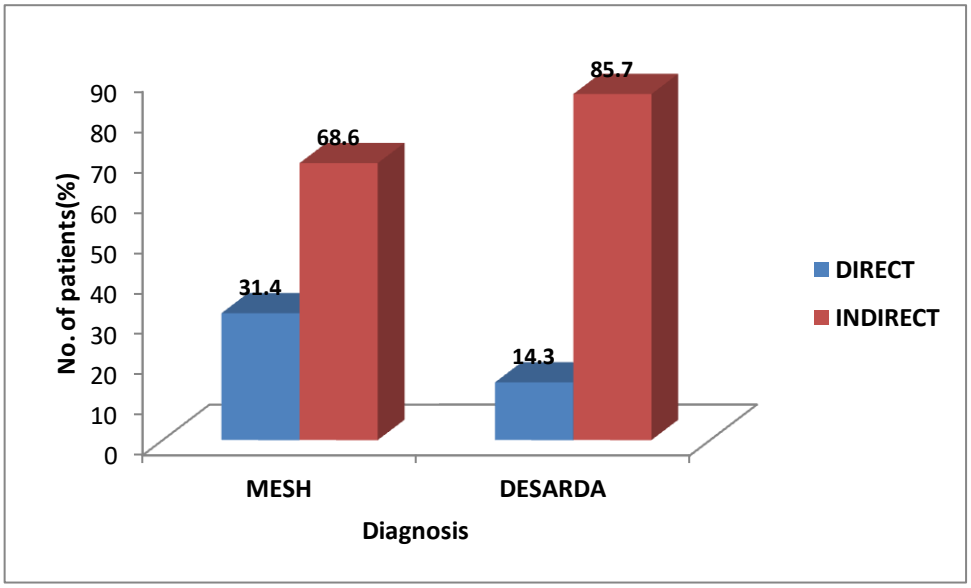
Side	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Left	13	37.1	16	45.7	X^2=0.5299	P=0.466
Right	22	62.9	19	54.3		
Total	35	100.0	35	100.0		



The present study showed that hernia was more common on right side 62.9% and 54.3%. Left sided hernia comprised about 37.1% and 45.7% in Lichtenstein mesh and desarda group. However the difference was not satistically significant with P value of 0.466.

Table 5: Distribution of patients according to TYPE OF HERNIA

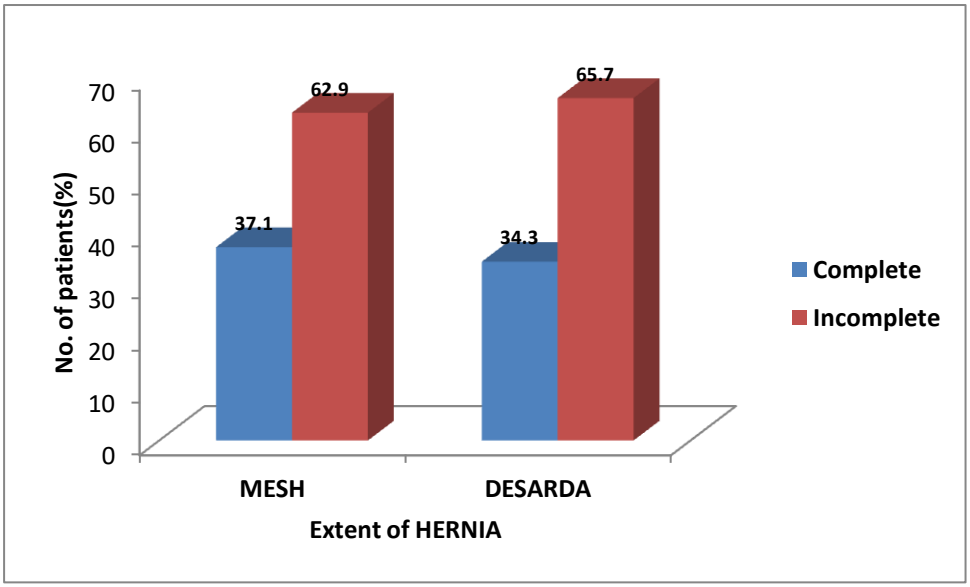
TYPE	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
DIRECT	11	31.4	5	14.3		
INDIRECT	24	68.6	30	85.7	X^2=2.917	P=0.087
Total	35	100.0	35	100.0		



In this present study 35cases of desarda group had Direct and Indirect hernia which contributed 14.3% and 85.7% in each type. And 35 cases Lichtenstein mesh had 31.4% Direct hernia and 68.6% Indirect hernia.

Table 6: Distribution of patients according to EXTENT of HERNIA

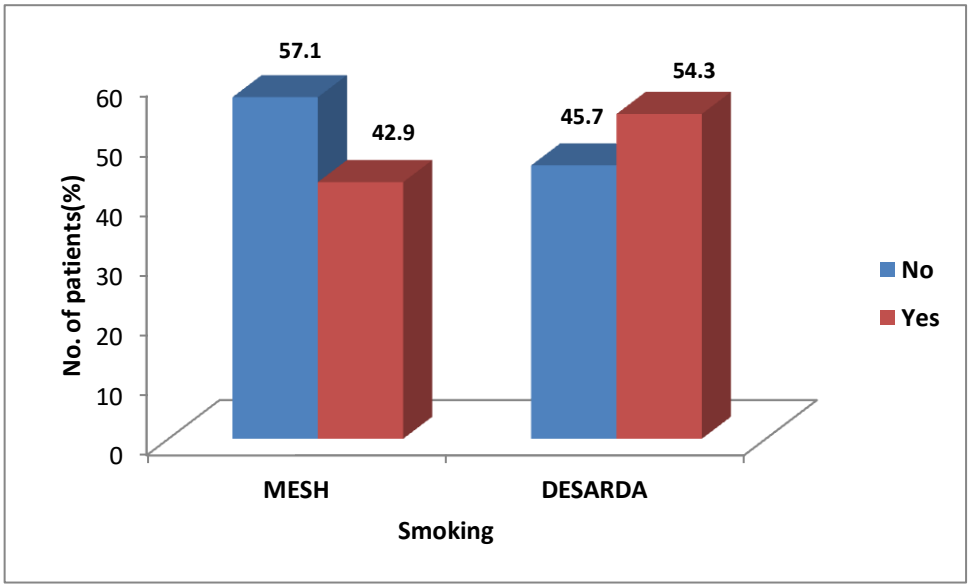
EXTENT of HERNIA	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Complete	13	37.1	12	34.3		
Incomplete	22	62.9	23	65.7	X^2=0.0622	P=0.8030
Total	35	100.0	35	100.0		



In this study 34.3% and 37.1% patients had complete inguinal hernia, 65.7% and 62.9% patients had incomplete inguinal hernia in desarda's and Lichtenstein mesh group respectively. Most of the patients had incomplete inguinal hernia in both the groups. With insignificant p value 0.8030

Table 7: Distribution of patients according to Smoking

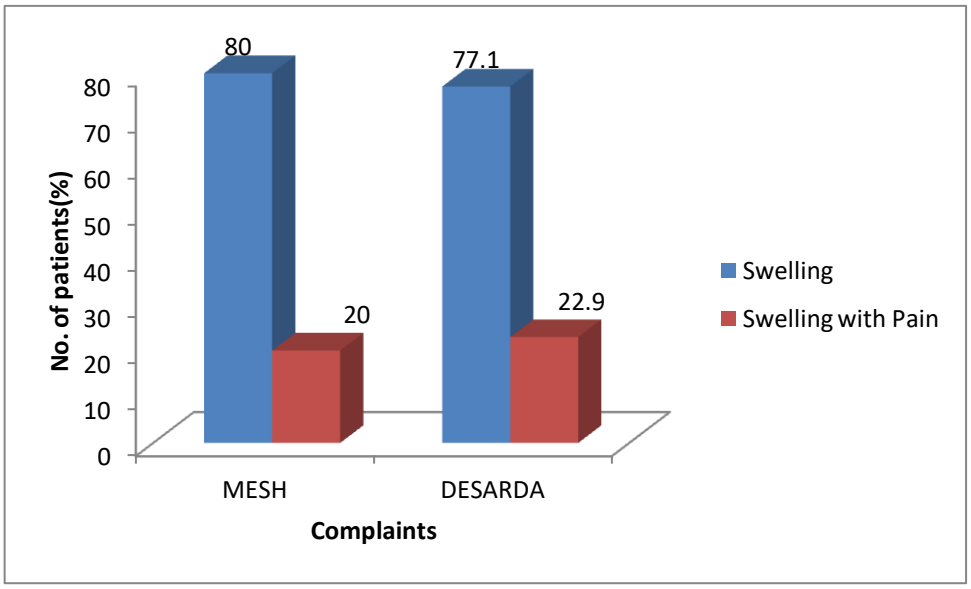
Smoking	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
No	20	57.1	16	45.7		
Yes	15	42.9	19	54.3	X^2=0.9150	P=0.338
Total	35	100.0	35	100.0		



In this study 54.3% and 42.9% patients are chronic smokers,among desarda's group and Lichtenstein group respectively.

Table 8: Distribution of patients according to Complaints

Complaints	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Swelling	28	80.0	27	77.1	X^2=0.084	P=0.7708
Swelling with Pain	7	20.0	8	22.9		
Total	35	100.0	35	100.0		



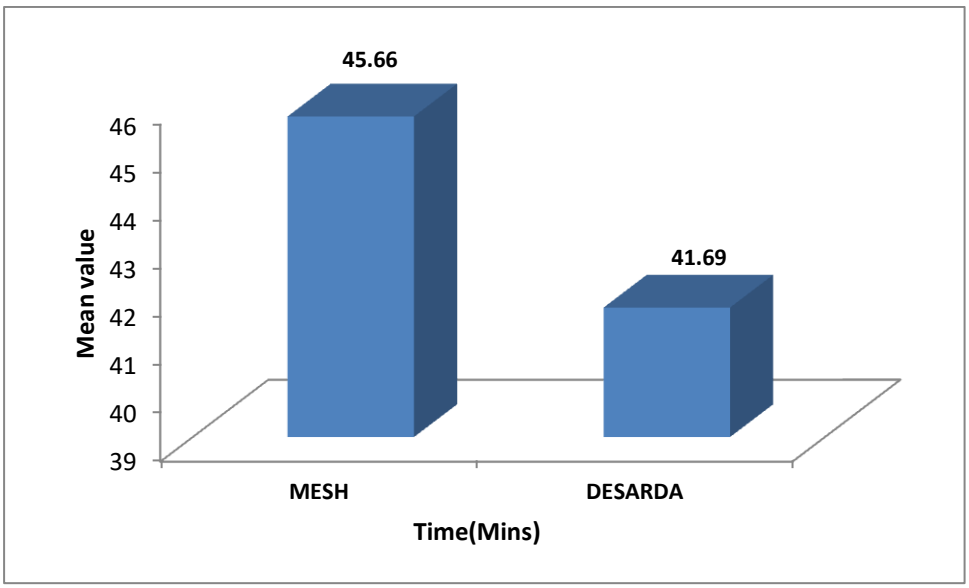
Without exception all the patients presented with swelling, of these 77.1% and 80.0% presented with only swelling, 22.9% and 20% patients presented with both swelling and pain in Desarda's and Lichtenstein mesh group respectively. There was no statistical difference in both groups with P value 0.77.

OUTCOME ASSESMENT:

Table 9: Comparison of variables between MESH and DESARDA group;

COMPARISION OF DURATION OF SURGERY:

Variables	MESH		DESARDA		Mann whitney U test	P value
	Mean	±SD	Mean	±SD		
TIME(MIN)	45.66	2.578	41.69	1.676	U=138.000	P<0.001 HS

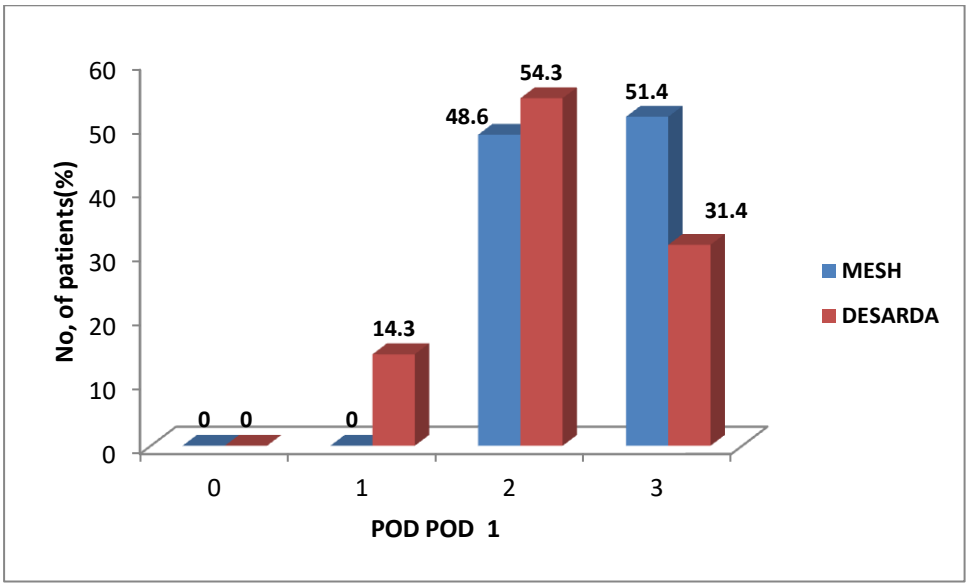


The mean duration of surgery in Desarda group was 41.69±1.676 while that in Lichtenstein group was 45.66±2.578 There was a satistically significant difference of nearly 4 minutes with a P value of <0.001

COMPARISON OF POST OPERATIVE PAIN:

Table 10: Distribution of patients according Pain POD 1

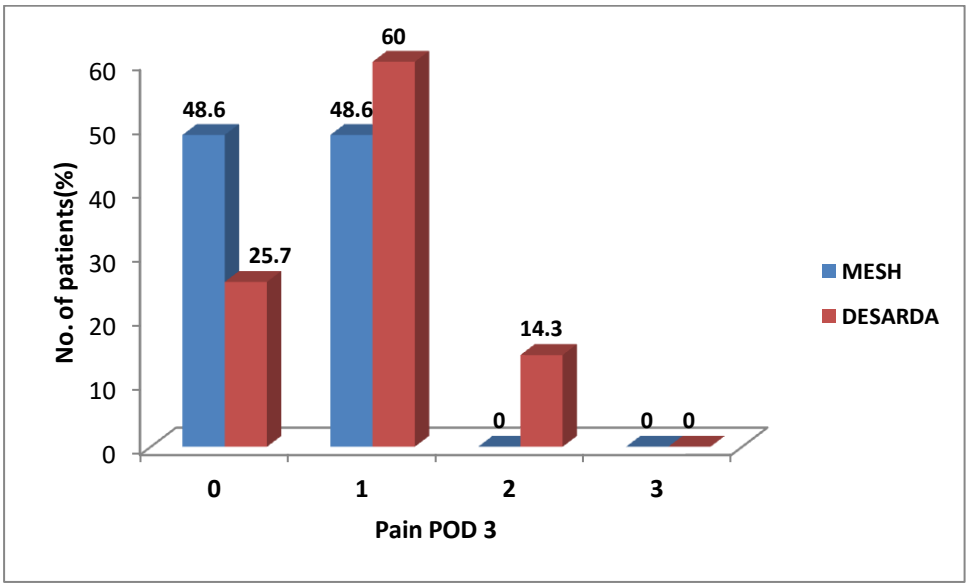
Pain-POD 1	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
0	0	0	0	0	X^2=6.801	P=0.00331 Sign
1	0	0	5	14.3		
2	17	48.6	19	54.3		
3	18	51.4	11	31.4		
Total	35	100	35	100		



On post operative **day -1:** 14.3% vs 0.0% had mild pain, 54.3% had moderate pain in desarda and 48.6% in mesh group, 31.4% vs 51.4% had severe pain in desarda's and Lichtenstein group respectively. Here the p value was found to be significant (p=0.00331).

Table 11: Distribution of patients according Pain POD 3

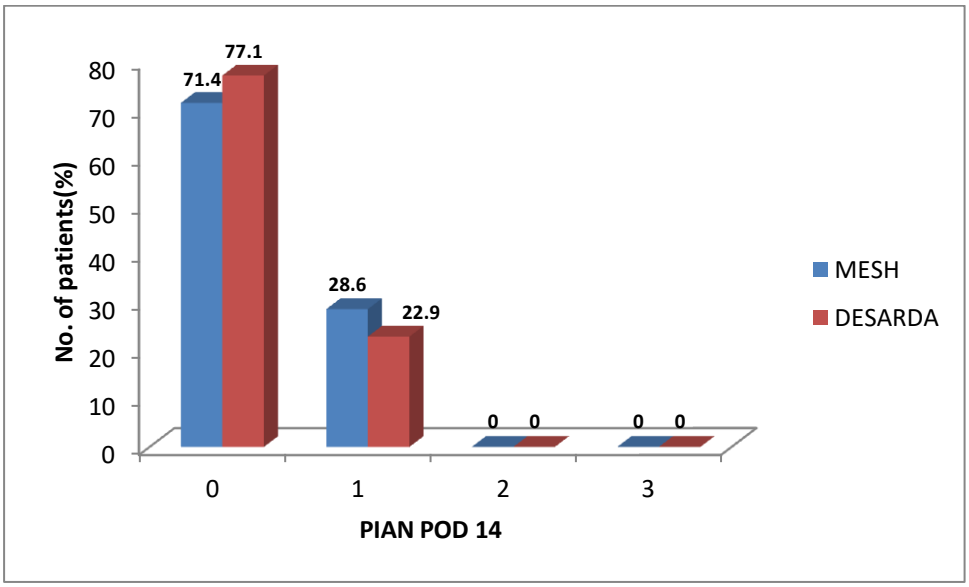
Pain-POD 3	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
0	17	48.6	9	25.7	X^2=5.549	P=0.0624 NS
1	17	48.6	21	60		
2	1	2.9	5	14.3		
3	0	0	0	0		
Total	3W5(100)	100	35(100.0)	100		



On POD-3; 25.70% vs 48.6% had no pain, 60% vs 48.6% had mild pain,14.3% vs 2.9% had moderate pain in both desarda's and Lichtenstein group respectively with insignificant p value (p->0.05).

Table 12: Distribution of patients according Pain POD 14

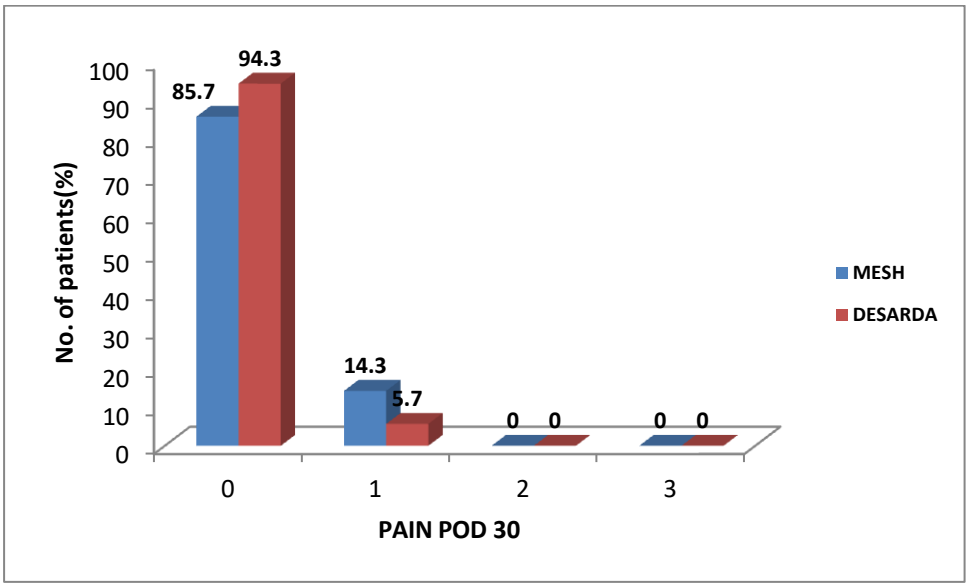
Pain-POD 14	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
0	25	71.4	27	77.1	X^2=0.2991	P=0.5844 NS
1	10	28.6	8	22.9		
2	0	0	0	0		
3	0	0	0	0		
Total	3W5	100	35	100		



On POD-14; 77.1% vs 71.4% patients had no pain, 22.9% vs 28.6% had mild pain in desarda's and Lichtenstein group respectively with less significant p value (p>0.05).

Table 13: Distribution of patients according Pain POD 30

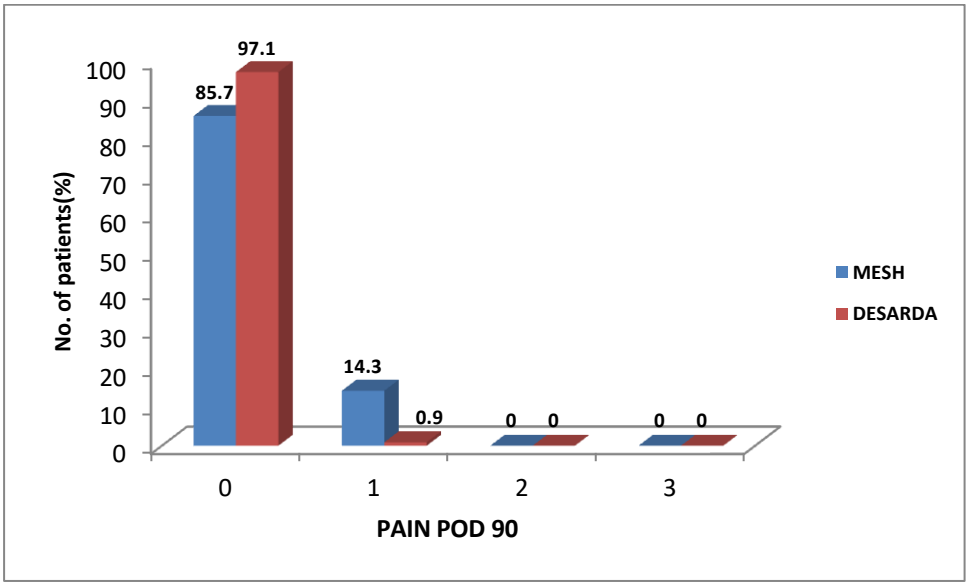
Pain-POD 30	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
0	30	85.7	33	94.3	X^2=1.429	P=0.2320 NS
1	5	14.3	2	5.7		
2	0	0	0	0		
3	0	0	0	0		
Total	3W5(100)	100	35(100.0)	100		



On POD-30; 94.3% vs 85.7% had no pain, 5.7% vs 14.3% had mild pain in desarda's and Lichtenstein group respectively with insignificant p value(p>0.05).

Table 14: Distribution of patients according Pain POD 90

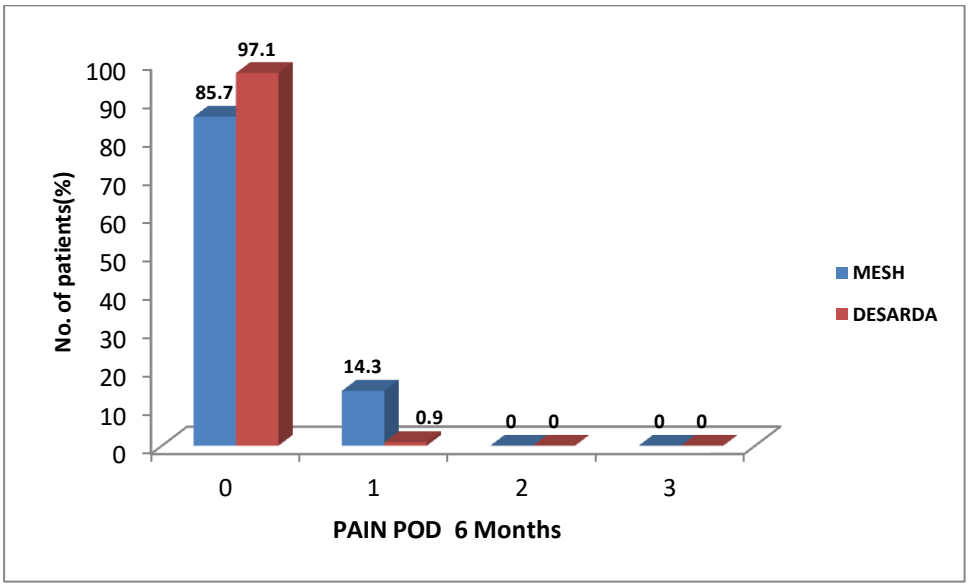
Pain-POD 90	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
0	30	85.7	34	97.1	X^2=2.917	P=0.0877 NS
1	5	14.3	1	2.9		
2	0	0	0	0		
3	0	0	0	0		
Total	35	100	35	100		



On POD-90 ; 97.1% vs 85.7% patients had no pain, 2.9% vs 14.3% had mild pain in desarda's and Lichtenstein group respectively with insignificant p value(p->0.05).

Table 15: Distribution of patients according Pain POD 6 MONTHS(CHRONIC PAIN)

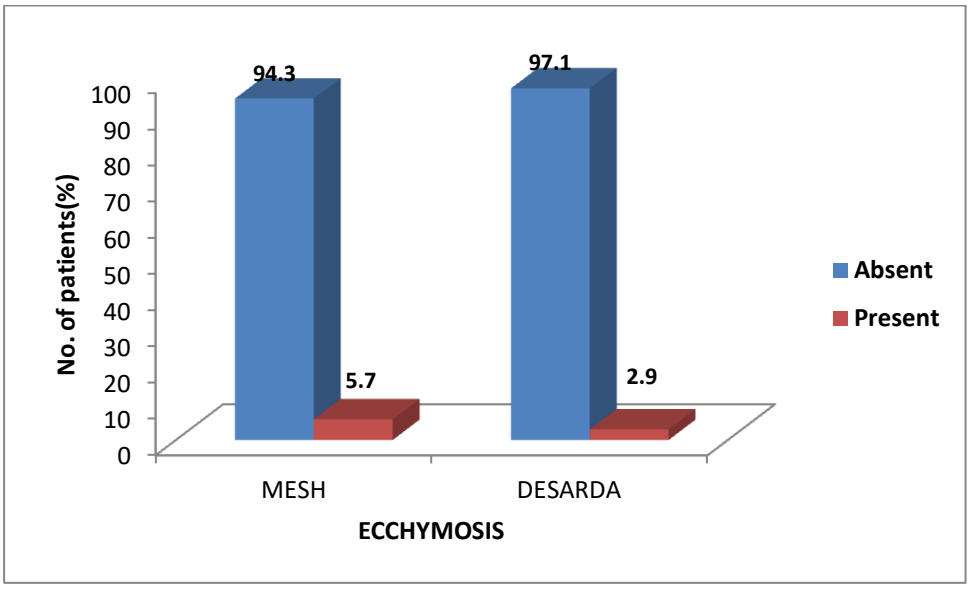
Pain-POD 6 MONTHS	MESH		DESARDA		Chi square test	
	No. of patients	Percentage	No. of patients	Percentage		
0	30	85.7	34	97.1	X^2=2.917	P=0.0877 NS
1	5	14.3	1	2.9		
2	0	0	0	0		
3	0	0	0	0		
Total	35(100)	100	35(100.0)	100		
NS: No significant						



In this study 2.9% of the patients of desarda group had mild groin pain when compare to 14.3% of mild pain in Lichtenstein with insignificant p value (>0.05)

Table 16: Distribution of patients according **ECCHYMOSIS**

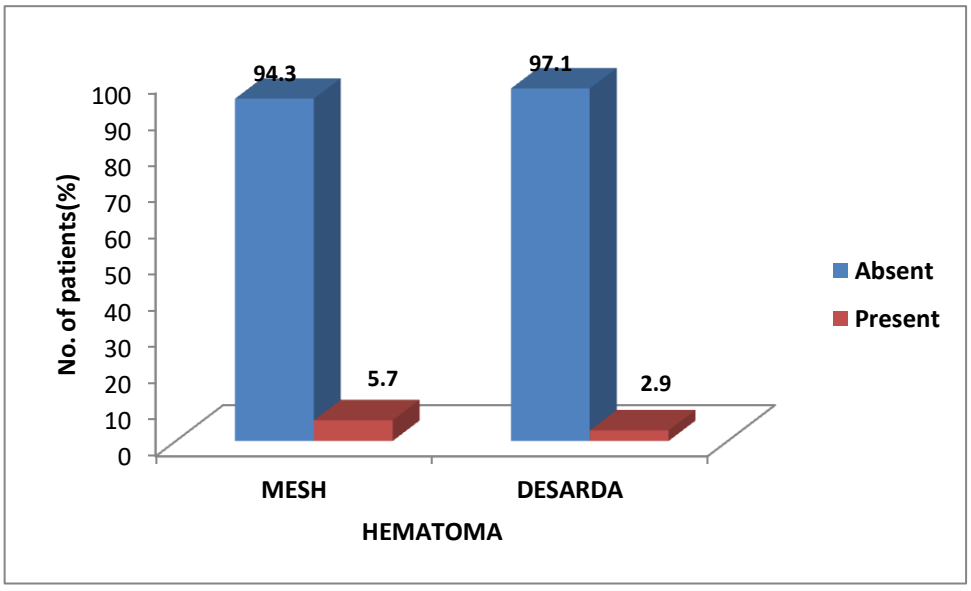
ECCHYMOSIS	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
ABSENT	33	94.3	34	97.1	X^2=0.3483	P=0.5551NS
PRESENT	2	5.7	1	2.9		
Total	35	100.0	35	100.0		



Present study 1(2.9%) patients in desarda's and 2(5.7%) patients in Lichtenstein group had Ecchymosis with insignificant p value(p>0.05).

Table 17: Distribution of patients according to **HEMATOMA**

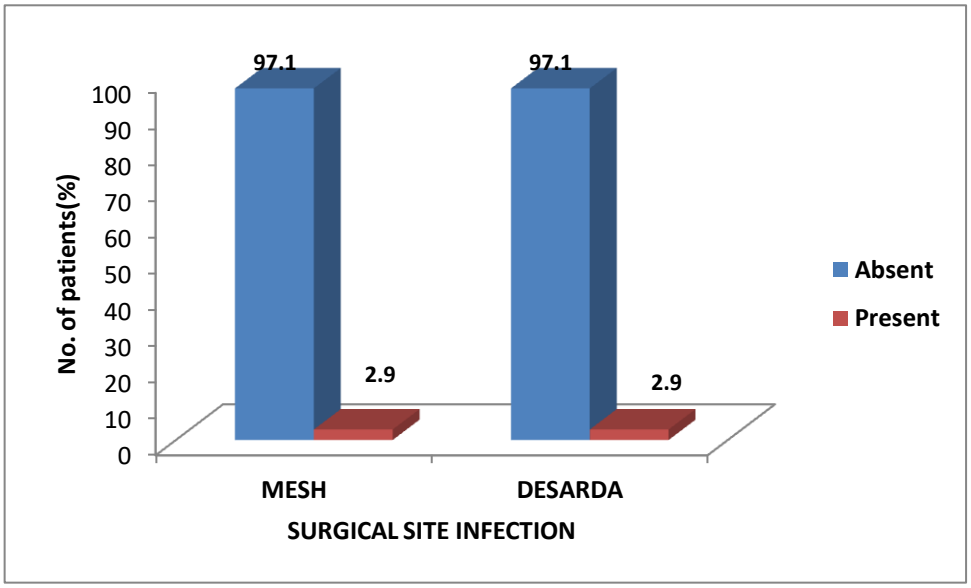
HEMATOMA	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Absent	33	94.3	34	97.1		
Present	2	5.7	1	2.9	X^2=0.34 83	P=0.7708
Total	35	100.0	35	100.0		



Present study 1(2.9%) patients and 2(5.7%) patients had hematoma in desarda's and Lichtenstein mesh group respectively with insignificant p-value(p>0.05).

Table 18: Distribution of patients according to SURGICAL SITE INFECTION

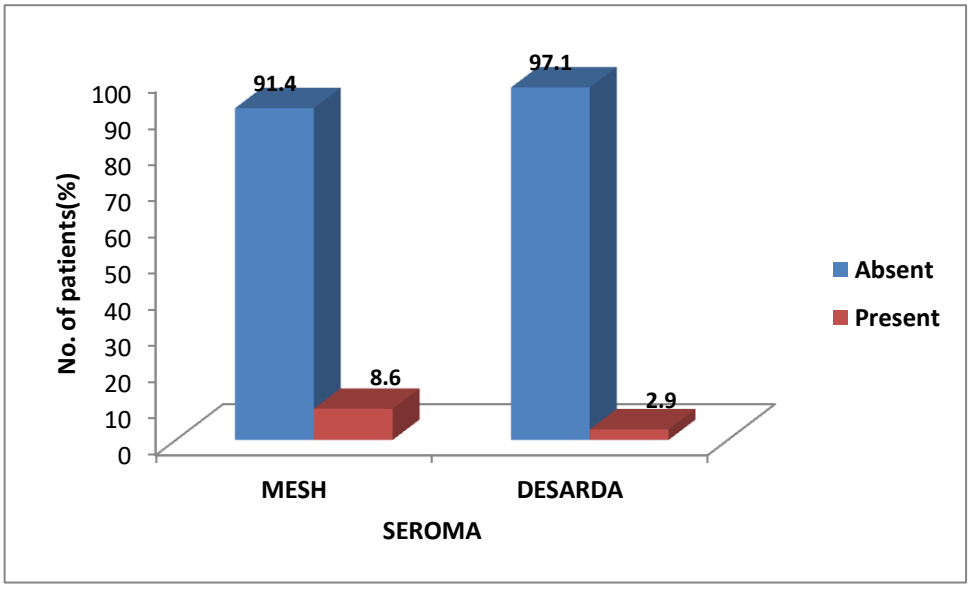
SURGICAL SITE INFECTION	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Absent	34	97.1	34	97.1	X^2=0.00	P=1.00 NS
Present	1	2.9	1	2.9		
Total	35	100.0	35	100.0		



Present study 1(2.9%) patients and 1(2.9%) patients had Surgical site infection in desarda's and Lichtenstein mesh group respectively. Here p value is insignificant(P>0.05).

Table 19: Distribution of patients according to SEROMA

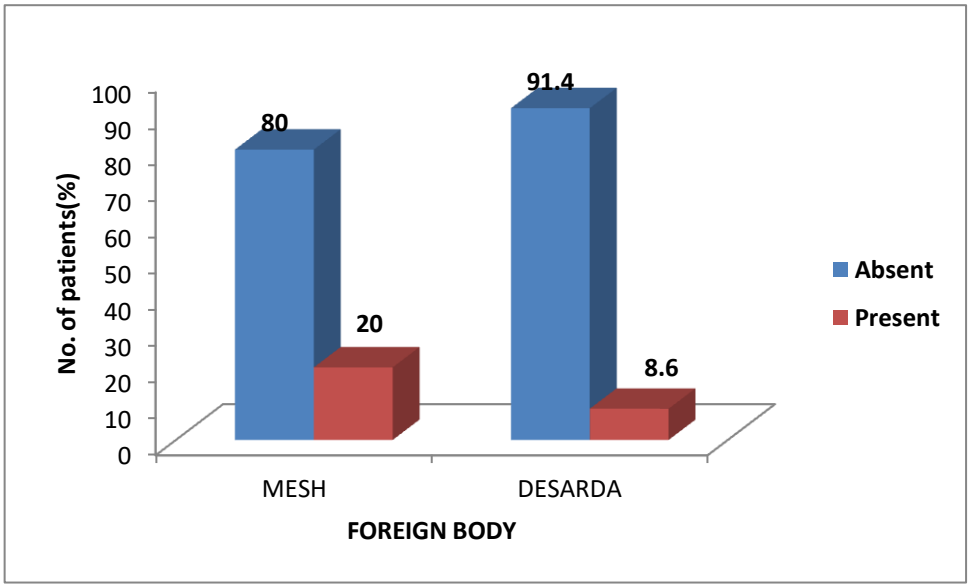
SEROMA	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Absent	32	91.4	34	97.1	X^2=1.061	P=0.3031NS
PRESENT	3	8.6	1	2.9		
Total	35	100.0	35	100.0		



Present study 1(2.9%) patients and 3(8.6%) patients had seroma formation in desarda's and Lichtenstein mesh group respectively. Here p value is insignificant(P>0.05).

Table 20: Distribution of patients according to FOREIGN BODY

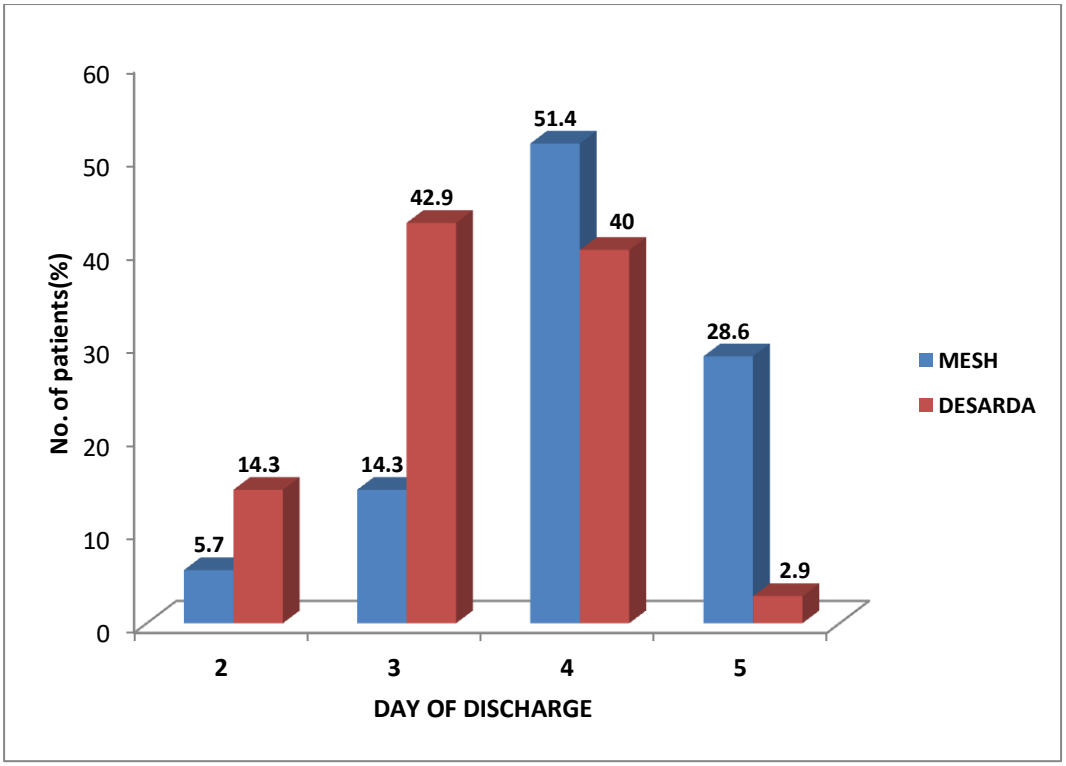
FOREIGN BODY	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Absent	28	80.0	32	91.4	X^2=1.867	P=0. 7191 NS
PRESENT	7	20.0	3	8.6		
Total	35	100.0	100.0	100.0		



In this study 3(8.6%) and 7 (20.0%) patient had foreign body sensation in Desarda's and Lichtenstein mesh group respectively. However there is a no significant statistical difference.

Table 22: Distribution of patients according Post operative day stay at hospital

Stay at hospital in days	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
2	2	5.7	5	14.3	X^2=14.149	P=0.0027 HS
3	5	14.3	15	42.9		
4	18	51.4	14	40.0		
5	10	28.6	1	2.9		
Total	35	100.0	35	100.0		



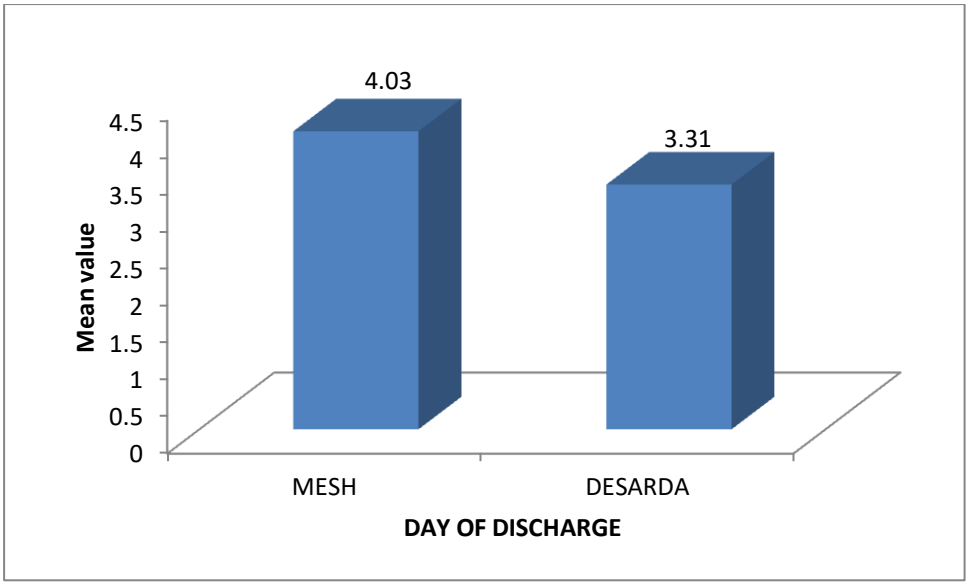


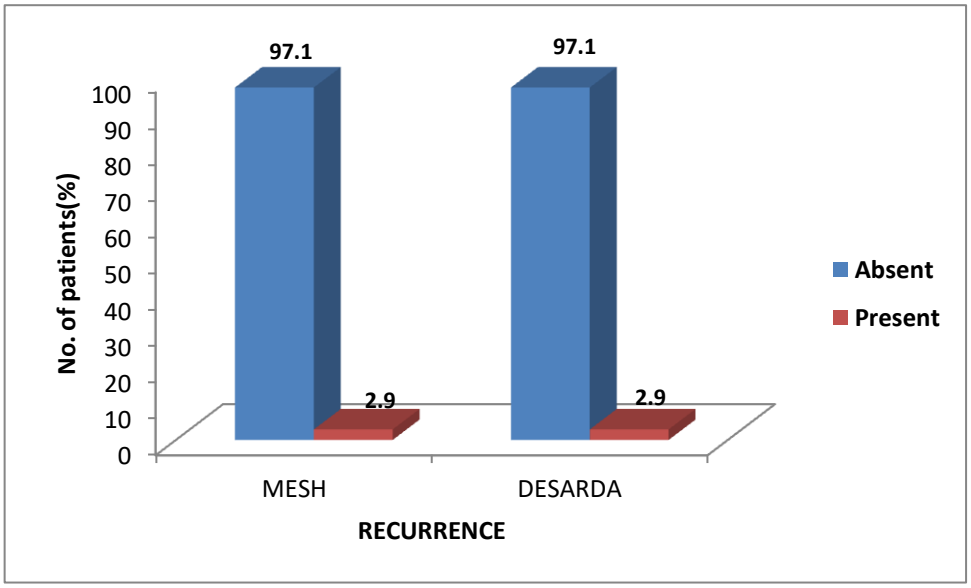
Table 23: Comparison of POD-DAY between MESH and DESARDA groups

Variables	MESH		DESARDA		Independent t test/Mann whitney U test	P value
	Mean	±SD	Mean	±SD		
POD-DAY	4.03	0.822	3.31	0.758	t=3.337	P<0.001 HS
NS: Not significant HS: Highly significant						

Mean duration of post operative hospital stay in desarda group was 3.31± 0.758 days while Lichtenstein group was 4.03 ±0.822 days with significant p value of <0.001.

Table 24: Distribution of patients according RECURRENCE

RECURRENCE	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
Absent	34	97.1	34	97.1	X^2=0.00	P=1.00 NS
PRESENT	1	2.9	1	2.9		
Total	35	100.0	35	100.0		



After 6 months of follow up there was 1 recurrence in both the groups. No statistical significance with p value of 1.00

Table 24: Distribution of patients according COST

COST	MESH		DESARDA		Chi square test	P value
	No. of patients	Percentage	No. of patients	Percentage		
<9000	0	0	20	57.1	X^2=29.123	P<0.001 HS
9000-11000	25	71.4	13	37.1		
>11000	10	28.6	2	5.7		
Total	35	100.0	35	100.0		

The cost of treatment in total between two groups was compared. The cost of treatment in desarda group in comparision with litchenstein group which was lesser by nearly 2000 rs. The difference was statistically significant with a p value of <0.001 .

DISCUSSION

Inguinal hernia is the most common surgical abdominal entity in the adults. In the past decade Lichtenstein repair has become the gold standard for treatment of inguinal hernias mainly due to the reduction in recurrences noted. It is used as blanket surgery for all types and sizes of inguinal hernia with very few exceptations. However it is practiced widely it is far from the definition of an ideal hernia repair as it is not tissue based and has complications likes chronic inguinal pain as quoted in an editorial in annuals of surgery in 2001 which observed that the incidence of chronic groin pain has dramatically increased from around 3% to nearly 19%.[87] Nerve entrapment within the mesh is often blamed for this consequence. Several other complications of mesh repair include hematoma, seroma, ischemic orchitis, testicular atrophy, mesh infection and sinus formation. Young patients especially those undergoing mesh repair for indirect hernias are affected mostly with a risk of infertility in future.

Hence a search for ideal hernia repair still underway and desarda's procedure might be the procedure satisfying procedure for an ideal hernia repair as it is tention free, tissue based and as per results of varies studies as less chronic groin pain than mesh repair as nerve entrapment does not occur. There is no risk of mesh infection as it uses un undetached strip of external oblique for repair .External oblique apponuerosis acts as a near perfect mess alternative as it as negligible foreign body reactions, causes no pathologic fibrosis, as low adhesion potential, as tensile strength >16N,Is of biological origin and matches the abdominal wall dynamics as closely as possible in flexibility, elasticity and memory as per the criteria let down by 30th international congress of European hernia society. This procedure if proved successful can be used extensively in all types of hernias where external oblique apponeurosis if well preserved.

The present study was carried out at B. L. D. E. (Deemed to be university)'s

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL &RESEARCH CENTRE, VIJAYAPUR, KARNATAKA Comparing these two procedures in various clinical scenarios and comparing the outcomes in immediate post-opertive period and by following up these patients for 6 months. The results were analyzed and compared to various other studies done in this field.

DEMOGRAPHICS AND SYMPTOMATOLOGY: The mean age of presentation in Lichtenstein group was 49.89 years and 43.71 in Desarda years . This was compared with the results in other studies and the correlated well which reported 52.5 yrs mean age. Swelling was the most common presentation with most patients presenting within 6 months. Pain was present in the 17 was also correlating well with other studies. The distribution of types of hernia varied slightly from other studies with Right indirect inguinal being most common. Manyilirah et al reported Right indirect hernia as the most common type.[69]

However there is no absolute correlation regarding this variable in all the studies oveall.There is no significant difference between the associated comorbidities a seen in Szopinski J et al.[70]

OPERATING TIME : The mean time difference between the two groups with respect to operating time in the current study is 4 minutes. The duration of surgery was shorter in the Desarda group. This correlated fairly well with Manyilirah et al which found a time difference of 12 mins. This showed a significant time advantage with Desarda procedure.

Operative time difference	present study	manyilirah et al
	4 mins	6 mins (L >D)

PAIN ASSESMENT: Though there was no statistically significant difference in pain in all days following surgery with lesser pain in desarda group other than post operative day 1 which showed significantly less pain in desarda group.their were more patients with severe pain in post operative day 1 in Lichtenstein group.

The pain patterns were insignificant when compared on post operative day 3,14,30,90 and after 6 months of surgery.The pain was comparable in both the groups.Since early post operative pain was less in desarda group it aided in early mobilization and early discharge from hospital.

COMPARISION OF COMPLICATIONS: Among the postoperative complications encountered in the present study seroma rate was roughly similar in both groups, however seroma rates were high compared to Szopinski J et al at the same time scrotal swelling, hematoma rates and wound infections rates were more than the given study.

Comparative parameter(D vs L)	Present study	Monyilirah et al	Szopinski J et al
Seroma Rate	2.9% vs 8.6%	1.9%vs0%	3.8% vs 5.8%
Rate of wound infection	2.9% vs 2.9 %	0% vs 0%	0.9% vs 1.9%
Hematoma	2.9%vs 5.7%	3.9% vs 2.0%	7.7% vs 9.7%
Foreign body sensation	8.6% vs 20%		14.6% vs 18.1%

COMPARISION OF OTHER PARAMETERS: The mean duration of hospital stay was 4.03 days and 3.31 days in Lichtenstein and desarda group respectively. The comparison of other parameters with others studies was not possible due to different operational definition of these variables in different studies. However a common trend of earlier mobilization and discharge was noted in a Desarda group in all studies.

	Present Study	Manyilirah et al	Szopinski J et al
Duration of Hospital Stay	4.03 vs3.31	6.1 vs 5.8	1 vs 1

COMPARISION OF FOLLOW UP OUTCOME: After 6 months follow up the percentage of patients with chronic pain in Desarda group was at 0% percent while that in Lichtenstein's group was at 11.4% .Though the rates in Desarda group was not similar but in Szopinski J et al it was lower than Lichtenstein's by nearly 10% after 3 years follow up. The number of recurrences though an insignificant number with a 6 months follow-up was similar to other studies. There was no statistically significant data regarding recurrence in the present study.

	Present Study	Szopinski J et al
Chronic Pain	0% vs 11.4%	4.8% vs 2.9%
Recurrence	2.9% vs 2.9%	1.9% vs 1.9% .

CONCLUSION

The present study comparing Desarda's technique for hernia repair with Lichtenstein's mesh repair for inguinal hernia came out with the following conclusions:

1)The operating time for Desarda's procedure is lesser then that of Lichtenstein's Mesh repair overall by nearly 4 mins.

2)Desarda's technique is a relatively easy technique to master and is easily reproducible.

3)However a thinned out external oblique muscle poses a difficulty in performing the procedure.

4)Desarda's technique is best suited for young patients and for Indirect Hernias as it has less risk of post-operative orchitis, infertility and inguinodynia.

5)The postoperative pain is lesser with Desarda's technique on all postoperative days and patients ambulate faster and get discharged faster with this technique than with mesh repair.

6)The risk of complications is roughly equal in both the procedures, however Desarda's technique is inherently free of risk of mesh infection as no prosthesis is used.

7)There is a dramatic difference in incidence of chronic pain in Desarda's technique as compared to mesh placement as there is no risk of nerve entrapment.

8)The recurrence data in this study is insufficient to comment on the chances of

recurrence in these patients. However other studies in this aspect prove that there is no significant difference between the procedures as far as recurrence is concerned.

9)On comparison of costs Desarda's technique is definitely more cost effective than Lichtenstein's as no mesh is used and the cost of antibiotics, mesh and hospital stay are reduced.

10) Desarda's technique is definitely a promising procedure and has a lot of potential to replace mesh repair in certain conditions and is best suited for situations like strangulated hernias where mesh use is contraindicated.

11) More number of Randomized control trails and multicenter trails need to be undertaken to study the pros and cons of this procedure in future.

12) Desarda's technique is a very reasonable alternative to mesh repair in many clinical situations.

SUMMARY

The present study was done to compare two different surgical procedures for Inguinal hernia repair, namely Lichtenstein's mesh repair and Desarda,s repair using external oblique aponeurosis.

The present study was done at between November 2017-April 2019 with a follow up period of 6 months. A total of 70 patients were included in the present study with 35 patients in Lichtenstein's group and 35 patients in Desarda's group.

The results of the study were inferred and it was found both the procedures were similar in certain aspects, however Desarda's repair was superior to Lichtenstein's repair in terms of operating time, post-operative pain, time for painless ambulation, hospital stay and incidence of chronic pain.

There was no significant difference in recurrence between two groups after

6 month of follow up.

The cost of treatment was significantly less with Desarda's technique as no prosthetic mesh was used.

The present study concluded that Desarda's repair is superior to mesh repair in short term outcomes and in certain long term outcomes like chronic groin pain.

However further studies and longer follow-up are needed to comment on recurrences. However Desarda's procedure is cost effective and is better suited for developing countries and certain clinical situations.

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ANNEXURE I

PARTICIPANT CONSENT FORM

Participant' s name: **Address:**

TITLE OF THE PROJECT:

"A PROSPECTIVE STUDY COMPARING THE DESARDA TECHNIQUE VERSUS LICHTENSTEIN TECHNIQUE FOR INGUINAL HERNIA TREATMENT"

The details of the study have been provided to me in writing and explained to me in my own language. I confirm that I have understood the above study and had the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without the medical care that will normally be provided by the hospital being affected. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). I have been given an information sheet giving details of the study. I fully consent to participate in the above study.

_____ _____

(Participant) (Date)

_____ _____

(Witness to signature) (Date)

_____ _____

(Investigator to signature) (Date)

ANNEXURE II

PATIENT INFORMATION SHEET

TITLE OF THE PROJECT:

"A PROSPECTIVE STUDY COMPARING THE DESARDA TECHNIQUE VERSUS LICHTENSTEIN TECHNIQE FOR INGUINAL HERNIA TREATMENT"

NAME OF THE INVESTIGATOR:

NAME OF THE GUIDE:

PROCEDURE:

CONFIDENTIALITY OF RECORDS:

This study will become a part of hospital records and will be subject to the confidentiality. If the data are used for publication, no name will be used. And photographs will be used with special written permission.

INJURY STATEMENT:

In the unlikely event of injury resulting directly from participation in this study, the injury will be reported promptly and the appropriate treatment will be given.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

Participation is voluntary and you may refuse to participate or withdraw consent and discontinue participation in the study at any time.

I, (Investigator) have explained to the patient in detail about the study in their own language and the written copy of the same will be given to participant.

ANNEXURE III

PROFORMA FOR CASE TAKING

Date:

Name:

Age:

Sex:

Occupation:

Address:

Mobile No.:

Chief complaints:

Brief history;

1. : Swelling
   i. Duration

   ii. Site and Size

   iii. Rate of Progress

   iv. Reducibility: +/-, Spontaneous/Manual

2. Pain in Swelling: Absent/Present
3. Others: Abdominal Pain/Vomiting/Abd.Distension/Fever
4. History of Straining Factors: Chr.Cough / Chr. Constipation / Straining at Micturition.

Past history:

I Previous surgery

1. For hernia a. Same side

b. Opposite side

2. Other abdominal surgery (particularly appendicectomy by extended grid iron incision)

II History of any associated medical condition

Diabetes/Hypertension/PTB/cardiac diseases.

Personal history:

i. Nature of work: Sedentary/Moderate/Heavy

ii Anemia/Cyanosis/Jaundice/Clubbing/DependentOedema

Lymphadenopathy

General physical examination:

Vitals

Temperature:

Pulse:

R/R:

BP

Local examination

(Patient in standing and recumbent positions)

INSPECTION

1. Swelling
   Unilateral/bilateral

   Position and Extent

   Size and Shape

   Type: Incomplete/ Complete

   Spontaneous Visible Peristalsis

2. Skin over the Swelling
3. Expansile Impulse on Coughing
   Direction of Impulse

4. Spontaneous reducibility in recumbent position

Palpation

1. Swelling: Position and Extent
   Warmth/ Tenderness

   Consistency: Doughy and Greanular/ Elastic/ Tense

   Reducibillity: Partial/Complete/Gurgling felt during reduction/ not reducible

2. Finger Invagination Test
3. Intenal Ring Occlusion Test

Systemic examination:

Per abdomen:

Cardiovasculas system:

Respiratory system:

Central nervous system:

Per-Rectal examination.

Provisional diagnosis:

Management:

Investigations:

1. HEMOGRAM- HB, TC, DC, PLATELET COUNT

2. BLOOD SUGAR

3. BLOOD UREA, SERUM CREATININE

4. COAGULATION PROFILE,

5. HIV, HBSAG, HCV

6. ELECTROCARDIOGRAM

7. CHEST X-RAY PA VIEW

8. ULTRASOUND ABDOMEN AND PELVIS

Final diagnosis:

Treatment:

Duration of the procedure;

Post operative details

Surgical site infection

Haematoma

Seroma

Ecchymosis

Postoperative hospital stay

Post operative pain

1st day

3rd day

14th day

1 month

3 month

Details of Cost

Comments

ANNEXURE IV
KEY TO MASTER CHART

SL NO	Serial number
IP NO	In patient number
AGE	AGE – In Years
SEX	**M** – Male F – Female
SIDE	**R**- Right **L** :-Left
TYP	**D**-DIRECT **IND**-INDIRECT
ET	EXTENT ;**C**- COMPLETE **IC** –INCOMPLETE
P	PRESENT
A	ABSENT
MP	MODE OF PRESENTATION **S**: Swelling only **SWP**: Swelling with pain
SMK	Smoking
POD **DO**	POST OPERATIVE DAY ;PAIN GRADE **0**-No pain **1-** Mild pain **2- 2-** Moderate pain **3- 3-** Severe pain Duration of operation(minutes)
CP	CHRONIC PAIN/Pain at 6 months
EC	ECCHYMOSIS

SSI	SURGICAL SITE INFECTION
SM	SEROMA
H	HEMATOMA
FB	FOREIGN BODY
RC	RECURRENCE
DOS	DURATION OF STAY
CO	COST **A**;<9000 **B**;9000-11000 **C**;>11000

ANNEXURE V

SL NO.	IPD NO	AGE	SEX	SIDE	TYP	ET	SMK	MP	PRD	DO	POD1	POD3	POD14	POD30	POD90	CP	H	SSI	SM	FB	EC	RC	DOS	CO
1	9803	44	M	R	IND	C	A	SWP	M	48	3	1	1	1	1	1	A	A	A	A	A	A	5	C
2	8899	65	M	R	IND	IC	A	S	M	45	2	0	0	0	0	0	A	A	A	A	A	A	4	B
3	13213	70	M	L	D	C	P	S	M	42	2	0	0	0	0	0	A	A	A	A	A	A	3	B
4	11571	42	M	L	IND	IC	A	S	M	46	2	0	0	0	0	0	A	A	A	P	A	A	5	B
5	5553	53	M	R	IND	C	A	SWP	M	42	3	1	1	0	0	0	A	A	A	A	A	A	2	B
6	12496	23	M	L	IND	IC	A	S	M	42	2	0	0	0	0	0	A	A	A	A	A	A	4	B
7	40373	70	M	R	IND	C	A	S	M	45	2	0	0	0	0	0	A	A	A	A	A	P	5	C
8	1748	48	M	R	IND	C	A	SWP	M	42	3	1	1	0	0	0	A	A	P	A	A	A	3	B
9	8900	64	M	L	D	IC	P	S	M	46	2	0	0	0	0	0	A	A	A	A	A	A	4	B
10	6174	52	M	L	IND	IC	A	S	M	45	2	0	0	0	0	0	A	A	A	P	A	A	4	B
11	13221	45	M	R	IND	C	P	S	M	42	2	1	1	1	1	1	P	A	A	A	P	A	5	B
12	7299	67	M	L	IND	IC	P	S	M	48	2	1	0	0	0	0	A	A	P	P	A	A	4	B
13	9667	55	M	L	IND	C	A	S	M	42	3	1	0	0	0	0	A	A	A	A	A	A	3	B
14	7125	45	M	R	IND	IC	P	S	M	48	3	1	1	0	0	0	A	A	A	A	A	A	3	B
15	40217	35	M	R	IND	IC	A	SWP	D	40	1	0	0	0	0	0	A	A	A	A	A	A	3	A
16	27159	40	M	L	IND	C	P	S	D	42	3	1	0	0	0	0	A	A	A	A	A	A	2	A
17	26228	62	M	R	IND	IC	A	S	D	44	3	1	0	0	0	0	A	A	A	A	A	A	3	B
18	9800	47	M	R	IND	C	P	S	D	40	1	0	0	0	0	0	A	A	A	A	A	A	2	A
19	29528	45	M	R	IND	IC	P	S	D	40	3	2	1	1	0	0	A	A	A	A	A	A	2	B
20	4947	32	M	R	IND	C	A	SWP	D	40	2	1	0	0	0	0	A	A	A	A	A	A	3	A
21	4080	48	M	R	D	C	P	S	M	48	3	1	1	0	0	0	A	P	A	A	A	A	3	C
22	12497	19	M	R	IND	IC	A	SWP	D	40	3	2	1	0	0	1	A	A	A	A	A	A	3	B
23	29530	55	M	L	IND	IC	P	S	D	40	2	1	0	0	0	0	A	A	A	A	A	A	2	A
24	28512	50	M	R	IND	IC	A	S	D	40	2	1	0	0	0	0	A	A	A	A	A	A	3	A
25	22614	70	M	L	IND	C	P	S	D	42	1	0	0	0	0	0	A	A	A	A	A	A	2	A
26	24228	24	M	R	IND	IC	P	S	D	40	3	2	1	0	0	0	A	A	A	A	A	A	4	A
27	22615	39	M	R	IND	C	A	S	D	42	2	1	0	0	0	0	A	A	A	P	A	A	4	B
28	5709	50	M	R	IND	IC	P	S	D	44	2	1	0	0	0	0	A	A	A	A	A	A	3	B
29	8890	63	M	R	D	C	P	S	D	42	3	1	0	0	0	0	A	P	A	A	A	A	3	C
30	6630	54	M	L	IND	C	A	S	D	46	2	1	0	0	0	0	A	A	A	A	A	A	3	B
31	10384	31	M	R	IND	IC	P	SWP	D	42	2	1	0	0	0	0	A	A	A	A	A	A	3	A
32	4948	32	M	L	D	IC	A	S	D	40	1	0	0	0	0	0	A	A	A	A	A	A	4	B
33	30428	46	M	R	IND	IC	P	S	D	41	3	1	0	0	0	0	A	A	A	A	A	A	4	A
34	5691	41	M	L	IND	C	P	S	D	41	2	1	0	0	0	0	A	A	A	A	A	A	3	A
35	25190	29	M	R	IND	C	A	SWP	D	42	3	2	1	0	0	0	A	A	A	A	A	A	3	A
36	11180	36	M	L	IND	IC	P	S	D	44	2	1	0	0	0	0	A	A	A	P	A	A	4	B
37	26843	41	M	L	IND	C	A	SWP	D	42	2	1	0	0	0	0	A	A	A	A	A	A	3	A
38	22260	58	M	L	IND	IC	A	SWP	M	48	3	1	0	0	0	0	A	A	A	A	A	A	2	B
39	22683	37	M	R	D	IC	P	S	M	46	2	0	0	0	0	0	A	A	A	P	A	A	5	C
40	24393	19	M	R	IND	C	P	S	M	43	3	1	0	0	0	0	A	A	A	A	A	A	4	B
41	23706	68	M	R	D	IC	A	S	M	46	2	0	0	0	0	0	P	A	P	A	P	A	5	C
42	9033	26	M	R	D	IC	P	S	M	42	3	2	1	1	1	1	A	A	A	A	A	A	4	B

43	10345	75	M	R	D	C	P	S	M	45	2	1	0	0	0	0	A	A	A	A	A	A	4	C
44	4148	49	M	L	D	IC	P	SWP	D	40	2	1	0	0	0	0	A	A	A	A	A	A	3	B
45	6697	46	M	R	D	IC	A	S	M	48	2	0	0	0	0	0	A	A	A	A	A	A	5	B
46	23284	28	M	R	D	IC	A	S	M	42	2	0	0	0	0	0	A	A	A	A	A	A	4	B
47	10394	48	M	L	IND	IC	A	S	D	42	2	1	0	0	0	0	A	A	A	A	A	A	3	B
48	14803	63	M	L	IND	IC	A	SWP	M	50	3	1	0	0	0	0	A	A	A	A	A	A	4	B
49	4526	46	M	R	D	IC	A	S	M	46	2	0	0	0	0	0	A	A	A	A	A	A	4	C
50	4568	60	M	R	IND	IC	A	S	M	46	2	0	0	0	0	0	A	A	A	A	A	A	4	B
51	14853	55	M	R	IND	C	P	S	M	46	3	1	0	0	0	0	A	A	A	P	A	A	5	B
52	21667	60	M	R	IND	IC	A	S	M	48	2	0	0	0	0	0	A	A	A	A	A	A	4	B
53	14265	45	M	R	IND	IC	P	SWP	M	42	3	1	1	1	1	1	A	A	A	A	A	A	4	C
54	17429	45	M	L	IND	C	A	S	M	48	2	0	0	0	0	0	A	A	A	A	A	A	4	B
55	11914	62	M	R	IND	IC	A	S	D	40	3	2	1	1	1	0	P	A	P	A	P	A	5	C
56	18309	70	M	L	IND	IC	A	S	D	44	2	0	0	0	0	0	A	A	A	A	A	P	4	B
57	20838	60	M	L	IND	C	P	S	D	42	2	1	0	0	0	0	A	A	A	A	A	A	3	A
58	11644	34	M	L	IND	IC	P	S	D	44	2	0	0	0	0	0	A	A	A	A	A	A	4	A
59	20054	50	M	L	D	IC	P	S	D	42	3	1	0	0	0	0	A	A	A	A	A	A	4	A
60	15682	24	M	L	IND	IC	P	S	M	48	3	1	0	0	0	0	A	A	A	A	A	A	4	C
61	12764	42	M	R	IND	IC	A	S	M	48	3	1	1	1	1	0	A	A	A	P	A	A	5	B
62	12748	51	M	L	D	IC	P	S	M	49	2	0	0	0	0	0	A	A	A	A	A	A	4	B
63	11971	47	M	R	IND	C	A	SWP	M	48	3	0	0	0	0	0	A	A	A	A	A	A	4	B
64	12142	60	M	L	IND	IC	P	S	M	48	3	1	1	0	0	0	A	A	A	P	A	A	5	C
65	16368	31	M	R	IND	IC	A	S	D	42	3	1	1	0	0	0	A	A	A	A	A	A	4	A
66	21454	35	M	R	IND	IC	A	S	D	45	2	0	0	0	0	0	A	A	A	A	A	A	4	A
67	14650	31	M	L	IND	IC	P	S	D	42	3	1	1	0	0	0	A	A	A	P	A	A	4	B
68	13709	39	M	L	D	IC	P	S	D	40	1	0	0	0	0	0	A	A	A	A	A	A	4	A
69	13975	45	M	R	IND	C	P	S	D	42	2	0	0	0	0	0	A	A	A	A	A	A	4	A
70	14746	35	M	R	IND	IC	A	SWP	D	40	3	1	1	0	0	0	A	A	A	A	A	A	4	B