

**COMPARATIVE STUDY OF LAPAROSCOPIC
TRANSABDOMINAL PREPERITONEAL VERSUS
LICHTENSTEIN TENSION FREE REPAIR
FOR INGUINAL HERNIA**

SUBMITTED BY

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In partial fulfillment of the requirements for the degree of
M.S.

GENERAL SURGERY

Under the guidance of

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LIST OF ABBREVIATIONS USED

BP	- Blood pressure
BPH	- Benign Prostatic Hypertrophy
CC	- Contingency co- efficient
Consti	- Constipation
COPD	- Chronic Obstructive Pulmonary Disease
DM	- Diabetes Mellitus
ECG	- Electrocardiogram
F	- Frequency
GP	- Generator Practitioner
Hb	- Hemoglobin
HBsAg	- Hepatitis B Antigen
HIV	- Human Immuno Deficiency Virus
HTN	- Hypertension
IHD	- Ischemic heart disease
P	- Probability
PR	- Pulse Rate
RBS	- Random Blood Sugar
TB	- Tuberculosis
D	- Direct sac
IEV	- Inferior epigastric vessels
SP	- Pubic tubercle
IC	- Inguinal canal
CS	- Cord structures
IPT	- Iliopubic tract
SP	- Spermatic vessels
TAPP	- Transabdominal Preperitoneal

ABSTRACT

Background and Objectives

“A comparative study of laparoscopic transabdominal preperitoneal versus Lichtenstein tension free repair for inguinal hernia”, is a prospective study of 60 cases of inguinal hernias which were treated by either open inguinal hernia mesh repair (Lichtenstein) or laparoscopic inguinal hernia repair (TAPP). The study was conducted with an objective to compare the effectiveness of these procedures and complications, if any.

Methods

60 cases of inguinal hernia admitted and operated in B.L.D.E.U.'s Shri B M Patil Medical College, Hospital and Research Centre, Vijaypur were selected alternatively. All patients with uncomplicated direct and indirect hernias treated by open Lichtenstein tension free inguinal mesh repair or laparoscopic transabdominal preperitoneal (TAPP) inguinal mesh repair approach were included. After preoperative preparation they were alternatively chosen for either open or laparoscopic repair. The age/ sex incidence, mode of presentation, precipitating factors, surgical treatment and postoperative complications were all evaluated and compared with standard published literature.

Results

In the post-operative period pain was more in open Lichtenstein group compared to TAPP. Post- operative complications were more in open Lichtenstein group, hematoma at the operated site was found in 1 case and seroma developed in 3 patients in cases of hernioplasty. One patient developed chronic inguinal pain in

Lichtenstein group. The mean duration of hospitalization after surgery was 5.5 days in hernioplasty group whereas 2.2 days in the laparoscopic (TAPP) group. The duration for surgery was significantly longer in the laparoscopic group with mean operating time of 98.7 minutes. Return to work is significantly early in case of laparoscopic (TAPP) group.

Conclusion

In this study incidence of hernia is more in farmers. Duration of surgery is significantly high in case of laparoscopy (TAPP) due to learning curve of the procedure. Post operatively pain was significantly less in laparoscopic (TAPP) repair. Postoperative complication and chronic inguinal pain was less in TAPP group. Duration of hospital stay after surgery was significantly less in laparoscopic (TAPP) cases. Return to work was very early in case of TAPP.

With limited follow up, it can be concluded that laparoscopic (TAPP) repair is better compared to Lichtenstein repair, except in case of duration of surgery in TAPP due to long learning curve.

Key Words:

Inguinal hernia, Transabdominal pre peritoneal (TAPP), Lichtenstein, Post-operative pain, wound infection, haematoma, seroma.

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INTRODUCTION

No disease of human body, belonging to the province of the surgeon, requires in its treatment a better combination of accurate, anatomical knowledge with surgical skill than HERNIA in all its varieties.¹ Sir Astley Paston Cooper's statement in 1804 still reverberates in the minds of surgeons.

Groin hernias are the most common conditions referred to surgeons all over the world and over five lakh hernia repairs are performed annually.² The lifetime risk for men is 27% and for women is 3%.³

Since Bassini published his landmark paper on the technique of tissue repair in 1887, numerous modifications have been proposed.⁴ There has been a revolution in surgical procedures for groin hernia repairs after the introduction of prosthetic material by Usher in 1958.⁵ Open Pre-peritoneal mesh repair by Stoppa was found to significantly reduce recurrence rate for multi-recurrent groin hernias.⁶ However, it was associated with significant postoperative pain and morbidity. The concept of Tension Free Open Mesh Repair was first described by Lichtenstein in 1989.⁷

Ger reported the first laparoscopic hernia repair in 1982 by approximating the internal ring with stainless steel clips.⁸ The laparoscopic Trans Abdominal Pre-Peritoneal (TAPP) repair as a revolutionary concept in the hernia surgery and was introduced by Arregui and Dion in the early 1990s.^{9&10} Laparoscopic groin hernia repair can be done by TAPP approach and also by Total Extra Peritoneal (TEP) approach.¹¹ In our Institution, inguinal hernia repair is one of the common surgeries performed daily. This study aims at studying the efficiency, advantages, disadvantages, limitations, post operative pain and duration of hospital stay between the open Lichtenstein tension free inguinal mesh repair and laparoscopic

transabdominal preperitoneal (TAPP) inguinal mesh repair surgeries and to arrive at a conclusion as to the best modality of treatment after comparison of morbidity and recurrence of these procedures among them and in relation to standard published material.

AIM & OBJECTIVES OF THE STUDY

To compare the outcome of both open Lichtenstein tension free inguinal mesh repair and laparoscopic transabdominal preperitoneal (TAPP) inguinal mesh repair in the view of

- Duration of surgery
- Postoperative pain
- Duration of hospital stay
- Postoperative complications

REVIEW OF LITERATURE

Historical Aspects

Since the dawn of surgical history, hernias have been a subject of interest, and their treatment has evolved through several stages. The history of hernia is the history of surgery.¹²

The history of hernia begins as early as the Greco-roman era, the earliest recorded reference appearing in the Egyptian Papyrus of Ebers (Circa 1552 B.C).¹³ The ancient Hindu surgeons treated hernia by severing the sac and cautery.¹⁴ Heliodorus was the surgeon who performed the first hernia operation. He separated the sac from the cord, twisted off the sac, and ligated the vessels without touching the testicles of reconstructing the posterior wall off the inguinal canal.¹⁵

The middle ages and the renaissance saw several further improvements related to the subject of hernia. Paul of Aegina (AD-607 or 625-900) Greece- Alexandria, Egypt performed hernia surgery using double ligation and excision en masse of cord, sac and testicel. He used the term “enterocele” if the sac contained intestine, “epiplocele” if it contained omentum (from the Greek epiploon, meaning omentum), and “hydroenteroepiplocele” if it contained intestine, omentum and fluid.¹⁶

Franco was the first to describe and perform an operation for strangulated hernia.¹⁷ Ambroise Pare (1510- 90) advocated the use of trusses for hernia treatment.¹⁸ Lorenz Heister (1683- 1758) differentiated direct from indirect hernia.¹⁹Through the eighteenth and the nineteenth century there were many developments both in anatomy of the inguinal region as well as hernia surgery.

In 1754, Albercht Von Haller (1708- 77) described congenital hernia.²⁰ Pieter Camper (1722- 89) in Holland Reported camper's fascia and the surgical anatomy of the inguinal hernia.²¹ Franz K. Hesselbach (1759- 1816) in Germany described Hesselbach's triangle.²² Astley Paston Cooper (1768- 1841) described the ligament of Cooper (pectineal), the cremasteric fascia, and the fascia transversalis.²³

Andres Adolph Retzius described the retropubic space or the cave of Retzius. Georg Lothessen (1868- 1935) of Austria was the first to use Cooper's ligament for repair.²⁴ Lucas- Championnaire (1843- 1913) advised incision of the aponeurosis of the external oblique from the external ring to the arc of the internal ring and removal of the peritoneal sac.²⁵

Eldarado Bassini (1844- 1924) recommended approximation with interrupted sutures of the layer of the internal oblique, transverse abdominal muscles and transversalis fascia to the shelving border of the inguinal ligament, leaving the cord under the aponeurosis of the external oblique, the original Bassini's repair.²⁶

The twentieth century saw the introduction of the prosthetic mesh and also improvements in the repair of hernias. Henry O. Marcy's (1837- 1924) introduced reconstruction of the inguinal ring, antiseptic use of animal structures and high ligation of the hernial sac.²⁷ G.L. Cheatle was the first to describe preperitoneal procedures.²⁸ Musgrove and McEvedy sutured the inguinal ring to the iliopectineal ligament.²⁹ McEvedy sutured the conjoint tendon (area) to iliopectineal ligament.³⁰

Hull and Ganey sutured the inguinal ligament to the iliopectineal.³¹ E. Shouldice (1891- 1965) of Toronto repaired inguinal hernia by overlapping layers with continuous suture.³² Chester Mc Vay advised suturing the transverse abdominal arch to Cooper's ligament for the repair of inguinal hernia.

A sutureless version of the Lichtenstein technique, transversing the internal ring to replace a prosthetic graft between the peritoneum and the transversalis fascia was creatively described by Gilbert.³³ Robbins and Rutkow have extended the technique with their work on the open mesh plug hernioplasty.¹⁷

Era of minimal access surgery:

In the last 2 decades there has been development in repair of inguinal hernias laparoscopically. Ger repaired an indirect inguinal hernia laparoscopically in 1982.³⁴ Arregui introduced TAPP (Trans- Abdominal Preperitoneal Repair) in 1991.³⁵

ANATOMY

The Latin word hernia means a rupture or tear.³⁶ A hernia is a protrusion of a viscous or part of a viscus through an opening in the wall of the cavity in which it is contained.³⁷

Inguinal canal

The inguinal canal is an oblique intermuscular slit about 4 cm long lying above the medial half of the inguinal ligament. It commences at the deep inguinal ring and ends at the superficial ring.³⁸ It is directed downwards, forwards and medially. In infants, the superficial and deep inguinal rings are almost superimposed and obliquity of the canal is slight.³⁹

The deep ring is a U shaped condensation of the transversalis fascia and it lies 1.25 cm above the inguinal ligament midway between the symphysis pubis and the anterior superior iliac spine.³⁹

The superficial inguinal ring is a triangular aperture in the aponeurosis of the external oblique and lies about 1.25 cm above the pubic tubercle. The ring is bounded by superomedial and inferolateral crus joined by crisscross antercrural fibers. Normally the ring will not admit the tip of little finger.³⁹

The inguinal ligament is the folded lower border of the aponeurosis of the external oblique presenting a grooved superior abdominal surface (the floor of the inguinal canal), and which stretches from the anterior superior iliac spine to the pubic tubercle. It has variously been called the crural arch, superficial crural arch, and poupart's ligament.⁴⁰

Boundaries⁴¹

i. Anterior wall is formed by the following

In its whole extent

- a) Skin
- b) Superficial fascia
- c) External oblique aponeurosis

In its lateral 1/3rd.

Fleshy fibres of the internal oblique muscle.

ii. Posterior wall

In its whole extent

- a) Fascia transversalis
- b) Extraperitoneal tissue
- c) Parietal peritoneum

In its medial 2/3rd.

Conjoint tendon

Reflected part of inguinal ligament (Medial End)

In its lateral 1/3rd.

Interfoveolar ligament (when present)

iii. Roof

Arched fibres of internal oblique and the transversalis abdominis muscles.

iv. Floor

Grooved upper surface of inguinal ligament and the medial end by the lacunar ligament.

Structures passing through the canal³⁸

In males,

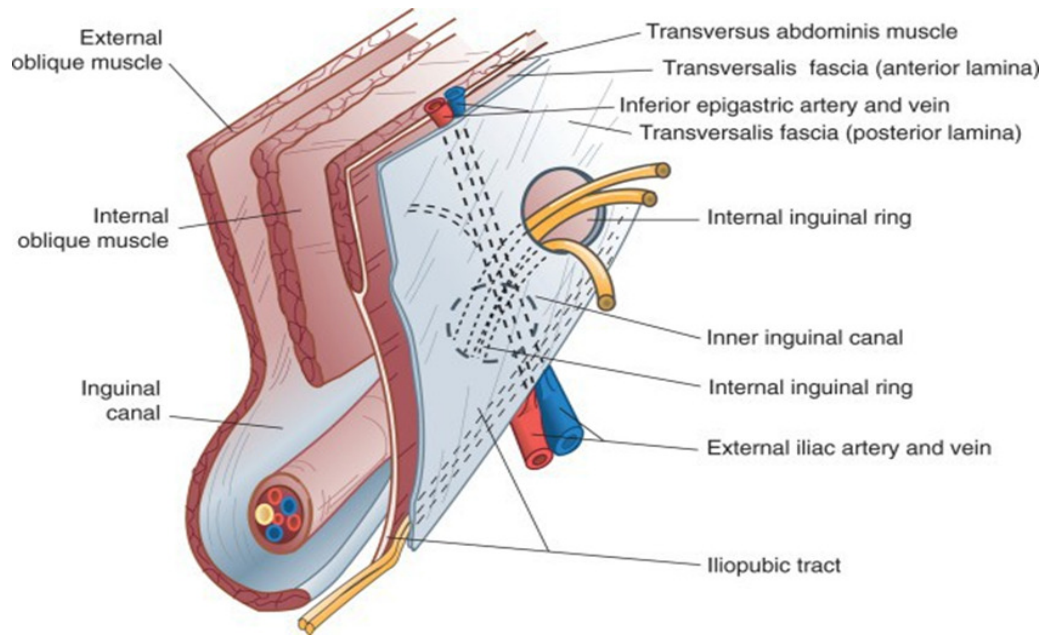
- Spermatic cord
- Vas deference and its artery
- Testicular artery
- Cremastic artery
- Pampiniform plexus of veins
- Obliterated remains of processus vaginalis
- Genital branch of genitofemoral nerve
- Autonomic nerves
- Lymphatics

In females,

- Obliterated processus vaginalis
- Round ligament
- Lymphatics from the uterus

The ilioinguinal nerve, although is a content of the inguinal ring, does not enter the canal through the deep ring, but by piercing the internal oblique muscle i.e. its slips into the canal from the side not from the back. The nerve lies in front of the cord and leaves the canal through the superficial ring.

Fig: 1. Inguinal canal anatomy



Hesselbach's Triangle⁴²

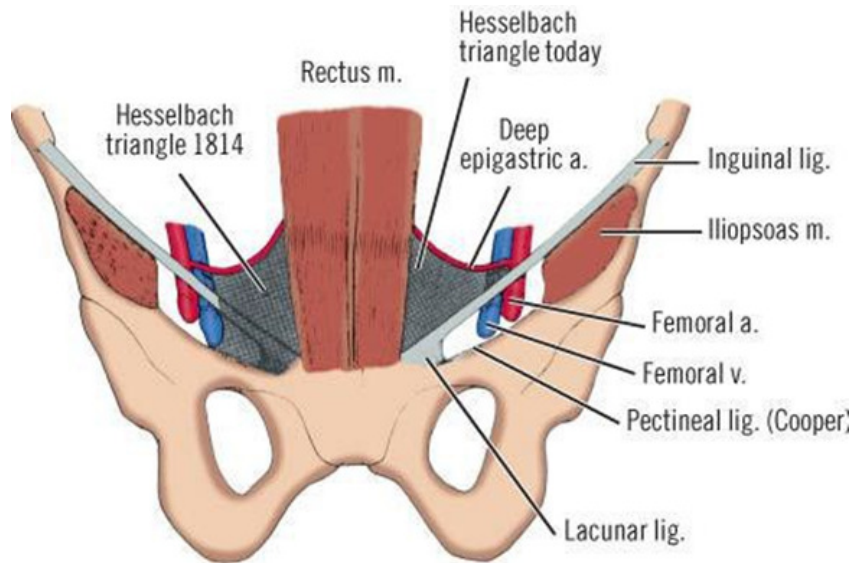
Laterally - Inferior epigastric artery

Medially - Outer border of rectus

Lower boundary - Inguinal ligament

Hesselbach's triangle is divided into medial and lateral halves by the obliterated umbilical artery (lateral umbilical ligament).

Fig: 2. Hesselbach's triangle



Transversalis Fascia⁴³

It is considered to be the downward continuation of the transversalis muscle and its aponeurosis. The lower free margin of the muscle arches with the internal oblique muscle over the internal ring to form the transverses abdominus aponeurotic arch which in turn fuses with the internal oblique aponeurosis in 15% to 10% of cases to form the conjoint tendon.

Iliopubic Tract

Is a fibrous condensation of endoabdominal fascia that arises from the iliopectineal arch and inserts on the anterior superior iliac spine and inner tip of the ileum. The iliopubic tract is located at the inferior border of the deep inguinal ring.

Cooper's Ligament

Is located on the posterior aspect of the superior ramus of the pubic and is formed of periosteum and fascial condensation. The Cooper ligament is an important fixation point in laparoscopic hernia repair as well as in McVay's repair.

Sites of herniation³⁷

Hernias of the abdominal wall occur only in area where aponeurosis and fascia are devoid of the protecting support of striated muscle. Without a counteracting force, the bare aponeurotic areas are subjected to ravages of intra-abdominal pressure and give way if they deteriorate or contain anatomical irregularities. Predictably, the common sites of herniation are thus the groin, the umbilicus, the linea alba, the semilunar line of Spiegel, the diaphragm and surgical incision. Other similar but rare sites of herniation are the perineum, the superior lumbar triangle of Grynfeltt, the inferior triangle of Petit and the sciatic foramina of the pelvis.

Laparoscopic Anatomy

In the lower abdomen there are five peritoneal folds or ligaments which are seen through the laparoscope in umbilicus. These ligaments are generally overlooked at the time of open surgery.

1. One Median Umbilical Ligament

In the midline there is median umbilical ligament extends from the mid of urinary bladder up to the umbilicus. Median umbilical ligament is obliterated urachus.

2. Two Medial Umbilical Ligament one on either side

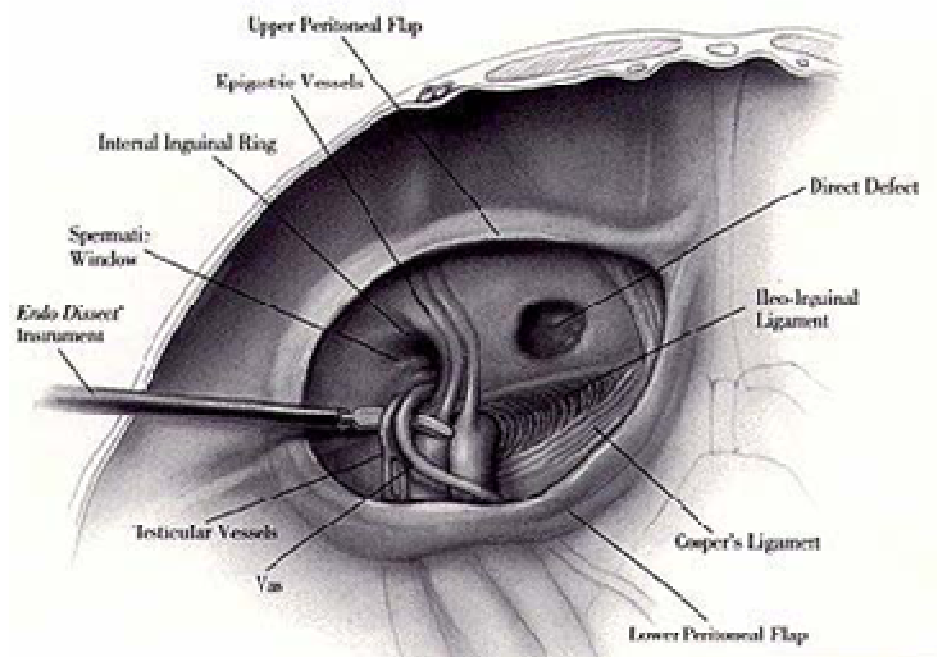
The paired medial umbilical ligament is obliterated umbilical artery except where the superior vesical arteries are found in the pelvic portion. The medial umbilical ligaments are the most prominent fold of the peritoneum. Sometime, hangs down and obscure the vision of lateral pelvic wall. These ligaments are important landmark for the lateral extent of the urinary bladder.

3. Two Lateral Umbilical Ligaments

Lateral to the medial umbilical ligaments, the less prominent paired lateral umbilical fold contains the inferior epigastric vessels. The inferior epigastric artery is lateral border of Hesselbach's triangle and hence is useful landmark for differentiating between direct and indirect hernia. Any defect lateral to the lateral umbilical ligament is indirect hernia and medial to it is direct inguinal hernia. The femoral hernia is below and slightly medial to the lateral inguinal fossa, separated from it by the medial end of the iliopubic tract internally and the inguinal ligament externally.

Important landmarks for extraperitoneal hernia dissection include the musculo- aponeurotic layers of the abdominal wall, the bladder, Coopers ligament and the iliopubic tract. The inferior epigastric artery and vein, the gonadal vessels and vas deferens should also be recognized. The space of Retzius lies between the vesicoumbilical fascia posteriorly and the posterior rectus sheath and pubic bone, anteriorly. This is the space first entered in extraperitoneal repair of hernia.

Fig: 3. Laparoscopic view of inguinal canal



TRANSVERSALIS FASCIA

The transversalis fascia and its derivatives form the main area of interest for the laparoscopic surgeon. Transversalis fascia is seen just anterior to the peritoneum. This continues laterally and posteriorly as endoabdominal and endopelvic fascia to form an extra-peritoneal reinforcing layer. This fascia is divided into anterior and posterior lamina. The anterior lamina of the transversalis fascia is closely related to the posterior aspect of the transversus abdominus muscle and its aponeurosis. The posterior lamina is composed of irregularly thickened fibrous tissue and is readily separable from peritoneum, is often referred to as the pre-peritoneal fascia.⁴⁴ The inferior epigastric vessels and the deep inguinal venous plexus are enclosed between of the transversalis fascia.⁴⁵

The pre-peritoneal space is the space between the parietal peritoneum and the anterior lamina of the transversalis fascia.⁴⁶ This pre-peritoneal space is divided into the medial space of Retzius and the lateral space of Bogros. This space is made use of in the hernia repairs done through the posterior approach or laparoscopic approach.⁴⁷ The derivatives of transversalis fascia such as iliopubic tract and Cooper's ligament provide suitable areas of fixation of prosthesis in laparoscopic hernia repair.

ILIOPUBIC TRACT

This structure runs parallel and deeper to the inguinal ligament on its entire length. This structure is usually not seen in anterior approaches, but is well appreciated in the posterior repair and the laparoscopic repair.⁴⁸

The iliopubic tract separates the deep inguinal ring from the femoral canal. The inferior fibres of the iliopubic tract that insert on the lateral aspect of the Cooper's ligament form the medial boundary of the femoral canal. Iliopubic tract is an

important signpost for the laparoscopic surgeon, as many of the branches of the lumbar plexus are found just below the iliopubic tract.⁴⁹ Any kind of mesh fixation in this area below the iliopubic tract and lateral to the testicular vessels will injure these nerves.

INTERNAL RING

The internal ring consists of anterior and posterior crus. The anterior crus are a dense band that arises from the transversalis fascia above the internal ring. The posterior crus consist of fibers that run parallel to the iliopubic tract and finally fuse with it. The two crura are continuous with each other on the medial aspect of the internal ring. This part of the inguinal ring is called as transversalis fascial sling. The transversalis fascial sling aids the surgeon in separation of the indirect hernia sac without injuring the inferior epigastric vessels.

1. TRIANGLE OF DOOM:

The triangle of doom is defined by vas deferens medially, spermatic vessels laterally and external iliac vessels inferiorly. This triangle contains external iliac artery and vessels, the deep circumflex iliac vein, the genital branch of genitofemoral nerve and hidden by fascia the femoral nerve. Staple should not be applied in this triangle; otherwise chances of mortality are there if these great vessels are injured.

2. TRIANGLE OF PAIN:

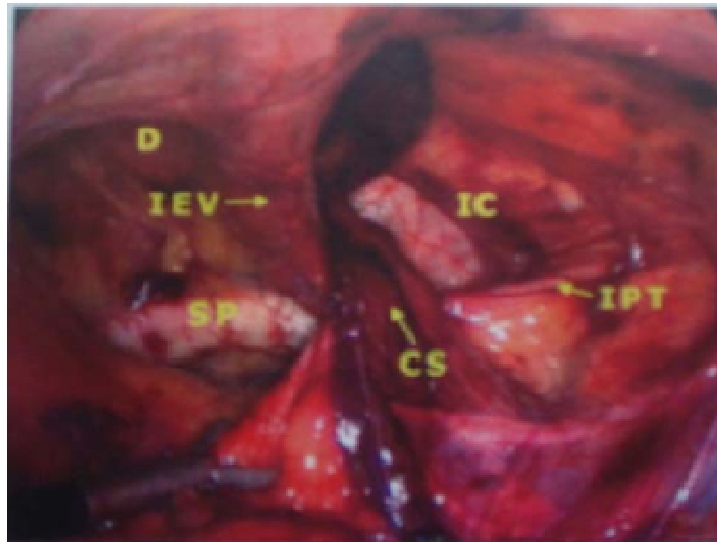
Triangle of pain defined as spermatic vessel medially, the iliopubic tract laterally and inferiority edge of skin incision. This triangle contains lateral femoral cutaneous nerve and anterior femoral cutaneous nerve of thigh. The staple in this area should be less because nerve entrapment can cause neuralgia.

3. CIRCLE OF DEATH:

This is also called as corona mortis and refers to vascular ring form by the anastomosis of an aberrant artery with the normal obturator artery arising from a branch of the internal iliac artery. At the time of laparoscopic hernia this vessel is torn both end of vessel can bleed profusely, because both arise from a major artery. The surgeon should remember these anatomic landmarks and the point of mesh fixation should be selected superiorly, laterally and medially.

Fig: 4. Structures in association to inguinal hernia

D- direct sac, IEV – Inferior epigastric vessels, SP-pubic tubercle, IC- inguinal canal, CS-cord structures, IPT-iliopubic tract.



PHYSIOLOGY

Mechanism of inguinal canal⁴¹

The presence of the inguinal canal is cause of weakness in the lower part of the anterior abdominal wall. The weakness is compensated by the following factors.

1. Flap valve mechanism

The deep and superior inguinal rings lie at opposite ends of the inguinal canal and the intervening part of the canal is pressed flat when the aponuerosis are under tension and the intra-abdominal pressure rise.

2. Ball valve mechanism

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

3. Slit valve mechanism

Contraction of the external oblique results in approximation of two crura of the superficial inguinal ring. The integrity of the superficial ring is greatly increased by intercrual fibres.

4. Shutter mechanism of internal oblique

This muscle has a triple relation to the inguinal canal. It forms the anterior wall, the roof and the posterior wall of the canal. When it contracts the roof is approximated to the floor, like a shutter. The arching fibres of the transverses also take part in the shutter mechanism.

5. The superficial inguinal ring is guarded from behind by the conjoint tendon and the reflected part of the inguinal ligament.

6. The deep ring is guarded from the front by the fleshy fibers of the internal oblique.
7. Hormones may play a role in maintaining the tone of the inguinal musculature.

Whenever there is a rise in intra-abdominal pressure (as in coughing, sneezing, and lifting heavy weights) all these mechanisms come in to play, so that the inguinal canal is obliterated, its openings are closed and herniation of abdominal viscera is prevented.

Etiology⁵⁰

The cause of hernia is probably multifactorial. It is assumed that 3 main factors are involved. The presence of preformed sac, repeated elevation in the intra-abdominal pressure and weakening of the body muscles and tissue with time.

A) Congenital

Predisposing factors for indirect inguinal hernia genesis is anatomic configuration and the patent processus vaginalis. But, it is not the sole cause of hernia genesis as many persons at postmortem had patent processus vaginalis without suffering from hernia during life. The descent of the testis carries along with it the processes, hence predisposes to hernia. Sex wise males are more commonly suffers from inguinal hernia.

Subtle variants in the attachment and arrangement of the abdominal muscles also play a role in hernia genesis as direct do not occur in the females because of narrowness between the inguinal ligament and transverses arch. Congenial defects in tissue metabolism, relating to enzyme deficiency also suffer from hernia. There are deranged collagen synthesis disorders such as Ehler's- Danlos Syndrome, where the tissues are defective. This leads to direct hernia formation. Similarly, persons with

high arched lower border of transverses abdominus also develop direct hernia because of congenital posterior inguinal weakness.

B) Contributory Factors

- 1) **Age:** as age advances, abdominal muscle tissue weakness develops because of gradual tissue breakdown, hence most common in elderly persons. The reason for hernias in elderly people may be linked to finding of Rodrigues, who in 1990, reported a decrease in Oxytatum fibres and an increase in the amorphous substances of the elastic fibres as a function of age, which may be responsible for alterations in the transversalis fascia.
- 2) **Obesity:** Increased fat layers in the various layers of the abdominal wall leads to weakness of the layers, predisposing to hernia formation.
- 3) **Pulmonary Causes:** Emphysema, chronic bronchitis, pneumonitis causes laborious and difficult respiration which leads to rise in intra-abdominal pressure.
- 4) **Raised Intra-abdominal Pressure:** Prostatism, constipation, diverticular disease, colonic carcinoma, all leads to straining to expel the excreta, causing raised intra-abdominal pressure. Other genitourinary problems such as cystitis, cystocele and urethrocele play role in female to the formation of hernia.
- 5) **Cardiac Problems:** Patients suffering from congestive heart failure will have ascites, which opens up dormant patent processus leading hernia.
- 6) **Pregnancy:** Stretching of the abdominal wall in pregnancy disrupts muscles and later replaced by collagen tissue which prevents effective action of these muscles thus predisposing to hernia.

C) Precipitating and existing causes

- 1) Sudden increase in intra-abdominal pressure as occurs with coughing, straining, heavy weight lifting, sneezing and crying.
- 2) Trauma- severe sudden blow or crush injury may lead to hernia formation.

D) Biological Factors

- 1) **Malnutrition:** Sailors who suffer from scurvy had hernia and rupture of healed scars. This is because of vitamin 'C' deficiency which is essential for collagen synthesis and healing.
- 2) **Environmental Toxins:** Smokers had the potentially undesirable combination of increase in proteolytic and reductions in alpha- antitrypsin, the major naturally occurring circulating protease. This combination could set the stage for the evolution of a hernia by affecting the synthesis- degradation equilibrium of groin collagen and could be a pathologic sequence initiated by excessive smoking.

E) Iatrogenic Factors

Previous Operations:

1. Appendectomy may predispose to the later appearance of ipsilateral inguinal hernia. The Presumptive mechanism is that damage to the innervation of the muscular constrictors of the internal ring shutter mechanism.
2. Increased intra-abdominal pressure associated with chronic ambulatory peritoneal dialysis frequently results in hernia.

CLASSIFICATION OF GROIN HERNIA

ANATOMICAL TYPES

Indirect inguinal hernia

An indirect hernial sac is actually a dilated persistent processus vaginalis. It passes through the deep ring, lies within the spermatic cord and follows the indirect course of the cord to the scrotum.

Fig: 5. Indirect inguinal hernia



Direct inguinal hernia

The direct inguinal hernial sacs originate through the floor of the inguinal canal i.e., Hesselbach's triangle, they protrude directly and they are contained by the aponeurosis of the external oblique muscle.

Fig: 6. Direct inguinal hernia



Types of indirect inguinal hernias

1. Vaginal

The processus vaginalis has failed to become occluded in any part of its course. The hernia therefore descends to the base of the scrotum and the testis is behind it and may be difficult to locate.

2. Funicular

The processus is obliterated above the testis. The testis can be felt separately from the hernia below it.

3. Infantile

A process of peritoneum of the processus vaginalis is found in front of the hernia as high up as the external ring. Therefore, at operation, a peritoneal sac is found in front of the hernia sac.

4. Encysted
As (1), but a process of peritoneum lies in front of the sac up to the external ring. Types (3) and (4) are due to a diverticulum of the processus vaginalis being caught up at the external ring during development.
5. Intestinal
In this type, a diverticulum of the processus vaginalis has been caught between the layers of the developing abdominal wall .

The sac may be,

- Preparietal or extraparietal (superficial) between the superficial fascia and external oblique. Intraparietal (intramuscular) between the internal and external oblique muscles.

Retroparietal or Intraparietal (preperitoneal) between the fascia transversalis and peritoneum. This type of hernia is rare and is usually found in association with an imperfectly descended testis.⁵¹

Types of direct inguinal hernia

A direct hernia leaves the Hesselbach's triangle through its outer or inner part and is therefore,

- a. **Lateral direct hernia**
- b. **Medial direct hernia**⁵²

CLINICAL TYPES

1. Reducible
2. Irreducible
3. Obstructed
4. Strangulated [complication of irreducible hernia]
5. Inflamed

Reducible hernia

The hernia either reduces itself when the patient lies down, or can be reduced by the patient or the surgeon. The intestine usually gurgles on reduction and the first portion is more difficult to reduce than the last. Omentum, in contrast, is described as doughy and the last portion is more difficult to reduce than the first. A reducible hernia imparts an expansile impulse on coughing.

Irreducible hernia

Here the contents cannot be returned to the abdomen, but there is no evidence of other complications. It is usually due to adhesions between the sac and its contents or from overcrowding within the sac.

Obstructed hernia

This is an irreducible hernia containing intestine which is obstructed from without or within, but there is no interference to the blood supply to the bowel. The symptoms (Colicky abdominal pain and tenderness over the hernia site) are less severe and the onsets more gradual.

Strangulated hernia

A hernia becomes strangulated when the blood supply of its contents is seriously impaired, rendering the contents ischemic. Gangrene may occur as early as 5 to 6 hours after the onset of first symptoms. Although inguinal hernia may be 10 times more common than femoral hernia; a femoral hernia is more likely to strangulate because of the narrowness of the neck and its rigid surroundings.

Inflamed hernia

Inflammation can occur from inflammation of the contents of the sac (ie, acute appendicitis or salpingitis) or from external causes (eg, the trophic ulcers which develop in the dependent areas of large umbilical or incisional hernias). The hernia is usually tender but not tense and the overlying skin is red and edematous.

MANAGEMENT

Patients undergoing hernia repair have the right to assume that the repair will last for the rest of their life.

Indications for operation³⁶

1. All inguinal hernias in children should be repaired without delay because of the risk of complications of incarceration and strangulation. (It has been estimated that the complication rate when operating urgently for a strangulated hernia in a child is 20 times that of a planned surgery).
2. In adults, the risk of a hernia operation is negligible and the recurrence rate, when a good repair has been done, is so small that there is hardly any reason for not operating on all hernias as soon as they are diagnosed.
3. Gardner, in his series of patients more than 80 years of age operated for inguinal hernia both electively and as emergencies showed that deaths were the results of complications of primary hernia rather than associated diseases indicating that one should treat hernias in the elderly early before the complications develop.
4. The small, wide necked direct inguinal hernias in elderly patients that pop out and back on coughing can be left alone unless they show signs of growing.

Preoperative assessment³⁶

Assessment of general condition of the patient by appropriate clinical examinations and laboratory tests.

- Stop smoking at least for 2 weeks prior to operation.
- Grossly overweight patients should be advised to reduce before the operation.

- Particular attention should be paid to medication use as the elderly are frequently receiving multiple drugs, creating an increased risk of drug interaction.

Preparation⁵³

- A current recommendation is no solid food on the day of surgery. Clear liquids in any amount up to 3 hours before surgery and oral medication with up to 1 ounce of water on the morning of the surgery.
- Use of H₂ receptor antagonists such as Ranitidine to alkalinize and decrease the volume of stomach contents.
- Relief of anxiety with pre-operative sedatives. Perhaps the most effective approach to preoperative anxiety is a thoughtful and compassionate interview with an anesthesiologist.

Skin Preparation³⁶

Shaving the skin before the operation is controversial since it damages the skin in the form of minor cuts and scratches. If the shaving is done on the preoperative day, these minor wounds have sufficient time to become infected, thus increasing the incidence of infected hernia wounds. Some surgeons avoid problem by using a depilatory cream. Operation in an unshaven pubic area is unpleasant; also nuisance and the problem can be reasonably overcome by shaving the area shortly before the operation. The area of the lower abdomen and upper thigh is scrubbed for 5 minutes with a povidone iodine solution.

Anaesthesia⁵³

Spinal or Epidural anaesthesia is excellent and is rapidly gaining popularity. For laparoscopic hernial repair general anaesthesia is the anaesthesia of choice.

The three main principles in the management of the inguinal hernia are as follows⁵⁴

1. The normal anatomy should be reconstituted as far as possible. The first layer to be defective in either indirect or direct hernias, is the transversalis fascia, this should therefore be repaired first.
2. Only tendinous/ aponeurotic/ fascial structures should be sutured together.
3. The suture material must retain its strength for long enough to maintain tissue apposition and allow sound union of tissues to occur. A non-absorbable or very slowly absorbable suture material must therefore be employed.

Forceps are applied to the two cut edges; the upper leaf is retracted to expose the conjoined muscles arching over the cord and the lower to expose the upper surface of one inguinal ligament. The ilioinguinal and iliohypogastric nerves are identified and safe guarded.

The cord, with which is included the hernial sac is lifted up from the medial part of the incision and is spread out on the finger. Its coverings are incised longitudinally and are further separated by blunt dissection, care being taken to avoid injuring the spermatic veins. The sac appears as a pearly white structures lying on the inner superior aspect of the cord structures. The sac is separated by gauze stripping, as the separation proceeds traction is applied to the sac and the stripping is continued until the neck comes into view. This is identified from the presence of an adherent pad

or collar of fat. The inferior epigastric vessels lie to the medial side of indirect and lateral to direct hernia and care should be taken that they are not injured. When separation is complete the sac is opened at some distance from its neck and a finger is introduced into its interior to ensure that it is empty of its contents. Adherent contents are freed from the sac and return into the abdomen. If there is any doubt about the omentum it is best excised, because to return omentum of doubtful viability to the peritoneal cavity invites the formation of adhesion.

In the case of scrotal hernia, where the fundus of the sac may not come easily into view, there is no objection to leaving the distal part of the sac in situ. This facilitates the dissection requiring delivering the sac from the depth of scrotum and greatly reduces the risk of subsequent testicular atrophy and haematoma formation.

The sac is now drawn strongly downwards and it's twisted at its neck in order to occlude it before the ligature is applied. The sac is amputated 1cm below the ligature prior to cutting the ligature so that there is adequate control of the stump in the event of the bleeding. If the ligature has been applied at a sufficiently high level the stump will immediately retract well above the deep inguinal ring to lay flush with the general peritoneum.

The Lichtenstein Tension-free repair

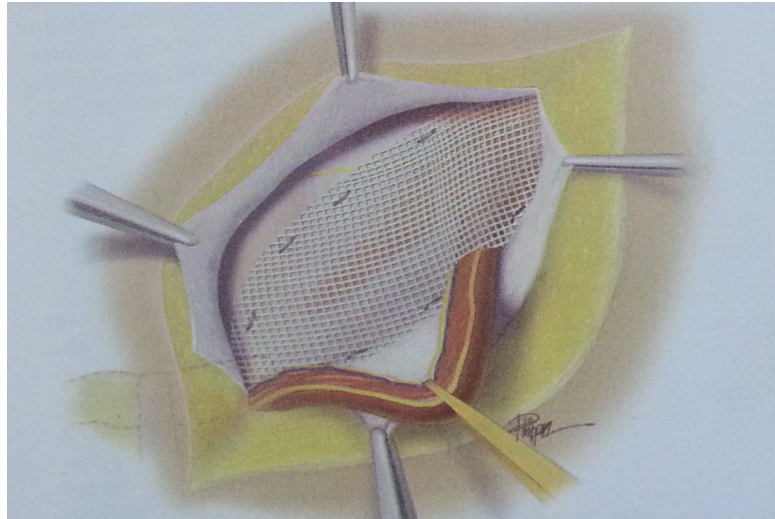
Since the early 1980s, the surgical techniques used in repairing groin hernias have undergone a profound transformation. In the tension-free the mesh prosthesis is not utilized to buttress or support a primarily sutured herniorrhaphy but is the actual repair.

After reducing the sac, a sheet of polypropylene mesh measuring approximately 8*6 cms is trimmed to fit the area exposed and used to reconstruct the entire floor of the inguinal canal without any attempt to close the defect by suture. The mesh is sutured along its lower edge to the public tubercle, the lacunar ligament and the inguinal ligament to beyond the internal ring with a continuous 2-0 polypropylene suture. The superior edge is tacked down to the aponeurosis or muscle of the internal oblique with a few interrupted sutures. The lateral edge of the mesh is slit and the two tails passed around to embrace the cord at the internal ring, they then are crossed over each other and tacked down to the inguinal ligament with one polypropylene suture. This creates a new internal ring and shutter mechanisms. The external oblique aponeurosis is then sutured in front of the cord. This is a completely tensionless repair and requires no formal reconstruction of the canal floor; it is a revolutionary departure from the tissue repair used for the past 100 years since Bassini.³⁶

Fig: 7. Opening of indirect sac



Fig: 8. Lichtenstein Tension- free repair



LAPAROSCOPIC INGUINAL HERNIA REPAIR⁵⁵

Indications for laparoscopic hernia repair:

Recurrence of hernia after open hernia repair.

Inguinal hernia on both sides as both can be repaired easily using the same small laparoscopic incision.

Preoperative preparation⁵³

Is similar to that done for open hernia mesh repair.

- A current recommendation is no solid food on the day of surgery. Clear liquids in any amount up to 4 hours before surgery and oral medication with up to 1 ounce of water on the morning of the surgery.
- Use of H₂ receptor antagonists such as ranitidine to alkalinize and decrease the volume of stomach contents.

- Relief of anxiety with pre-operative sedatives. Perhaps the most effective approach to preoperative anxiety is a thoughtful and compassionate interview with an anesthesiologist.

Skin Preparation³⁶

The skin from the nipple below 7 up to the midnight is shaven for patients undergoing laparoscopic hernia mesh repair.

Operative Procedure⁵⁵

The two commonly performed laparoscopic herniorrhaphies, the transabdominal preperitoneal (TAPP) and the totally extraperitoneal (TEP), are modeled after the open preperitoneal operation described above. The major difference is that the peritoneal space is entered through three trocar sites rather than a large open incision.

Patient Position

The patient is positioned supine with the surgeon standing on the opposite side of the table from the hernia. The first assistant stands opposite side of the table from the hernia. The first assistant stands opposite to the surgeon. Three laparoscopic cannulas are placed in a horizontal plane with the umbilicus. A 10 mm cannula at the umbilicus allows the surgeon to use the 10 mm laparoscope and facilitated the introduction of a sufficient sized mesh into the peritoneal cavity or the preperitoneal space.

Transabdominal Preperitoneal (TAPP) Procedure:

After the introduction of a 10mm cannula at the umbilicus, 10mm laparoscope is inserted and an initial diagnostic laparoscopy done. Two additional cannulas are

placed just lateral to the rectus muscle. The anatomic land marks including the median and medial umbilical ligaments, the bladder, the inferior epigastric vessels, the vas deferens, the spermatic cord, external iliac vessels and the hernial defect are identified. An incision of the peritoneum is initiated at the medial umbilical ligament at least 2cms above hernial defect and extends laterally towards the anterior superior iliac spine.

The preperitoneal space is exposed using blunt and sharp dissection, mobilizing the peritoneal flap inferiorly. The symphysis pubis, Cooper's ligament, iliopubic tract and the cord structures are identified. Direct hernial sacs are reduced during this dissection. Indirect sacs may have tenacious adhesions with the cord structures. The cord must be skeletonized, taking care not to cause trauma to the vas or the blood supply to the testicles. A small sac should be reduced, but if a large sac descending into the scrotum is present, it may be divided. The proximal sac then is closed before reduction, and the distal sac is opened distally as far as possible on the side opposite the cord. Finally, the peritoneal flap is dissected inferiorly well proximal to the divergence of the vas and the internal spermatic vessels. This assures that the prosthesis will lie flat in the preperitoneal space and will not roll up when the peritoneum is closed.

Next step is the placement of prosthesis. A large piece of mesh, 15x11cm or greater, is introduced into the abdominal cavity through the umbilical cannula and is positioned over the myopectineal orifice so that it completely covers the direct, indirect, and femoral spaces. Some surgeons prefer to split the mesh so as to accommodate the cord structures, while the others prefer to simply place the prosthesis over them. To prevent the chances of mesh migration or shrinkage some surgeons prefer to use staples, tacks or biological glue to fix the prosthesis. The

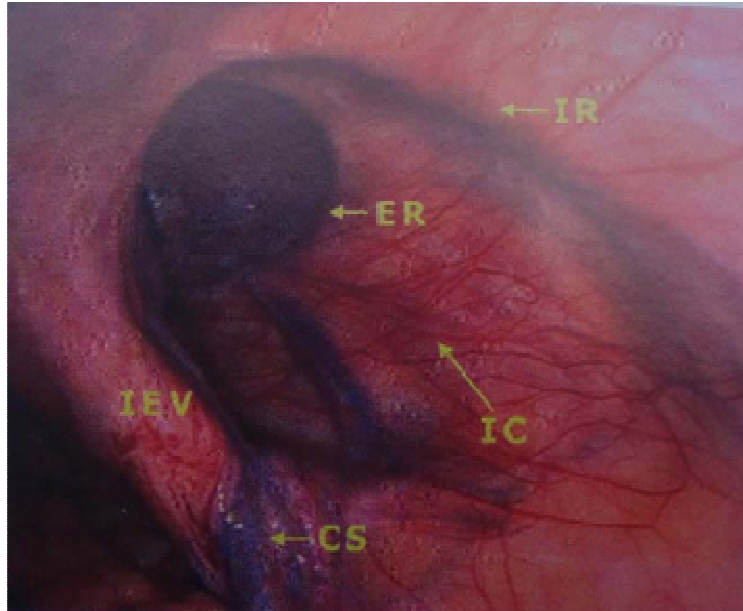
landmark for the fixation of the prosthesis are the contralateral pubic tubercle and the symphysis pubis for the medial edge, Cooper's ligament or the tissue just above it for the inferior border and the posterior rectus sheath transversalis fascia at least 2 cm above the hernia iliac spine to assure wide overlap. The peritoneum is closed taking into consideration not to leave gaps because small bowel has been known to find its way through them, leading to intestinal obstruction.

Preoperative preparations

The most important preoperative precaution is proper patient selection prior to surgery, especially in the initial part of the learning curve. Ideally, direct or small indirect hernias are best. Large hernias, irreducible, obstructed hernias are best avoided. An absolute contraindication is strangulated hernia. Also, detailed work-up of elderly patients to assess cardio respiratory status mandatory to ensure a safe outcome.

Fig: 9. Laparoscopic view of hernial sites.

ER- external ring, IR- internal ring, IC- inguinal canal, CS- cords structures, IEV- inferior epigastric vessel.



Intra operative complications and precautions

A) During creation of preperitoneal space

This is the most important step.

1. A wide linea alba may result in breaching the peritoneum; in such a situation, it is best to close the rectus and incise the sheath more laterally.
2. Improper placement of balloon trocar causing dissection of muscle fibers.
3. Entry into peritoneum causing pneumoperitoneum.
4. Rupture of balloon in preperitoneal space.
5. The Hassan's trocar must snugly fit into incision to avoid CO₂ leak.

To avoid these, one must ensure that the balloon is made properly and the correct space is entered by retracting the rectus muscle laterally to visualize the posterior rectus sheath. Also the balloon trocar is inserted gently, parallel to the abdominal wall, to avoid puncturing the peritoneum. The balloon must be inflated slowly with saline to ensure smooth and even distension and prevent its rupture.

B) Precautions during port placement

The trocars should be short and threaded in proportion to less workspace and to ensure a snug fit respectively. The skin incision should be just adequate to grip the trocar and prevent its slipping. The patient should empty their bladder before surgery as the suprapubic trocar could injure a filled bladder. The pressure in the preperitoneal space must be such as to offer sufficient resistance during trocar insertion to avoid puncturing the peritoneum.

C) Correct Identification of the anatomical landmarks

The next most important and crucial step in any hernia surgery is the correct identification of anatomical landmarks. This is difficult for beginners as the anatomy is different from that seen in open surgery. The first most important step is to identify the pubic bone. Once this is seen, the rest of the landmarks are traced keeping this as reference point. One is advised to keep away from the triangle of doom, which contains the iliac vessels and to avoid placing tacks in the triangle of pain laterally.

D) Bladder Injury:

Bladder injury most commonly occurs during port placement, dissecting a large direct sac or in a sliding hernia. It is mandatory to empty the bladder prior to an inguinal hernia repair to avoid a trocar injury. The diagnosis is evident when one sees urine in the extraperitoneal space.

E) Bowel Injury

It is rare during hernia surgery. It can occur when reducing large hernias, inadvertent opening of peritoneum causing the bowel to come into the field of surgery and in reduction of sliding hernias. Injury is best avoided in such circumstances by opening the hernial sac close as possible to the deep ring.

F) Vascular Injury

This is one of the commonest injuries occurring in hernia repair and often a reason for conversion. The various sites where it can occur is rectus muscle vessel injury during trocar insertion; inferior epigastric vessel injury; bleeding from venous plexus on the pubic symphysis; aberrant obturator vein injury; testicular vessel injury; and the most disastrous of all, iliac vessels, which requires an emergency conversion to control the bleeding and the immediate services of a vascular surgeon to repair the same. Most of the other bleeding can be controlled with cautery or clips. Careful dissection and adherence to the principles of surgery will help in avoiding most of these injuries.

G) Injury to vas deferens

Injury occurs while dissecting the hernial sac from the cord structures. The injury causes an eventual fibrotic narrowing of the vas. A complete transaction of the vas is best avoided and this may be done by identifying before dividing any structure near the deep ring or floor of the extraperitoneal space. Also the separation of cord structures from the hernial sac must be gentle and direct grasping of vas deferens with forceps must be avoided.

H) Pneumoperitoneum

It is common occurrence in TEP which every surgeon should be prepared to handle. Putting the patient in Trendelenberg position and increasing the insufflation pressures to 15mmHg helps. If the problem still persists, a verses needle can be inserted at Palmer's point.

Postoperative Complications

1. Seroma/ hematoma formation

It is a common complication after laparoscopic hernia surgery, the incidence being in the range of 5- 25%. They are specially seen after large indirect hernia repair. Most resolve spontaneously over 4- 6 weeks. A seroma can be avoided by minimizing dissection of the hernial sac from the cord structures, fixing the direct sac to pubic bone and fenestrating the transversalis fascia in a direct hernia. Some surgeons put in a drain if there is excessive bleedings or after extensive dissection.

2. Urinary Retention

This complication after hernia repair has a reported incidence of 1.3 to 5.8%. It is usually precipitated in elderly patients, especially if symptoms of prostatism are present. These patients are best catheterized prior to surgery and catheter removed the next day morning.

3. Neuralgias

The incidence of these complications is reported to be between 0.5 and 4.6% depending on the technique of repair. The intraperitoneal onlay mesh method had the highest incidence of neuralgias in one study and was hence abandoned as a form of viable repair. The commonly involved nerves are lateral cutaneous nerve of thigh,

genitofemoral nerve and immediate cutaneous nerve of thigh. They are usually involved by mesh- induced fibrosis or entrapment by a tack.

4. Testicular pain and swelling

It occurs due to excessive dissection of a sac from the cord structures, especially a complete sac. Reported incidence is of 0.9 to 1.5%. Most are transient orchitis was found in a small number of patient but did not lead to testicular atrophy.

5. Mesh infection and wound infection

Wound infection rates are very low. Mesh infection is a very serious complications and care must be taken to maintain strict aseptic precautions during the entire procedure. Any endogenous infection must be treated with an adequate course of antibiotics prior to surgery.

6. Recurrence:

It is the most important endpoint of any hernia surgery. It requires a proper and thorough knowledge of anatomy and a thorough technique of repair to help keep the recurrence in endoscopic repair to a minimum.

METHODOLOGY

SOURCE OF DATA:

- All patients came to B.L.D.E.U.'s Shri B M Patil Medical College, Hospital and Research Centre and admitted and operated for inguinal hernia.

METHOD OF COLLECTION OF DATA:

- Period of study was from October 2013 to June 2015.
- In this study 60 cases were studied, in each group 30 cases were allocated alternatively.
- A Proforma was used to collect all the relevant data from the patients.
- Detailed history was taken and thorough clinical examination and investigations were performed for all the patients in both the study groups.
- Data entered on master chart for analysis.
- All cases were followed up to discharge and subsequently for a follow up for three months.

SAMPLING:

- Prospective, interventional study.
- A minimum of 30 cases each for the Lichtenstein tension free repair and Laparoscopic transabdominal preperitoneal mesh repair.
- A study titled outcome and cost comparison of laparoscopic transabdominal preperitoneal hernia repair versus open Lichtenstein technique by Nadim Khan et al found in his study that, in post operatively the mean standard deviation of

number of patients had the pain by TAPP and Lichtenstein hernioplasty were 2.0800 ± 1.60153 and 2.9800 ± 1.85703 respectively.

- Considering the average standard deviation 1.729 at α error 0.05 and β error 0.20 the calculated sample size is 57.9
- Calculated sample size is $57.9 \cong 60$.

- Formula for estimating sample size:
$$n = \frac{(Z\alpha + z\beta)^2 \times 2 \times SD^2}{d^2}$$

Where

Sample size to be estimated.

$Z\alpha$ = Z value α error

P= Prevalence rate.0.18

$Z\beta$ =z value for beta error

s=common SD

d=clinically meaningful difference

Statistical Analysis:

- Data expressed as mean, median and standard deviation.
- Diagrams.
- Chi square test and T test will be used to compare the results between two groups.

INCLUSION CRITERIA

- Patients with unilateral inguinal hernia with reducible and non-obstructive and either primary or recurrent hernias are included in the study.

EXCLUSION CRITERIA

- Complicated Inguinal hernia (like obstruction or strangulation) is excluded from the study.

RESEARCH HYPOTHESIS:

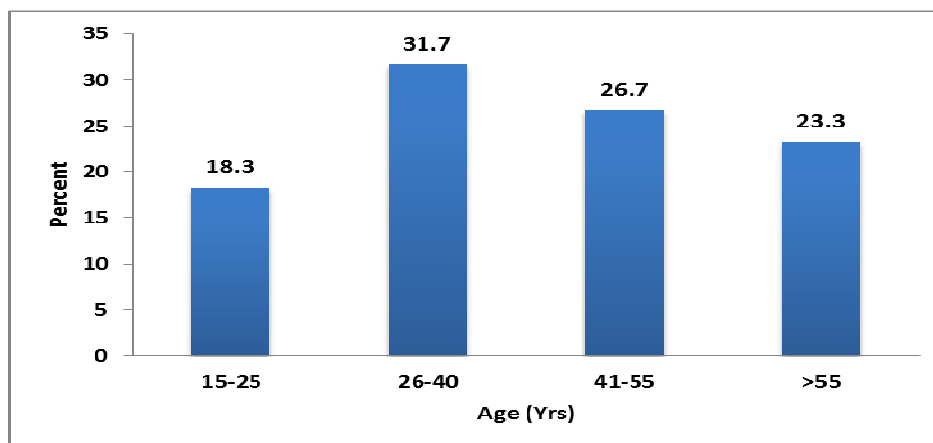
Trans-abdominal pre-peritoneal laparoscopic inguinal hernia repair is effective in decreasing the incidence of post-operative pain, complications and post-operative hospital stay in comparison with Lichtenstein tension free mesh hernioplasty.

RESULTS AND OBSERVATION

Table: 1. Percent distribution of Age (yrs)

Age (Yrs)	N	Percent
15-25	11	18.3
26-40	19	31.7
41-55	16	26.7
>55	14	23.3
Total	60	100

Graph: 1. Percent distribution of Age (yrs)



In our study majority of the patients are between 26-40 years of age and least below 25 years.

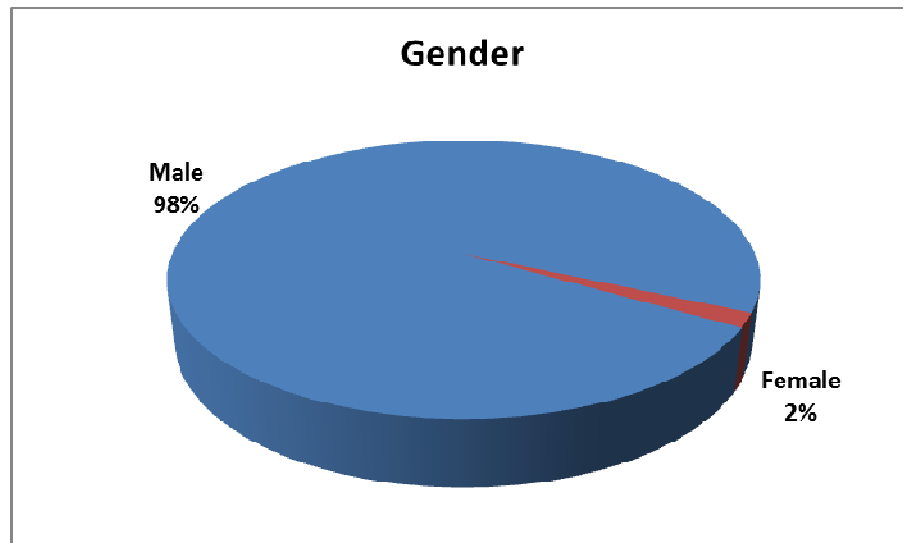
Table: 2. Mean age

	Cases	Control	Ttotal
Mean age	35.9	47.1	41.5
S D	14.2	12.7	14.5

Table: 3. Percent distribution of Gender

Gender	N	Percent
Male	59	98.3
Female	1	1.7
Total	60	100

Graph: 2. Percent distribution of Gender

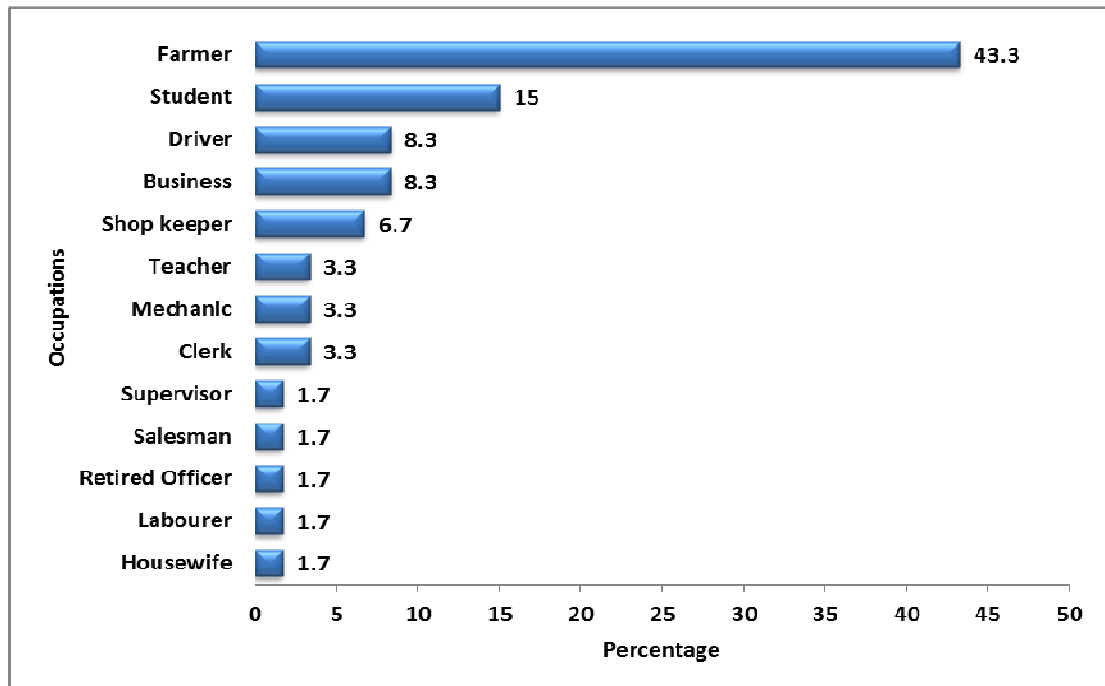


In our study hernia is commonly seen in male ie, 98% and had only one female.

Table: 4. Percent Distribution of Occupations

Occupation	N	Percent
Housewife	1	1.7
Labourer	1	1.7
Retired Officer	1	1.7
Salesman	1	1.7
Supervisor	1	1.7
Clerk	2	3.3
Mechanic	2	3.3
Teacher	2	3.3
Shop keeper	4	6.7
Business	5	8.3
Driver	5	8.3
Student	9	15
Farmer	26	43.3
Total	60	100

Graph: 3. Percent Distribution of Occupations



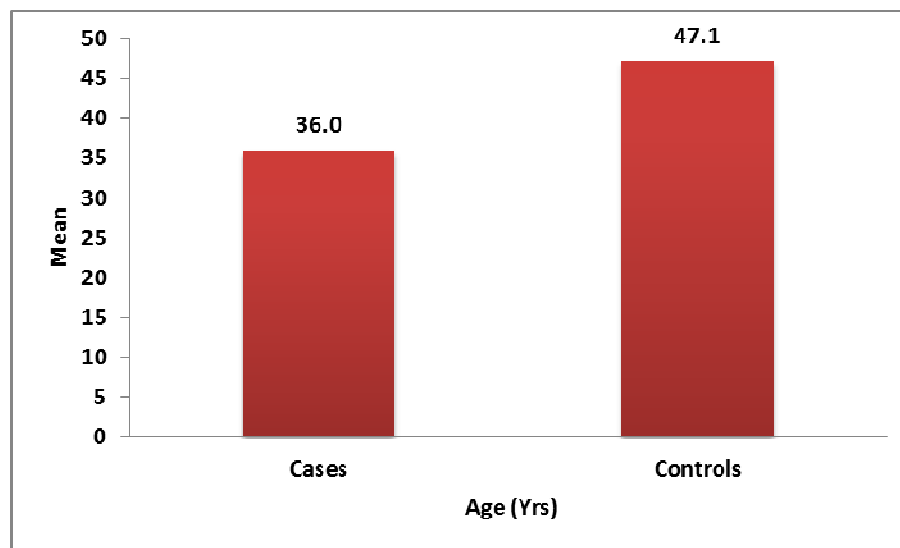
The incidence of hernia was common among farmers (43.3%) in comparison to other occupations.

Table: 5. Mean comparison of variables between cases and controls

Variables	Cases		Controls		p value
	Mean	SD	Mean	SD	
Age	36.0	14.2	47.1	12.7	0.002*
Duration of Surgery (in minutes)	98.7	9.3	58.3	8.4	0.000*
Post Op Hospital Stay (in days)	2.2	0.4	5.5	2.0	0.000*
Post Op Pain after					
6hrs	3.8	0.6	4.9	0.6	0.000*
12hrs	3.1	0.6	4.5	0.6	0.000*
18hrs	2.7	0.7	4.0	0.6	0.000*
24hrs	2.2	0.6	3.6	0.5	0.000*

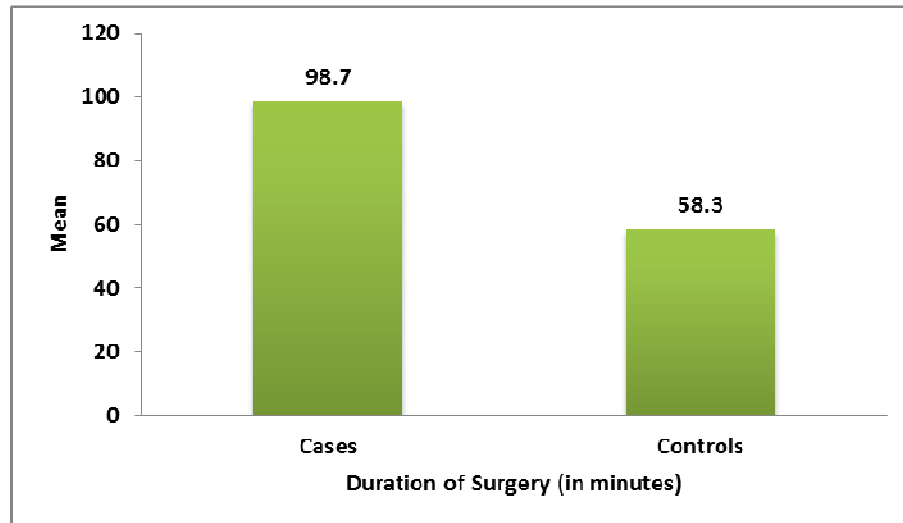
*significant difference with $p < 0.05$

Graph: 4. Mean comparison of Age between cases and controls



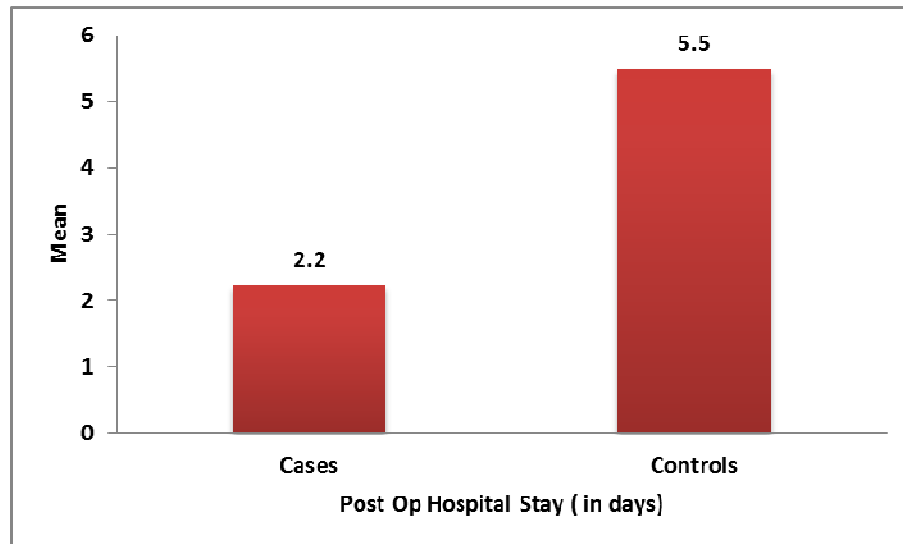
In our study the minimum age at which occurrence of hernia was at 19 yrs and the eldest being at 70 yrs. In case mean age is 36 yrs and control 47.1 yrs.

Graph: 5. Mean comparison of Duration of Surgery between cases and controls



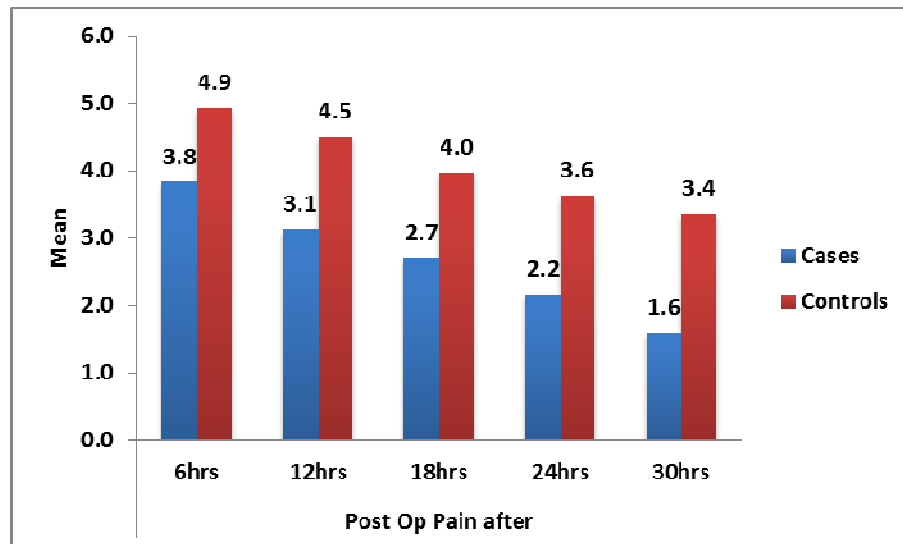
In our study we found that the mean time taken for open Lichtenstein tension free inguinal mesh repair was about 58.3 minutes compared to the mean time of 98.7 minutes taken for laparoscopic inguinal hernia repair.

Graph: 6. Mean comparison of Post Op Hospital Stay between cases and controls



The mean duration of hospital stay after surgery was found to be 5.5 days for the hernioplasty group compared to the laparoscopic hernia group which was around 2.2 days. Laparoscopic hernioplasty (TAPP) had significantly less post-operative hospital stay compared to open hernioplasty.

Graph: 7. Mean comparison of Post-op Pain between cases and controls



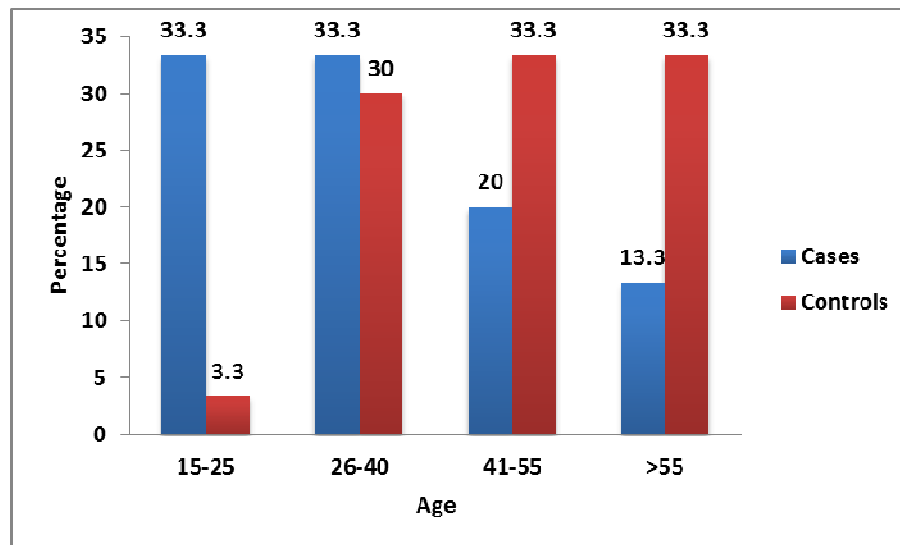
In our study there is a significant difference between post-operative pain after open and laparoscopic hernioplasty (TAPP).

Table: 6. Association of Age between cases and controls

Age (Yrs)	Cases		Controls		Total		p value
	N	%	N	%	N	%	
15-25	10	33.3	1	3.3	11	18.3	0.012*
26-40	10	33.3	9	30.0	19	31.7	
41-55	6	20.0	10	33.3	16	26.7	
>55	4	13.3	10	33.3	14	23.3	
Total	30	100.0	30	100.0	60	100.0	

More than 50% patients were below age 40 yrs among both cases and controls. Majority of patients were from age group 26-40 yrs. Age is significantly associated between cases and controls (p value=0.012).

Graph: 8. Association of Age between cases and controls

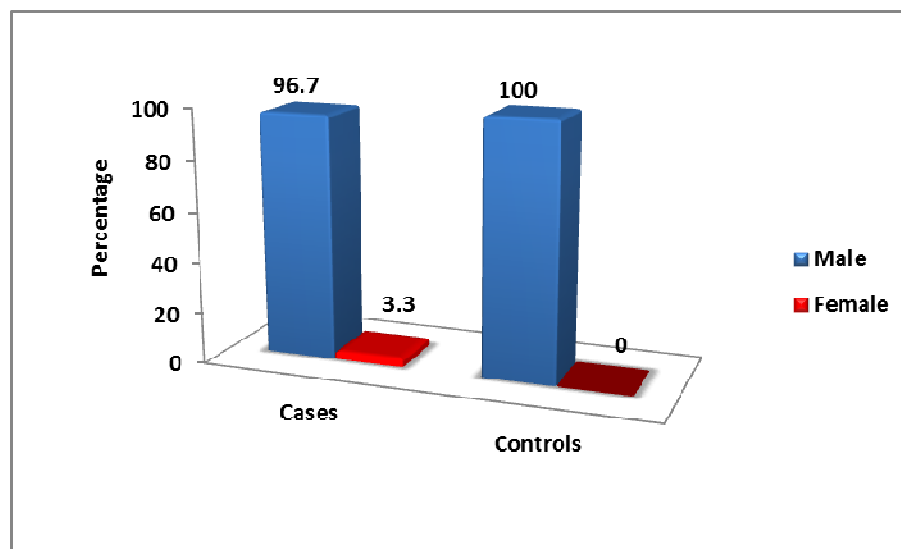


In this study younger age group patients are choosing laparoscopic hernioplasty (TAPP) and elder patients underwent open hernioplasty.

Table: 7. Association of Gender between cases and controls

Sex	Cases		Controls		Total		p value
	N	%	N	%	N	%	
Male	29	96.7	30	100.0	59	98.3	0.313
Female	1	3.3	0	0.0	1	1.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 9. Association of Gender between cases and controls

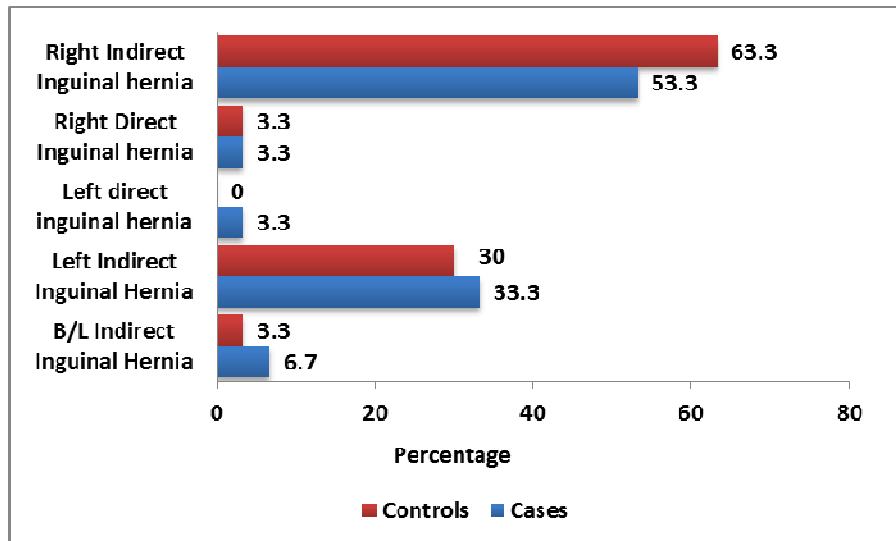


In our study 98% were male and only 1 female underwent laparoscopic hernioplasty (TAPP).

Table: 8. Association of Diagnosis between cases and controls

Diagnosis	Cases		Controls		Total		p value
	N	%	N	%	N	%	
B/L Indirect Inguinal Hernia	2	6.7	1	3.3	3	5.0	0.801
Left Indirect Inguinal Hernia	10	33.3	9	30.0	19	31.7	
Left direct inguinal hernia	1	3.3	0	0.0	1	1.7	
Right Direct Inguinal hernia	1	3.3	1	3.3	2	3.3	
Right Indirect Inguinal hernia	16	53.3	19	63.3	35	58.3	
Total	30	100.0	30	100.0	60	100.0	

Graph: 10. Association of Diagnosis between cases and controls

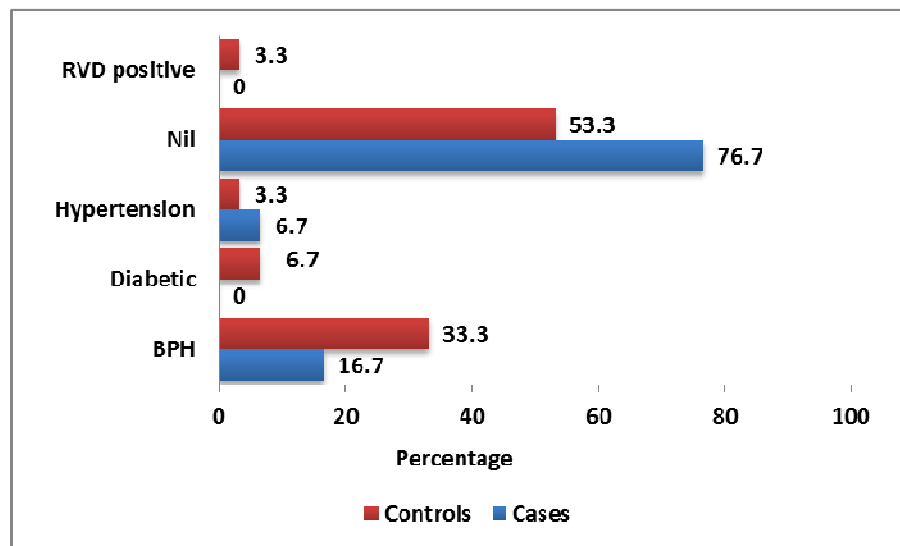


Incidence of right sided indirect inguinal hernia is more in both cases and controls and least in case of left sided direct hernia.

Table: 9. Association of Associated Disease between cases and controls

Associated Disease	Cases		Controls		Total		p value
	N	%	N	%	N	%	
BPH	5	16.7	10	33.3	15	25.0	0.181
Diabetic	0	0.0	2	6.7	2	3.3	
Hypertension	2	6.7	1	3.3	3	5.0	
Nil	23	76.7	16	53.3	39	65.0	
RVD positive	0	0.0	1	3.3	1	1.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 11. Association of Associated Disease between cases and controls

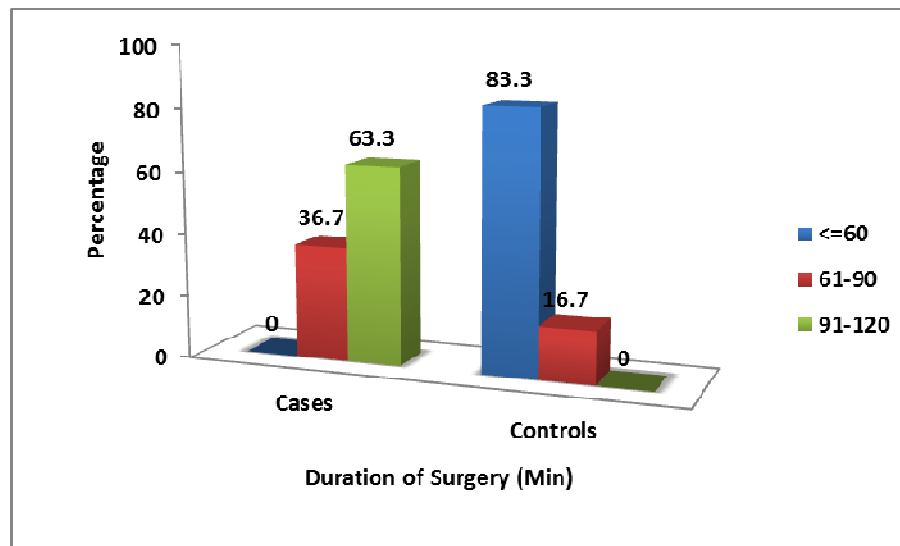


BPH was the most common associated illness, hypertension seen in 3 patients and diabetes mellitus was in 2 patients. One patient was RVD positive.

Table: 10. Association of Duration of Surgery between cases and controls

Duration of Surgery (min)	Cases		Controls		Total		p value
	N	%	N	%	N	%	
<=60	0	0.0	25	83.3	25	41.7	0.000
61-90	11	36.7	5	16.7	16	26.7	
91-120	19	63.3	0	0.0	19	31.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 12. Association of Duration of Surgery between cases and controls

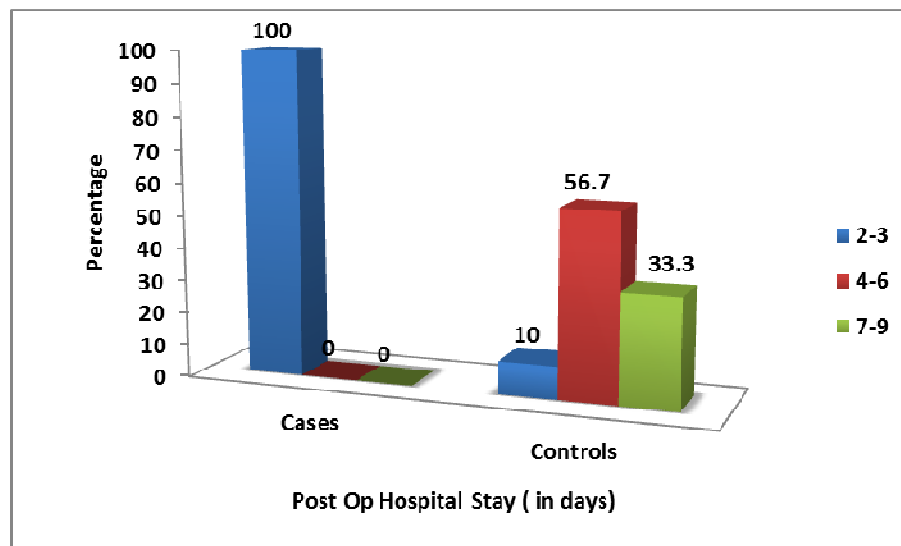


In this study most of the open hernioplasty took less than 60 min ie, 83.3% and most of the laparoscopic hernioplasty (TAPP) took more than 90 min ie, 63.3.

Table: 11. Association of Post Op Hospital Stay between cases and controls

Post Op Hospital Stay (in days)	Cases		Controls		Total		p value
	N	%	N	%	N	%	
2-3	30	100.0	3	10.0	33	55.0	0.000
4-6	0	0.0	17	56.7	17	28.3	
7-9	0	0.0	10	33.3	10	16.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 13. Association of Post Op Hospital Stay between cases and controls

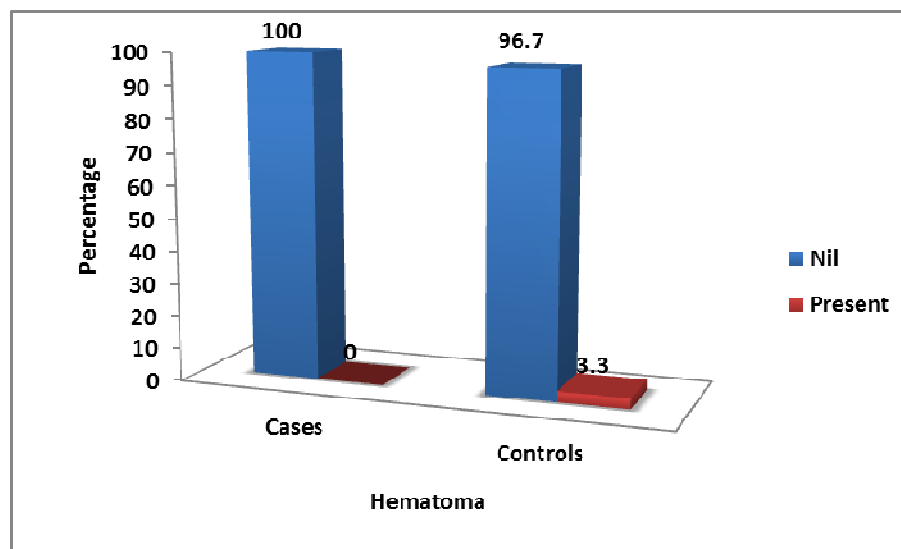


In case laparoscopic hernioplasty (TAPP) all patient got discharged within 3 days after the surgery and in open hernioplasty most of the patients got discharged 4days after surgery.

Table: 12. Association of Hematoma between cases and controls

Hematoma	Cases		Controls		Total		p value
	N	%	N	%	N	%	
Nil	30	100.0	29	96.7	59	98.3	0.313
Present	0	0.0	1	3.3	1	1.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 14. Association of Hematoma between cases and controls

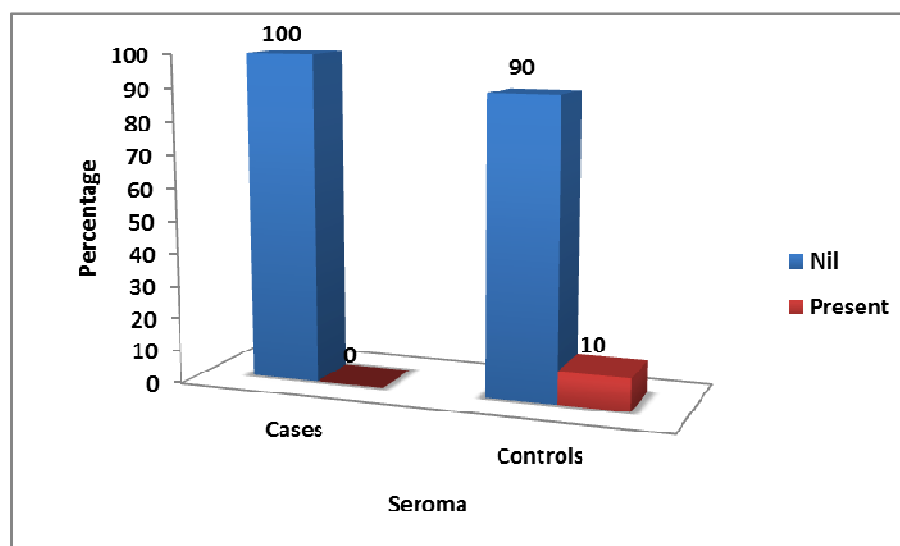


Laparoscopic hernioplasty had no incidence of hematoma and in case of open hernioplasty had one case of hematoma.

Table: 13. Association of Seroma between cases and controls

Seroma	Cases		Controls		Total		p value
	N	%	N	%	N	%	
Nil	30	100.0	27	90.0	57	95.0	0.076
Present	0	0.0	3	10.0	3	5.0	
Total	30	100.0	30	100.0	60	100.0	

Graph: 15. Association of Seroma between cases and controls

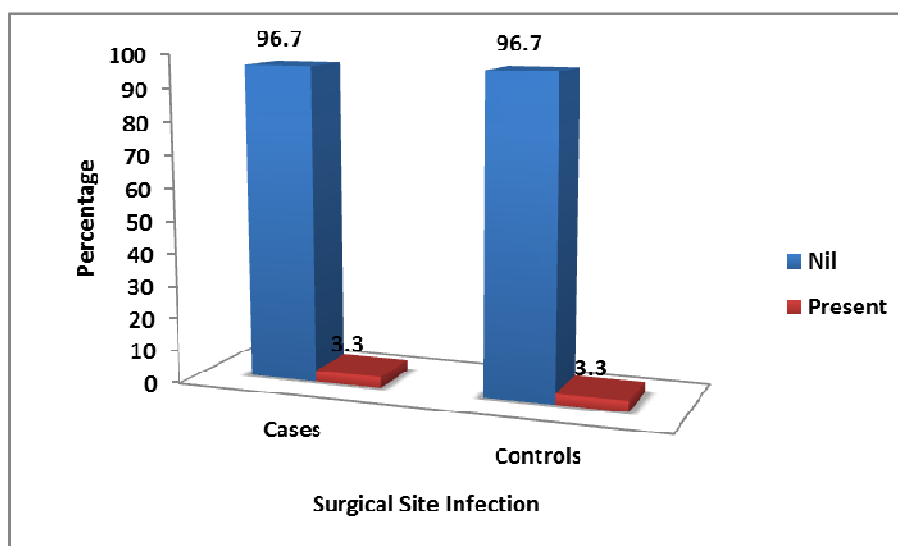


In our study there is significant cases with seroma formation after open herioplasty and no cases in laparoscopic hernioplasty(TAPP).

Table: 14. Association of Surgical Site Infection between cases and controls

Surgical Site Infection	Cases		Controls		Total		p value
	N	%	N	%	N	%	
Nil	29	96.7	29	96.7	58	96.7	1.000
Present	1	3.3	1	3.3	2	3.3	
Total	30	100.0	30	100.0	60	100.0	

Graph: 16. Association of Surgical Site Infection between cases and controls

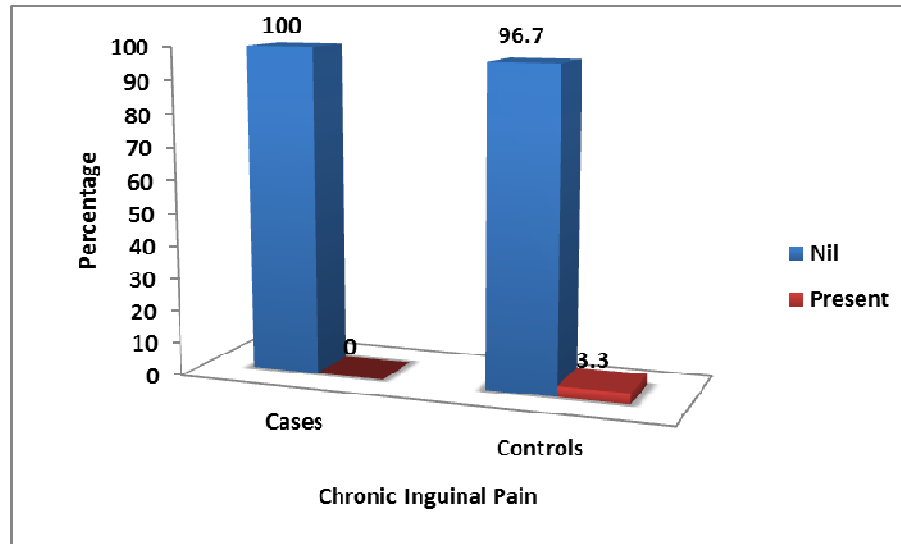


In this study we had similar incidence of surgical site infection ie 3.3 % (one case in each).

Table: 15. Association of Chronic Inguinal Pain between cases and controls

Chronic Inguinal Pain	Cases		Controls		Total		p value
	N	%	N	%	N	%	
Nil	30	100.0	29	96.7	59	98.3	0.313
Present	0	0.0	1	3.3	1	1.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 17. Association of Chronic Inguinal Pain between cases and controls



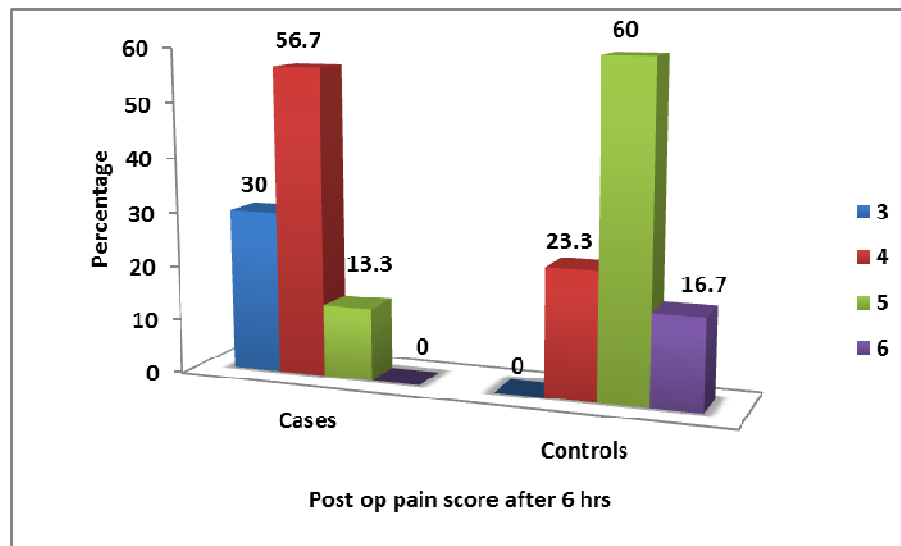
One chronic inguinal pain seen in case of open hernioplasty.

Table: 16. Association of Post op pain score after 6hrs between cases and controls

Post op pain score after 6hrs	Cases		Controls		Total		p value
	N	%	N	%	N	%	
3	9	30.0	0	0.0	9	15.0	0.000*
4	17	56.7	7	23.3	24	40.0	
5	4	13.3	18	60.0	22	36.7	
6	0	0.0	5	16.7	5	8.3	
Total	30	100.0	30	100.0	60	100.0	

Significant with $p < 0.05$

Graph: 18. Association of Post op pain score after 6hrs between cases and controls

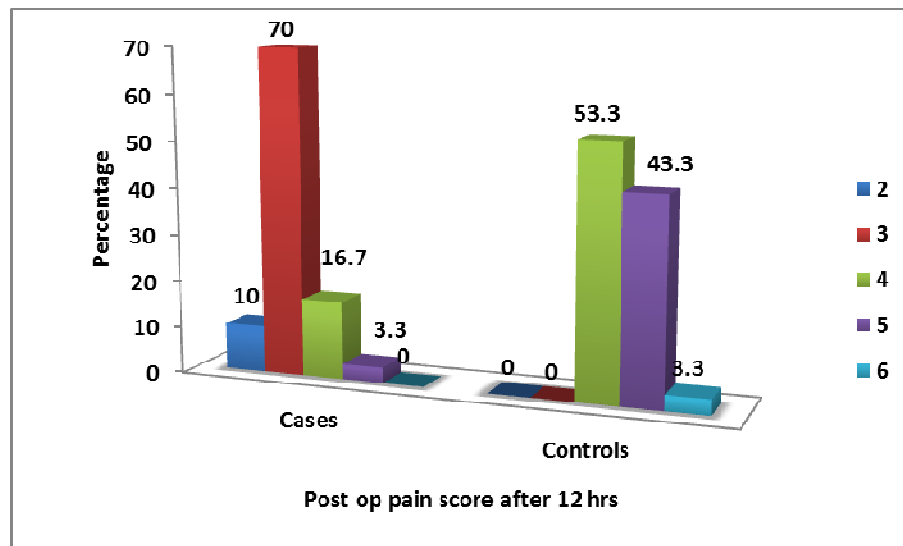


Compared tolaparoscopic and open hernioplasty there was significant difference in pain 6 hours after the surgery.

Table: 17. Association of Post op pain score after 12hrs between cases and controls

Post op pain score after 12hrs	Cases		Controls		Total		p value
	N	%	N	%	N	%	
2	3	10.0	0	0.0	3	5.0	0.000
3	21	70.0	0	0.0	21	35.0	
4	5	16.7	16	53.3	21	35.0	
5	1	3.3	13	43.3	14	23.3	
6	0	0.0	1	3.3	1	1.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 19. Association of Post op pain score after 12hrs between cases and controls

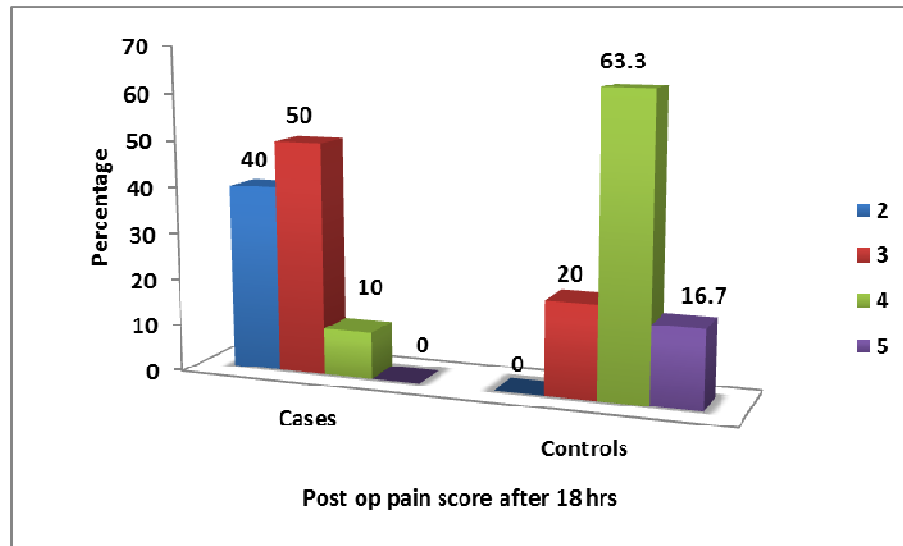


12 hours after laparoscopic hernoplasty most of the patients had mild pain compared to open hernioplasty.

Table: 18. Association of Post op pain score after 18 hrs between cases and controls

Post op pain score after 18hrs	Cases		Controls		Total		p value
	N	%	N	%	N	%	
2	12	40.0	0	0.0	12	20.0	0.000
3	15	50.0	6	20.0	21	35.0	
4	3	10.0	19	63.3	22	36.7	
5	0	0.0	5	16.7	5	8.3	
Total	30	100.0	30	100.0	60	100.0	

Graph: 20. Association of Post op pain score after 18 hrs between cases and controls

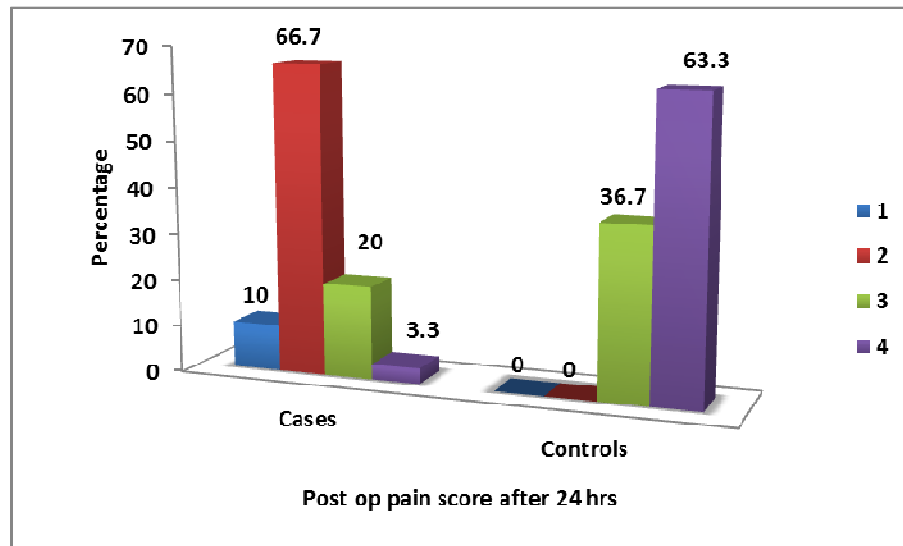


After 18 hours of surgery 90% of laparoscopic hernioplasty patients had only mild pain.

Table: 19. Association of Post op pain score after 24 hrs between cases and controls

Post op pain score after 24hrs	Cases		Controls		Total		p value
	N	%	N	%	N	%	
1	3	10.0	0	0.0	3	5.0	0.000
2	20	66.7	0	0.0	20	33.3	
3	6	20.0	11	36.7	17	28.3	
4	1	3.3	19	63.3	20	33.3	
Total	30	100.0	30	100.0	60	100.0	

Graph: 21. Association of Post op pain score after 24 hrs between cases and controls

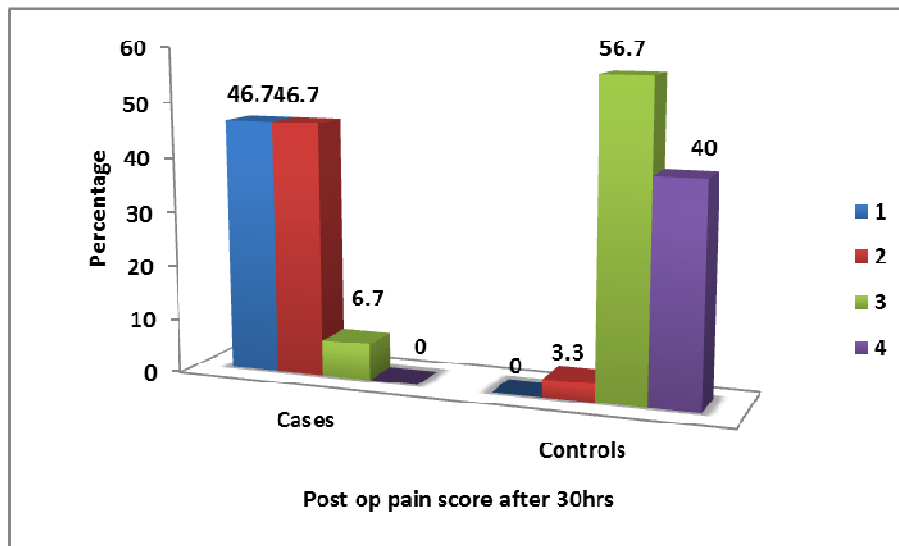


After 24 hours of surgery there is significant reduction of pain in laparoscopic hernioplasty patients. In case of open hernioplasty most of the patients had moderate pain.

Table: 20. Association of Post op pain score after 30 hrs between cases and controls

Post op pain score after 30hrs	Cases		Controls		Total		p value
	N	%	N	%	N	%	
1	14	46.7	0	0.0	14	23.3	0.000
2	14	46.7	1	3.3	15	25.0	
3	2	6.7	17	56.7	19	31.7	
4	0	0.0	12	40.0	12	20.0	
Total	30	100.0	30	100.0	60	100.0	

Graph: 22. Association of Post op pain score after 30 hrs between cases and controls

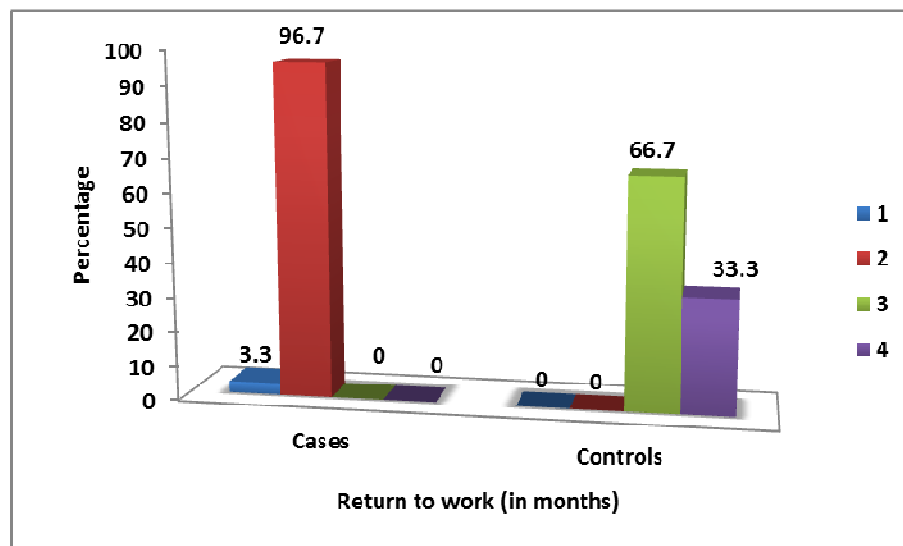


Laparoscopic hernioplasty patients had only minimal pain 30 hours after the surgery while open hernioplasty patients had mild to moderate pain.

Table: 21. Association of Return to work (in months) between cases and controls

Return to work (in months)	Cases		Controls		Total		p value
	N	%	N	%	N	%	
1	1	3.3	0	0.0	1	1.7	0.000
2	29	96.7	0	0.0	29	48.3	
3	0	0.0	20	66.7	20	33.3	
4	0	0.0	10	33.3	10	16.7	
Total	30	100.0	30	100.0	60	100.0	

Graph: 23. Association of Return to work (in months) between cases and controls



All the patients underwent laparoscopic hernioplasty returned to work within 2 months after the surgery. In open hernioplasty all the patients took minimum 3 months to return to work.

DISCUSSION

Age: Comparison of mean age of the study population

Mean age in others standard study is compared with our study below.

Table: 22. Mean age Comparison with other studies

Mario Testini	Alfredo Moreno	C Kim Fuchs	Giampiero Campanelli	PRESENT STUDY
58	57	56.1	59	41.5

In our study mean age of inguinal hernia was 41.5 which significantly less compared to others study. In all others study mean age was above 56 yrs.

Sex: In a study by Ira M. Rutkow⁵⁴, 90% of total cases were male and 10% female.

In a study by Martin Kurzer⁵⁵ of British hernia centre, 975 cases were male and 3% female.

Table : 23. Comparison of sex incidence in the present study with standard literature

Sex	In our study	Ira M. Rutkow	Martin Kurzen
Male	98%	90%	97%
Female	2%	10%	3%

The sex incidence is correlating with others study. In our study female patient was only 2% compared to others ie,3% and 10%.

LOCATION OF HERNIA

Percentage of location of inguinal hernia compared to various other standard studies.

Table: 24. Location of hernia Comparison with other studies

Location	Lousies & Wendall	Bholasingh Sindhu	Delvin	Bk Study	Our Study
Right	49%	60%	55%	63%	62%
Left	38%	36%	45%	37%	33%
Bilateral	13%	4%	-	-	5%

Our study is comparable to other studies in case of laocation of hernia. The percentage in our study is right- 62%, left- 33% and bilateral 5% when other standared studies shows almost same results.

Comparison of type of hernia

Type of inguinal hernia in our study comparing below with other standard studies

Table: 25. Comparison of type of hernia with other studies (direct or indirect hernia)

Type	Mario Testini	Lousies & Wendall	L Palanivelu	RHS	Present Study
Indirect	38.5 %	65%	76%	63%	95%
Direct	54.5%	20%	24%	35%	5%

Compared to other standard studies in our study having more cases of indirect hernia ie,95% and less direct hernia ie,5%.

Duration of surgery

Table : 26. Duration of surgery

Type of surgery	Mean time in our study (time in min.)	Udwadia Tehemton	MRC Trail
Open Lichtenstein tension free inguinal mesh repair	58.3	55.5	43.3
TAPP	98.7	67.5	58.4

The mean duration for hernioplasty in our study was 58.3 min which is in comparison to the study conducted by Udwadia Tehemton et al.⁵⁷ Time for laparoscopic inguinal hernia repair (TAPP) was 98.7 min compared to the standard study which was around 67.5 min. This may be due to the initial learning curve of the surgeons in our study leading to prolonged operating time. In the MRC trail the operating times were 43.3 min for the hernioplasty group compared to 58.4 min for the laparoscopic hernial repair group.⁵⁸

Post operative pain

Table : 27. Post operative pain

	Cases		Controle		P Value
6hrs	3.8	0.6	4.9	0.6	0.000*
12hrs	3.1	0.6	4.5	0.6	0.000*
18hrs	2.7	0.7	4.0	0.6	0.000*
24hrs	2.2	0.6	3.6	0.5	0.000*

Immediate post operative pain was assessed using visual analog scale. A visual analog scale (VAS) consists of a facial expression describing different levels of pain intensity or pain effect, ordered from least to most intense. It shows significant difference in open hernioplasty and laparoscopic hrnioplasty(TAPP). As can be seen from the table above, the severity of pain was more in the cases where hernioplasty was performed and less in the laparoscopic inguinal hernia repair. This can be probably explained by the extensive dissection involved in the tissue repairs.

Post operative complication

Table : 28. Comparison hematoma with other studies

Mario Testini		Alfredo Moreno		C Kim Fuchs		Giampiero Campanelli		Present study*	
Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls
1 (2%)	4 (7%)	0 (0)	2 (10%)	3(2.3%)	5 (3.7%)	0 (0)	1 (3%)	0 (0)	1 (3.3%)

Number in parenthesis indicate percentage.

Comparison of chronic pain

Table: 29. Comparison of chronic pain with other studies

Mario Testini		Alfredo Moreno		Present study*	
Cases	Controls	Cases	Controls	Cases	Controls
0	2 (4%)	0	2 (10%)	0	1(3.3%)

In our study the post operative complications like hermatoma, seroma and wound infection were comparatively lower in the laparoscopic hernia repair group 0, 0and 3.3% compared to that of the hernioplasty group 3.3%, 10% and 3.3% respectively.

In the study done by Udwadia Tehemton et al wound infection rates were significantly lower after laparoscopic techniques (1%) than after the Lichtenstein operation (2.7%).⁵⁷ The incidence of inguinal hermatoma was found to be significantly lower after the laparoscopic repairs (13.1%) than after the Lichtenstein repair (16.0%). Our study has comparable results with the above study regarding post operative complications.

Duration of Hospitalization after surgery

Table: 30. Duration of Hospitalization after surgery

	Surgery done	No of patients	Mean
Post operative hospital stay	Open hernioplasty	30	5.5
	TAPP	30	2.2

In our study we found that post operative hospital stay was significantly less (mean 2.2days) when compared to open Lichtenstein tension free hernioplasty(mean 5.5 days).

CONCLUSION

The present study is comparative study between the Lichtenstein tension free mesh repair and the Laparoscopic inguinal hernia mesh repair (TAPP). The study was conducted with an intension to compare the effectiveness of the different surgeries and complications, if any.

All patients were intensively monitored in the immediate post-operative period and the complications noted. We found that there was a marked reduction in post-operative pain in laparoscopic (TAPP) hernia repair compared to the Lichtenstein tension free mesh hernioplasty surgery. But the laparoscopic hernia repair is expensive than open repair and it require general anaesthesia. There was marked difference in the post-operative complications between the two groups. Post-operative hospital stay was significantly less in laparoscopic (TAPP) cases. The patients were followed up in the postoperative period for three month durations. Drop- outs to follow up were eliminated.

There was little limitation in this study, the learning curve for laparoscopic hernia repair led to prolonged duration of surgery. Long term outcomes and results cannot be assessed.

To conclude, laparoscopic hernia repair is significantly better compared to open Lichtenstein tension free method.

SUMMARY

In our study the incidence of hernia was common in the younger age group, greatest in the 26 - 40 yrs age group and men were affected more than women.

The occurrence of hernia is common among the farmers accounting for 43.3% in comparison to other occupation like teacher, drivers, or students.

In our study 15 patients having BPH, 3 patients suffered from hypertension, while 2 of them had illness like diabetes mellitus.

Right indirect hernia was seen in 35 cases being the most frequent type.

In our study 30 cases underwent laparoscopic hernia repair (TAPP) and 30 cases underwent Lichtenstein hernioplasty. They were randomly chosen for the different surgeries.

Duration of surgery was more in TAPP due to learning curve of the procedure.

Severe pain was complained in cases of Lichtenstein hernioplasty and very less pain scores in case of laparoscopic hernia repair.

Post- operative wound infection developed in 1 case of each group. Hematoma at the operated site was found in 1 case of Lichtenstein hernioplasty. Seroma occurred in 3 cases of Lichtenstein hernioplasty and 1 case of chronic inguinal pain seen in Lichtenstein group.

The duration of hospitalization after surgery was 5.5 days in case of Lichtenstein hernioplasty and it was 2.2 days in case of laparoscopic hernia repair.

There were no recurrences noted in any group.

Returns to work is early (2 month) in case of TAPP repair compared to Lichtenstein repair.

Repair of inguinal hernia is one of the commonest operations performed by surgeons around the world. The treatment of this common problem has seen an evolution from the pure tissue repairs to the prosthetic repairs and in conventional open approach to laparoscopic approach. Laparoscopic approach having benefits over open hernia repair eventhough it requires general anaesthesia, more time and cost.

Quality assessment of hernia surgery is essential. It is necessary for education and for evaluation of new methods. For surgeons and surgical units, quality assessment is necessary for improving and defending achievements. We have a long way to go in order to make hernia repair without complications and more perfect.

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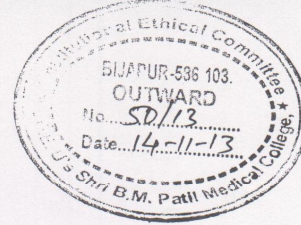
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ANNEXURES

ETHICAL CLEARANCE CERTIFICATE



B.L.D.E. UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103
INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 13-11-2013 at 3-30pm to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.

Title "Comparative study of Laparoscopic transabdominal preperitoneal mesh repair versus Lichtenstein tension free mesh repair for inguinal Hernia"

Name of P.G. student Dr. Anesh P.

Department of Surgery

Name of Guide/Co-investigator Dr. Hemanth Kumar M.

Assoc prof of Surgery

DR. TEJASWINI VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization

- 1) Copy of Synopsis/Research project.
- 2) Copy of informed consent form
- 3) Any other relevant documents.

PROCEDURE:

Patient will be explained about the need of the surgery and posted for surgery and patient will also be explained about the required investigations as per standard protocol.

RISKS AND DISCOMFORTS:

I understand that I/my ward may experience some pain, may be pain at the operated site, there may be leak from the wound that I /my ward these are expected complications of any hernioplasty and I understand that necessary measures will be taken to reduce these complications as and when they arise.

BENEFITS:

Prevention of post-operative complications and to improve quality of life.

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital records and will be subjected to the confidentiality and privacy regulation of this hospital. Information of a sensitive, personal nature will not be a part of the medical records, but will be stored in the investigator's research file and identified only by a code number. The code key connecting name to numbers will be kept in a separate secure location.

If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identifiers such as photographs and audio or video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. Dr. Umesh P is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me.

And that a copy of this consent form will be given to me to keep it and for careful reading.

REFUSAL OR WITHDRAWL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand that Dr. Umesh P will terminate my participation in this study at any time after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician or therapist, if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly to my participation in this study, if such injury were reported promptly, then medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving any of my legal rights.

I have explained to _____ the purpose of this research, the procedures required and the possible risks and benefits, to the best of my ability in patient's own language.

Date:

Dr. Hemanth Kumar M

(Guide)

Dr. Umesh P

(Investigator)

PROFORMA

**B.L.D.E.U'S SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL
AND RESEARCH CENTRE, VIJAYPUR.
GENERAL SURGERY**

SL NO

NAME:

AGE:

IP NO:

SEX:

UNIT:

RELIGION:

DOA:

OCCUPATION:

DOO:

ADDRESS:

DOD;

SOCIO-ECONOMIC STATUS:

COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

HISTORY OF PAIN

HISTORY OF SWELLING

1. MODE OF ONSET
2. SITE
3. SIZE
4. REDUCIBILITY

SYSTEMIC SYMPTOMS:

PAST HISTORY:

PERSONAL HISTORY: SMOKER/ALCOHOLIC

GENERAL PHYSICAL EXAMINATION

BUILT: WELL/MODERATE/POOR

NOURISHMENT: WELL/MODERATE/POOR

PALLOR

ICTERUS

FEBRILE

PEDAL EDEMA

GENERAL LYMPHADENOPATHY

VITAL DATA:

TEMPERATURE:

PULSE

RESPIRATORY RATE

BLOOD PRESSURE:

LOCAL EXAMINATION:

INSPECTION

SWELLING

SKIN OVER THE SWELLING

IMPULSE ON COUGHING

POSITION OF THE PENIS

PALPATION

POSITION AND EXTENT

TO GET ABOVE THE SWELLING

CONSISTENCY

RELATION TO TESTIS AND SPERMATIC CORD

IMPULSE ON COUGHING

REDUCIBILITY

INVAGINATION TEST

RING OCCLUSION TEST

SYSTEMIC EXAMINATION:

PER ABDOMEN:

PER RECTAL:

RESPIRATORY SYSTEM

CARDIOVASCULAR SYSTEM

CENTRAL NERVOUS SYSTEM

CLINICAL DIAGNOSIS:

LABORATORY TESTS

HB%

TOTAL COUNT

DIFFERENTIAL COUNT

N/L/E/B/M:

URINE ROUTINE:

RBS

B.UREA

S.CREATININE

HIV

HBsAg

CHEST X RAY:

ULTRASONOGRAPHY OF ABDOMEN AND PELVIS:

OTHERS: OPERATIVE PROCEDURE (DATE AND TIME):

INTRA-OPERATIVE DIAGNOSIS:

DURATION OF PROCEDURE:

POST OPERATIVE INVESTIGATIONS:

LENGTH OF STAY IN HOSPITAL AFTER PROCEDURE

POST OPERATIVE COMPLICATIONS

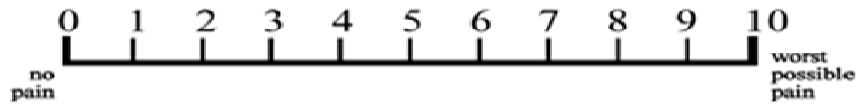
1. BLEEDING.
2. POST OPERATIVE SURGICAL SITE INFECTIONS.
3. PAIN –analysed by VAS
4. Follow up for 3 months

VISUAL ANALOG SCALE (VAS)
FacesPainScale



0	2	4	6	8	10
Very happy, no hurt	Hurts just a little bit	Hurts a little more	Hurts even more	Hurts a whole lot	Hurts as much as you can imagine (don't have to be crying to feel this much pain)

Visual Analog Scale (VAS)



KEY TO MASTER CHART

S NO	-	Serial number
IP NO	-	In patient number
D O A	-	Date of admission
D O S	-	Date of surgery
D O D	-	Date of discharge
B P H	-	Benign prostatic hypertrophy
TAPP	-	Transabdominal Preperitoneal
HTN	-	Hypertension
DM	-	Diabetes mellitus
M	-	Male
F	-	Female
RIH	-	Right indirect inguinal hernia
LIH	-	Left indirect inguinal hernia
LDH	-	Left direct inguinal hernia
RDH	-	Right direct inguinal hernia
BIH	-	Bilateral indirect inguinal hernia
O	-	Open Lichtenstein mesh repair