https://doi.org/10.48047/AFJBS.SI.2.2024.6348-6377

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Unilateral Inguinal Hernia: Laparoscopic Vs Open Repair

Dr. Sachin Kautikrao Deore[1], Dr. Badhe Ketan R.[2], Dr. Badhe Vaishalee Ketan[3], Dr. Dipti Sachin Deore[3]

[1 &2] M.B.B.S, DNB Surgery, Assistant Professor in Dept. of Surgery, Pravara Medical Trust, Loni BK, Maharashtra, India.

[3] M.B.B.S, DNB Anasthesia, Associate Professor in Dept. of Anasthesia, Pravara Medical Trust, Loni BK, Maharashtra, India.

[3] M.B.B.S, DMRE, Pravara Medical Trust, Loni BK, Maharashtra, India.

Article History
Volume 6, Issue Si2, 2024
Received : 03 May 2024
Accepted : 28 Aug 2024
Published: 07 Sep 2024
doi:10.48047/AFJBS.6.Si2.2024.6348-6377

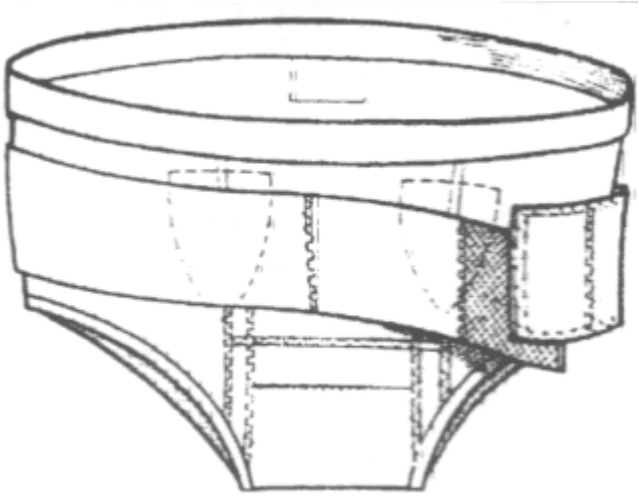
1. Introduction

Man in the evolutionary process, while standing erect and learning to walk created a defect in the anterior abdominal wall. The inguinal region is the abdominal Achilles heel. A hernia (or rupture) is the protrusion of an organ through that part of the body that usually contains it. In the case of groin hernia, this is the protrusion of a part of the abdominal contents through the abdominal wall into the groin. Groin hernias can occur at any age. They are common in babies and small children, become less common in the teens and twenties and then rise in incidence throughout the middle and later years of life. Conventional treatments for hernia are various forms of surgery and trusses, both of which have been in use for a considerable length of time. An Egyptian papyrus (Ebers 1550 BC) described the use of bandaging (the ancient equivalent of a truss) and the use of cathartics and hot poultices for strangulation. The first description of surgery was by Celsus in AD 25.[1]

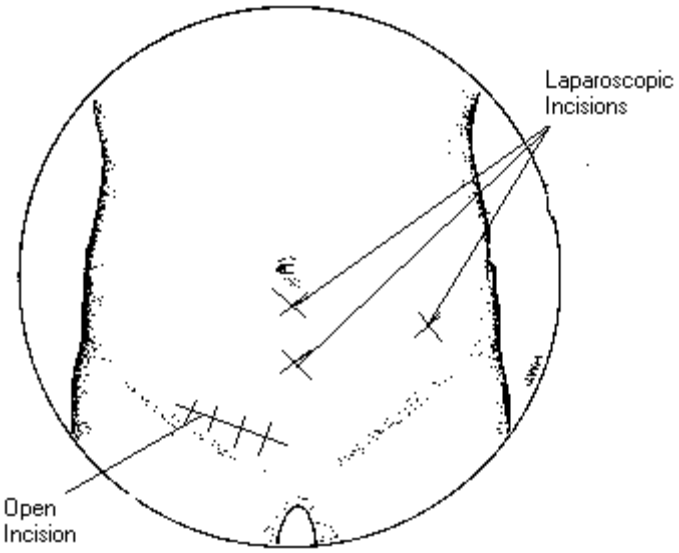
Hernias do not correct themselves over time and will often deteriorate, with consequent enlargement of the hernia and increasing discomfort. The aims of the surgical repair are to eliminate swelling, to relieve pain and discomfort and to remove the risk of strangulation. The cumulative probability of strangulation of an inguinal hernia has been estimated to be 2.8% at 3months and 4.5% and 2 years[2], and this complication carries a significant morbidity and mortality, particularly in the elderly. Successful treatment will prevent such complications and help improve quality of life.

Untreated or recurrent inguinal hernias are responsible for an incalculable loss of productivity and revenue. The inguinal canal is the only area of the anterior abdominal wall which lacks musculo-tendinous support. The posterior wall of the inguinal canal is thus a potential site for hernia .The most important site in the inguinal region for inherent weakness is the Myopectineal orifice [M. P. O.]. All modern hernia tissue repairs are aimed in reconstruction and strengthening of the fascial wall in the M. P.O. It is therefore reasonable to conclude that a hernia should be treated; the issue then becomes one of access to effective treatment.

HERNIA TRUSS



Are We Done With It?



Where The Future Will Take Us?

Inguinal hernias are common, with a lifetime risk of 27% in men and 3% in women[4]. Inguinal hernia repair is one of the most common operations in general surgery. Despite more than 200 years of experience, the optimal surgical approach to inguinal hernia remains controversial. Surgeons and patients face many decisions when it comes to inguinal hernias: repair or no repair, mesh or no mesh, what kind of mesh, open or laparoscopic, extra-peritoneal or trans-abdominal, and so forth. Inguinal hernia repairs have morbidity and recurrence rates that are not inconsequential. The search for the gold standard of repair continues. Now in 2012 though open Lichtenstein hernioplasty is acceptable method of hernia repair we have many other options like laparoscopic (T.A.P.P., T.E.P, Single port hernia repair), Robotic surgery and even Robotic single-port inguinal hernia repair is feasible and efficient. This represents a further milestone in laparoscopic surgery. [5]

But still laparoscopic hernia repair is second most acceptable method after open mesh-plasty. Role of laparoscopic surgery is very well defined in bilateral or recurrent hernias but in unilateral hernias role of laparoscopic surgery is not very clear till date.

This study is an attempt to find out the feasibility of laparoscopic hernia repair in unilateral inguinal hernia cases.

AIM

The aim of this study is to evaluate the intraoperative and early postoperative complications inLaproscopic versus open mesh hernioplasty for unilateral inguinal hernia.

1. Objectives

1. To evaluate the operative time of open versus laproscopic mesh hernioplasty.
2. To evaluate post operative pain in open versus laproscopic mesh hernioplasty using pain visual analogue score.
3. To evaluate postoperative rehabilitation and convalescence in open versus laproscopic mesh hernioplasty.
4. To evaluate the early postoperative complications in open versus laproscopic mesh hernioplasty.
5. To evaluate economical aspect in open versus laparoscopic mesh hernioplasty.

2. Review of Literature

The Evolution of Hernia Surgery: The earliest record of hernia description was in 1500 B.C.[6], in Greek literature as the Greek physicians were aware of inguinal hernia. The term hernia is derived from Greek word -Hernios meaning an off- shoot, a budding or bulge.

	Major Milestones[6]
Hammurabi of Babylon	Described hernia reduction and application of bandages to prevent protrusion (1700 BC)
Hippocrates	Described hernia as “a tear in the abdomen’’(400 BC)
Galen	Described the anatomy of the abdominal wall. (200 BC)
Heliodorus	Described the original method of hernia repair. (200 BC)
Celsus	Introduced Trans-illumination; described clinical signs that differentiate a hernia from the hydrocele, described an operation for hernia. (100 AD)
Paulus Aegina	Divided hernia into enterocoele (abdominal contents descend into the scrotum), and bubonocele (swelling remains in the groin and does not descend into the scrotum)
Guy de Chaulac	Differentiated between inguinal and femoral hernia. Described a technique for reduction of hernia.(1363A.D)
Maupassius	First operation to relieve a strangulated hernia. (1559)
Caspar Stromayr (16th century)	Wrote PractaicaCoposa; defined direct and indirect hernias; stressed the importance of high dissection of the indirect sac; sanctioned removal of testicle and spermatic cord for inguinal hernia. (1559)
Litter	Reported a Meckel’s diverticulum in a hernia sac
DeGarengeot	Described the appendix in a hernia sac
Franco	Use of grooved director to cut the strangulating neck of the hernia
Vesalius Fallopius (Italy) Poupart (France)	Described the inguinal ligament.

Heister	Described direct hernia 1724
Pott (ENGLAND)	Anatomy of congenital hernia and method of incarceration.
Camper (HOLLAND)	Described the superficial subcutaneous fascia
Scarpa (ITALY)	Described deep subcutaneous fascia Anatomic and surgical importance of sliding hernia
Sir Ashley Paston Cooper (ENGLAND)	Described anatomy of the groin including the superior pubic [Cooper's] ligament, cremastric fascia and transversalis fascia. Wrote a hernia monogram in two parts{ Part I-17 chapters:12 plates, Part II-10 chapters:17 plates} (1768- 1841)
John Hunter	Emphasized the role of processes vaginalis
Morton	Described the conjoint tendon
Cloquet	Noted post natal closure of the processusvaginalis made observation of iliopubic tract
Franz Casper Hesselbach (STAHELIANO)	Defined iliotibial tract described importance of the medial triangle of the groin [including the femoral canal] Wrote VallstendigeAnlietungZirZergliederungskunde des MenschlicherKorpes.(1759-1816)
De Gimbernat	Described medial ligament in the of the femoral canal [Lacunar ligament] and division of that ligament in the treatment of strangulated femoral hernia
Richter (GERMANY)	Described partial obstruction and incarceration of bowel wall in a hernia defect
BassiniEdvardo FATHER OF MODERN HERNIORRAPHY	Described transversalis fascia repair and reinforcing the posterior wall of the canal using interrupted sutures of silk. (1884)
George Paul La Rogue	Advocated the trans-abdominal approach for absolute assurance of ligating hernial sac high up in combination with Bassini repair via a grid iron incision.(1919)
George LenthalCheatle	An extra peritoneal preperitoneal approach to groin hernioplasty through Pffannelstiel type of incision. (1920)
William Edward Gallie	Use of autologous fascia grafts as overlays or strip suture using fascia lata.(1921)
Norman Cecil Tanner	Relaxation incision of the rectus sheath to reduce the tension.(1942)
E.E. Shouldice	Four layered anatomical repair –SHOULDICE REPAIR (1953)
Moloney	Used monofilament (nylon) for Bassini's repair (1948)
Usher	Popularized the use of knitted mesh of polyamide and polypropylene in hernia repair.(1958)
Ger 5	First attempt for laparoscopic approach for groin hernia Use of Michael staple to close the peritoneal opening of the hernial sac.(1977) Took his ideas to animal laboratory for study.
Popp	Laparoscopic hernia using 4x5 cm dural patch over the defect.(1990)
Fitzgibbons R.J.	Trans abdominal pre-peritoneal mesh repair of inguinal hernia.(1992)
Dellemagne. B.	Totally extra peritoneal mesh repair for hernia.(1996)

Hernia Surgery- An Overview

The first attempt in understanding the surgical anatomy of the inguinal region was done by Marcy[8]. Bassini was truly the first to incorporate the teaching of Marcy in his anatomical repair of the inguinal region. Halsted, Cooper, Shouldice modified and incorporated the same principle in an aim to achieve the anatomical repair. However, long term follow-up shows that 15-30% of all hernia repairs will fail, and 60% of these will cause symptoms. In view of such a rate of recurrence after sutured hernia repair, the concept of tension free mesh repair started gaining wide acceptance. Recurrence rate of less than 1%[9,10,11] without any evidence of mesh rejection have been reported from hernia centers specializing in the anterior tension free approach.

The three main principles10 of the operative management of inguinal hernia are:

1. 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.
2. Only tendinous /aponeurotic /fascial structures should be sutured together.
3. The suture material should retain its strength for long enough to maintain tissue apposition and allow sound union of tissue to occur .A non-absorbable or very slow absorbable suture material therefore must be employed.

With the new era and understanding of the anatomy of the inguinal region and importance of tension free repair, Mesh herniorrhaphy came in as a standard practice. Mesh plasty showed reduced recurrence rate, easy acceptability, early convalescence and low morbidity[13] .With the better understanding of the mechanical factors involved in the hernia formation, the posterior repair of the hernial defect gained importance. Pascal (1623-1662) a French scientist and mathematician, proposed the principle that –gas or liquid at rest in a closed container will transmit pressure changes without loss to every portion of the gas or fluid and to the wall of the container. Rives and Stoppa[14, 3] recognized that this principle would apply to the pressures within the peritoneal and extra peritoneal spaces as a salutary mechanism in the use of prosthetic mesh in pre peritoneal hernia repair. Many surgeons tried the posterior pre-peritoneal repair with different approaches. With the advent of minimal access surgery, the focus was shifted from open mesh hernia repair to laparoscopic mesh repair in an attempt to reduce the morbidity and allow early convalescence.

Different methods of mesh repair are practiced, predominantly open and laparoscopic mesh herniorrhaphy.

They further can be grouped as:

LAPAROSCOPIC	**OPEN**
1. T.A.P.P (Trans Abdominal Pre-Peritoneal Approach) 2. T.E.P. (Totally Extra Peritoneal Approach)	1. Lichtenstein repair 2. Prolene hernia system

There are advocates for each method.

We in this study will evaluate the efficiency of open Lichtenstein versus laparoscopic mesh hernioplasty with respect to cost efficacy, morbidity, convalescence.

Review

There is division in opinion about open and laparoscopic mesh hernia repair. Post operative pain and convalescence, recurrence, duration of surgery and cost-efficacy are the major issues in hernia surgery.

In 1994 D.C. Brooks[15] in a prospective comparison of laparoscopic and tension-free open herniorrhaphy observed that patients undergoing open repair were older than those undergoing laparoscopic repair, though the distribution of hernia types was similar. The laparoscopic operation took longer than the open operation, was more expensive, and required more postoperative admissions. There were three recurrences in the laparoscopic group and none in the open group. Patients undergoing laparoscopic repair consumed the same amount of narcotic analgesics as did the group undergoing open repair and had discomfort for the same amount of time. Patients undergoing laparoscopic repair returned to work sooner than did patients undergoing open repair (5.6 days vs. 10.3 days). The study concluded that Laparoscopic hernia repair returns patients to the workplace faster than open hernia repair despite a similar analgesic requirement. The laparoscopic repair costs more and has a higher recurrence rate than open repair. Laparoscopic repair, was however found to be most suitable for bilateral hernia repairs.

In 1998, Aitola P[16], in laparoscopic versus open preperitoneal inguinal hernia repair: a prospective randomized trial, observed that, when comparing unilateral repairs, the mean operation time was significantly shorter in the open group (55 min) than in the laparoscopic group (66 min). Pain on movement and pain on coughing receded more rapidly in the laparoscopic group. The median time before return to work or normal activity was 7 days (range 1-60) in laparoscopic and 5 days (1-30) in open repair. There were five (21%) complications associated with the laparoscopic procedure, while the open procedure resulted in two (8%) complications. After a median follow-up of 18 months the recurrence rate in the laparoscopic group was 13% and in the open group 8%. The study concluded that, the open method was associated with fewer complications and recurrences than the laparoscopic technique. Despite the decreased postoperative discomfort after laparoscopic repair, there was no significant difference in median time before return to work or normal activity. These results together with the higher cost of the laparoscopic procedure suggest that the open method is more suitable at least for unilateral hernias.
1999.

Surgical ANATOMY OF INGUINAL REGION [3]

Fascia—layered condensation of connective tissue

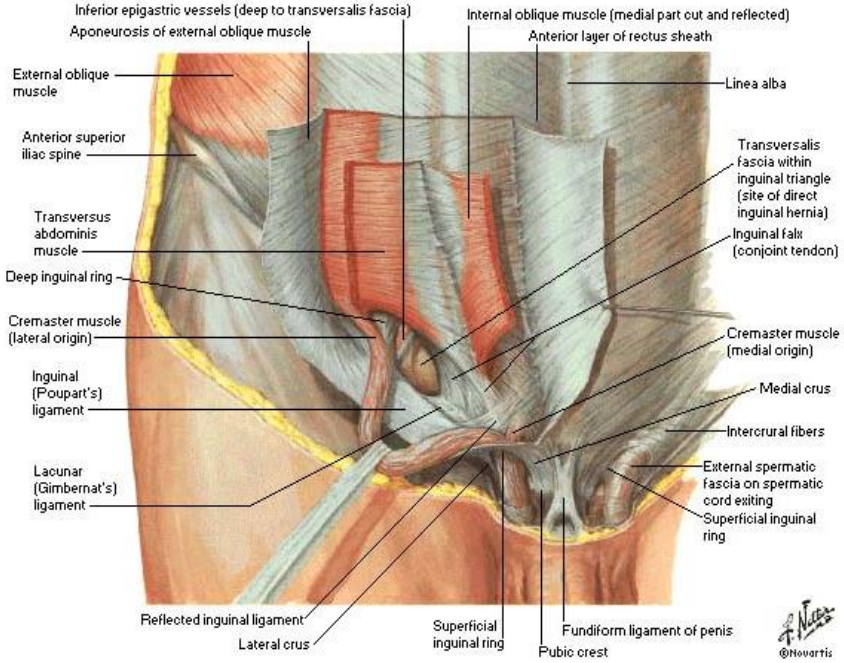
Aponeurosis-Connective tissue organized and with measurable strength

Muscles—Major muscles of the abdominal wall are the external and internal oblique, the transverses abdominus and the rectus muscle.

- The anterior rectus sheath –composed of Aponeurosis of both oblique muscles and the transverses abdominus muscle.
- The posterior rectus sheath – composed of fibers from the transverse abdominus and the internal oblique Aponeurosis .Both the semicircular lines described by Douglas [located midway between the pubis and the umbilicus]. Posterior sheath lacks any strength, being only transversalis fascia.
- The innominate fascia –covers the external oblique and the spermatic cord as it emerges between the crura of the external ring.
- The external spermatic fascia-covers the pubic and the scrotal portion of the spermatic cord.
- The internal spermatic fascia.-covers the spermatic cord within the inguinal canal.

- The internal inguinal ring is located 2cm above the skin crease in the groin and midway between pubic tubercle and anterior superior iliac spine.
- Inguinal ligament is formed by fibers of the external oblique aponeurosis that swing posterior and medial after they insert on the pubic bone. It is held together by epitendineum and is attached at the anterior iliac spine and at the pubic tubercle ,where it fans out to become the Lacunar ligament
- The external ring is formed by the intercrural fibers of the external oblique aponeurosis, between its medial and lateral crura. The reflected inguinal ligament on each side meets in the midline over the rectus sheath. Interpretable fascia separates the oblique and transversus muscle.

Anatomy of the Inguinal Region



The conjoined tendon exists in only 3% to 6% of patients, is a fused tendinous structure of the internal oblique and the transversusabdominus muscle that reaches the pubic tubercle

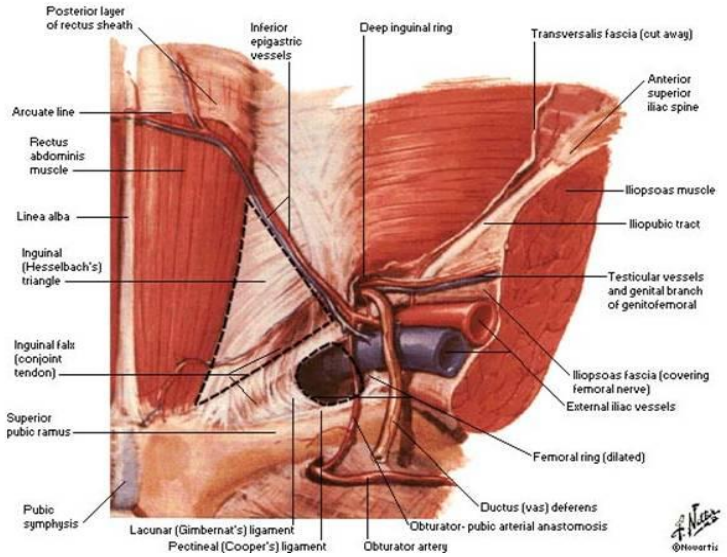
- The cremastric fascia arises from the internal oblique muscle.
- The endoabdominal fascia in the pelvis is called endo-pelvic fascia, in the groin called transversalis fascia. The transversalis fascia, described as the Achilles tendon of the groin, covers the medial triangle of the groin [Hesselbach'sHessert's]. The transversalis fascia gives rise to many structures in the groin, the superior pubic ligament.
- The posterior wall of the inguinal canal is composed of 3 layers. The most superficial is the Aponeurosis of transversusabdominis. Deep below it are 2 thin layers of transversalis fascia. The deep epigastric vessels run between these 2 layers. Defects in the canal's posterior wall results in the deficiency of some strong fibers of the transversusabdominusaponeurosis in the lower half of the triangle, just above the most vulnerable area of the abdomen.
- The superior pubic ligament [Cooper's ligament] is the periosteum of the superior pubic ramus.
- The iliopubic tract is an aponeurotic band of tissue within the transversusabdominusaponeurotic layer. It runs parallel to the inguinal ligament from the

iliopectineal arch to the superior ramus of pubis. It is most easily visualized from a posterior view, and is often difficult to discern from an anterior approach.

Myopectineal orifice [M. P. O.]— Site of indirect, direct, femoral and some interstitial hernia

- The M. P. O. is bounded anteriorly by the inguinal ligament, and posteriorly by the iliopubic tract. It is bounded medially by the lateral border of the rectus muscle, superiorly by arching fibers of the transversusabdominus and the internal oblique muscles, laterally by the iliopsoas muscle and inferiorly by the Cooper's ligament.
- The M. P. O is perforated in its superior plane by the spermatic cord, and through its inferior pane by the femoral vessels.
- The M. P. O. is protected by the combined lamina of thin aponeurosis of the transversusabdominus and the transversalis fascia.

Anatomy of the Inguinal Region



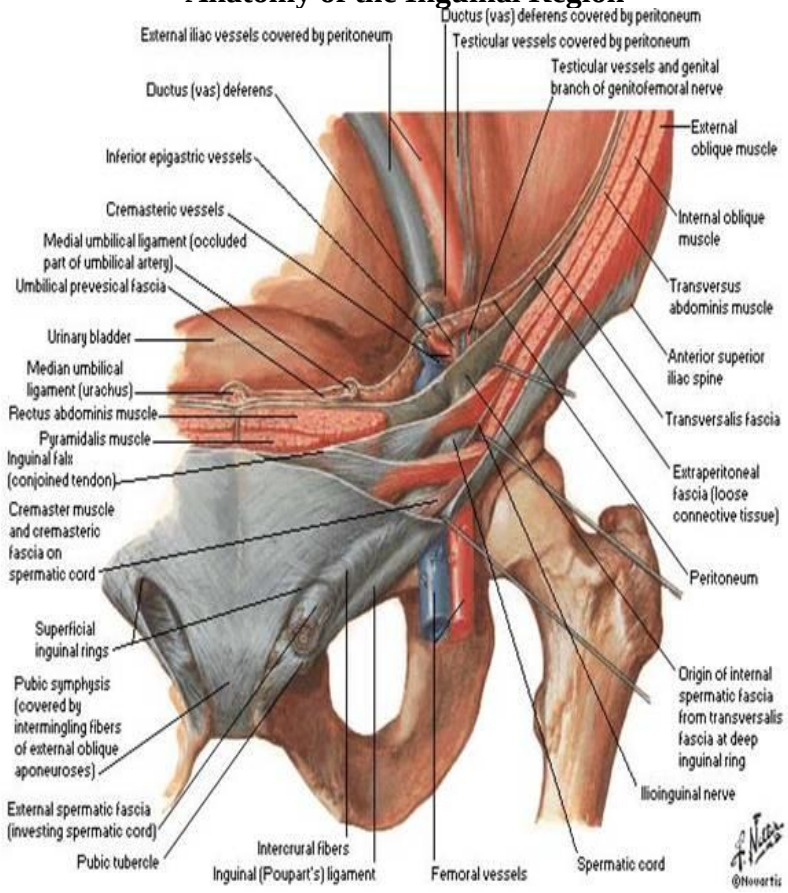
Vascularity

- The arterial supply in the groin arises from the external iliac artery, which gives of the deep circumflex iliac and inferior epigastric arteries before becoming the common femoral artery. The internal spermatic (testicular) artery arises from the aorta. Venous drainage proceeds through the spermatic cord by way of the pampiniform plexus. This plexus of delicate veins is intertwined within the interstitial fat of the spermatic cord. The internal spermatic vein on the left side drains into the renal vein. Venous drainage on the right is into the inferior vena cava.

Nerve Distribution

- The lower 6 dorsal and the first lumbar nerves innervate the abdominal wall. The nerves travel between the transversusabdominus and internal oblique muscles.

Anatomy of the Inguinal Region



Anatomy during laparoscopic surgery[30]

The widespread use of laparoscopic herniorrhaphy necessitates an understanding of the inguinal region to prevent iatrogenic neurovascular damage. The anatomy of this region is conventionally thought of as beginning with the superficial structures and proceeding to the deep structures, each layer of structure reviewed in the sequence as encountered during a laparotomy. However the scene seen in the laparoscope is reversed, and disorienting to surgeon accustomed to this traditional presentation. The over view of anatomy of the inguinal preperitoneal region as it would be encountered in laparoscopic herniorrhaphy is given below.

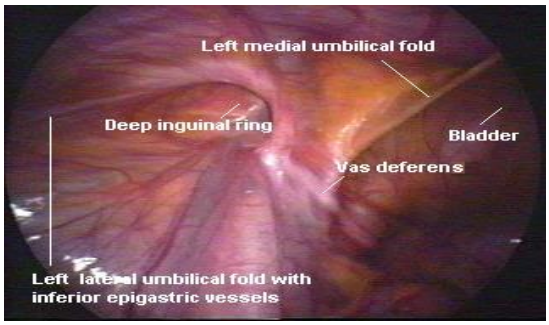
Peritoneal folds and fossae

Inspection of the interior aspect of the abdominal wall with a telescope reveals five peritoneal folds or ligaments that flare out inferior to the umbilicus. The midline or the median umbilical ligament is the peritoneal fold over the urachus, the fibroid remnant of the fetal allantois. It courses superiorly from the fundus of the bladder to the umbilicus. On either side of this median umbilical fold are the medial umbilical ligaments; these are the peritoneal folds covering the obliterated portion of the umbilical arteries. These vessels originate from the internal iliac vessels and course superior-medially towards the umbilicus, giving of the superior vesicular branches from the proximal patent portion of the arteries. On the either lateral side of these folds are the lateral umbilical ligaments. These ligaments are folds of peritoneum that contain the inferior epigastric vessels.

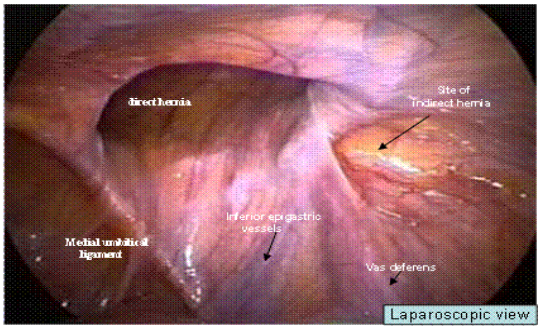
The medial and lateral umbilical ligaments as well as the fundus of the bladder delineate these depressions, or fossae, within the peritoneum. The lateral fossa is situated laterally on the either side of the lateral umbilical ligaments. It contains the internal inguinal (deep) ring and therefore

is the site of the indirect hernias that traverse the deep inguinal ring. The medial fossa is bordered by the medial umbilical ligament and the lateral umbilical ligament. It is the site of Hesselbach's triangle and both direct and femoral hernias. The supravesical fossa is situated between the median and the medial umbilical ligaments. Hernia in this fossa occurs rarely because the fossa is reinforced by the rectus abdominis muscle and the rectus sheath.

Left Indirect Inguinal Hernia



Right Direct Inguinal Hernia



Contents of the preperitoneal space

On dissection of the peritoneum away from the transversalis fascia, the extra peritoneal space is opened. The space contains adipose tissue, blood vessels, lymphatic channels, and nerves and therefore is a site for potential iatrogenic injury during laparoscopic herniorrhaphy. The pre peritoneal space is further subdivided into several different clinically significant spaces.

The musculopectineal orifice of Fruchaud [M. P. O.] and its contents.

It is a space within the anterior abdomen with the following boundaries:
The inferior border of the transversusabdominis and the internal oblique muscles superiorly, the rectus abdominus muscle medially, the iliopsoas muscle laterally and the pectin pubis inferiorly (Cooper's ligament). It houses the inguinal triangle and is an important site for abdominal herniation: the deep inguinal ring that opens into the inguinal canal and the femoral ring that opens into the femoral canal.

The inguinal triangle of Hesselbach's is located within the medial fossa, and is bounded by the inferior epigastric vessels superiolaterally, the lateral border of the rectus sheath medially, and the Cooper's ligament inferiorly. This is the original triangle as described by Hesselbach. The inguinal canal opens into the abdomen as the deep inguinal ring. The deep inguinal ring is visible by the telescope on the inferior aspect of the anterior abdominal wall as a fingertip sized indentation just lateral to the lateral umbilical ligament. Dissecting away the peritoneum reveals the deep inguinal ring as a condensation of the transversalis fascia known as the transversalis fascia sling. The ring is just lateral to the weak area of the Hesselbach's triangle separated by the lateral umbilical ligament. The iliopubic tract, another condensation of the transversalis fascia provides a landmark for the inferior edge of the deep inguinal ring. Through

the deep inguinal ring, traverses the spermatic cord on its way to the testes. The spermatic cord is the conduit to many structures that travel to or from the testes. Its contents include the ductus deferens and its vascular supply, the testicular artery and the pampiniform plexus, the cremasteric artery, sympathetic nerve fibers, the genital branch of the genito-femoral nerve, and the lymphatics. The cord originates at the deep inguinal ring and courses through the inguinal canal and the superficial inguinal ring to end in the scrotum on the posterior surface of the testes. It accumulates several fascial layers as it passes through the inguinal canal, each layer being superimposed on the one before it.

Vessels within the M. P. O.-

The main source of vessels in the M. P. O. is the external iliac artery and vein. Proximal to the iliopubic tract and the inguinal ligament, the iliac vessels give off the inferior epigastric vessels medially and the deep circumflex iliac vessels laterally. The inferior epigastric vessels course superiorly, giving off the artery to the cremastric muscle and entering the space of Borgos. The cremastric artery then courses inferolaterally to enter the medial portion of the inguinal ring on its way through the inguinal canal. The testicular artery is the paired branch of the abdominal aorta. It travels inferiorly in the retro peritoneum along the medial border of the psoas muscle. It crosses the common iliac artery proximal to its bifurcation and travels with these vessels until it reaches the femoral ring, where it courses superiorly to enter the inguinal canal through the deep inguinal ring.

Nerves in the M. P. O.

Several sensory nerves arising from the lumbar plexus course through the preperitoneal space on their way to the lower extremity or the genital area.

- Ilioinguinal nerve- the ilioinguinal nerve arises posterior to the lateral border of the psoas muscle and descends inferolaterally along the quadrates lumborum muscle. It then traverses along the iliac crest to dive deep to the transverses abdominus muscle into the internal oblique to travel between the internal and external oblique muscles. It enters the deep inguinal ring and travels through the inguinal canal on the surface of the spermatic cord. After exiting the canal, the nerve supplies the sensation to the skin of the scrotum, the base of the penis, and the medial thigh.
- Iliohypogastric nerve- the iliohypogastric nerve also arises from the lateral border of the psoas muscle and courses inferolaterally on the ventral surface quadrates lumborum muscle to reach the transversusabdominus muscle. It penetrates this muscle and travels medially to pierce both the internal and the external oblique muscles 2-4 cm above the superficial inguinal ring where it supplies sensation to the skin in this region.
- Genito-femoral nerve- the genito-femoral nerve arises from L1-L2. It passes inferiorly through the psoas muscle, and then divides into a medial genital branch (external spermatic nerve) and a lateral femoral branch (lumboinguinal nerve). The genital branch continues inferiorly parallel to the course of the external iliac artery. At the origin of the inferior epigastric artery, the genital branch courses superomedially to enter the inguinal canal within the spermatic cord on its dorsal aspect. The femoral branch enters the femoral sheath lateral to the artery, pierces the fascia lata of the thigh. It supplies the sensory innervation to the anterior portion of the thigh
- Femoral nerve- the femoral nerve emerges from the inferolateral surface of the psoas muscle and courses inferiorly along the lateral border on the surface of iliacus muscle. The nerve then divides inferior to the iliopectineal arch and continues its inferior course lateral to the femoral vessels.

Pathophysiology

There are congenital, metabolic, anatomic, and physical factors influencing the incidence of hernia. The patent processusvaginalis is a well known factor for the indirect inguinal herniation [31,32]. Epidemiological evidence has shown that 20% of men pass into the adulthood with a patent processusvaginalis, of which less than 50% develop clinical herniation[1]. There is also a genetic influence with familial tendency to groin herniation.

The main site of pathology of hernia lies in the fascia transversalis. Hernia tends to occur whenever it is unsupported by muscles and Aponeurosis. The ability of the fascia to withstand the physiologic and pathologic increase in the intra-abdominal pressure is dependent on the state of collagen fibers that makes up it's tissue. The fascia transversalis may be attenuated by the factors that interfere with normal production of collagen or caused increased destruction or production of abnormal collagen fibers. These factors include certain congenital disorders like Marfan's syndrome, Ehler-Danlos syndrome, Hurler- Hunter syndrome and certain mesenchymal metabolic defects causing deficiency of collagen and structural abnormalities of the collagen fibers predisposing to groin hernia

Read[14,33] found that the collagen frame work of the transversalis fascia in patients with groin hernia was found to be disorganized and modified with increased vascularity and cellularity. Read found out that substances in cigarette smoke inactivate anti-proteases in the lung and so upset the protease –anti-protease system. The free unbound and active protease and elastasecompounds are also found in the serum of smokers apparently discharged by the increased number of the white corpuscles in the blood and the lungs of the smokers. These enzymes bring about destruction of elastin and collagen of the rectus sheath and the fascia transversalis, predisposing them to herniation. The level of the circulating elastolytic enzymes and protease substances is higher in those with direct as compared to indirect hernia and is still higher in patients with bilateral direct hernia

PREDISPOSING FACTORS FOR OCCURRENCE OF INGUINAL HERNIA-
I] Congenital factors – **a. UnobliteratedProcessusVaginalis.** **b. Congenital high arching of the lower border transversusabdominusaponeurosis leads to high risk of direct hernia, which occurs between the pubic ramus and the border of the transversusabdominus muscle.** c. **Low pubic tubercle causes a weak inguinal triangle because of the increased distance of the pubic tubercle of the bicrestal line.**
II] Biological factors- **Abnormalities of the local collagen metabolism {Peacock and Madden[34] in 1974 compared the rates of collagen synthesis and lysis in both inguinal areas in patients with unilateral hernia, there was a decrease in the hydroxyprolene level on the hernial side} weakening of the fascia and the muscle with the advancing age, lack of physical exercise adiposities and multiple pregnancies.**
III]Malnutrition – **a. Scurvy** **b. Lathyrism [LathirusSativus] Active Principle B-OxalylaminoOlamine Prevents** **c. Maturation Of Collagen** d. **Environmental toxins- smokers have the potential undesirable combination of increase proteolytic enzyme activity and reduction of the alpha 1 anti**

trypsinlevels which are the major naturally occurring circulating anti protease.
IV] Increased abdominal tension- **a. Lifting Heavy Weights[35]** **b. Bladder Outlet Obstruction** **c. Chronic Cough** **d. Chronic Constipation** **e. Ascites** f. **Continuous Ambulatory Peritoneal Dialysis[36]**
V] Iatrogenic factors. – **Previous surgery with injury to the nerve in the inguinal region eg – appendicectomy.**

The increase in the level of the elastase and collagenase levels can also occur in stress and systemic illness due to enhanced leukocyte response which may be partly responsible for the attenuation of the fascia transversalis and hernia formation in the nonsmokers.

Lichtenstein repair- a sheet of 7.5 x 15cm polypropelene mesh sheet is used**.**
The medial end of the mesh is rounded to the shape of the medial shape of the inguinal canal. With the cord retracted upwards, the rounded corners are sutured with a non-absorbable monofilament suture material, to the aponeurotic tissue over the pubic bone and overlapping the bone by 1-1.5 cm. taking care that the periosteum of the bone is avoided. This suture is continued to attach the lower end of the patch to the inguinal ligament up to a point just lateral to the internal ring. Suturing the mesh beyond this point is unnecessary and could injure the femoral nerve. A slit is made towards the lateral end of the mesh creating two tails, a wide (two third the width of the mesh) one above and a narrower (one third the width of the mesh) below. The upper wide tail is grasped with a hemostat and passed towards the head of the patient underneath the spermatic cord, as this positions the cord between the two tails of the mesh. The wider upper tail is crossed over the narrower one and held in place temporarily with a hemostat. With the cord retracted downwards and the upper leaf of the external oblique aponeurosis retracted upwards, the upper edge of the flap is sutured in place with two interrupted absorbable sutures, one to the rectus sheath and other to the internal oblique aponeurosis, just lateral to the internal ring. Using a single monofilament non absorbable suture, the lower edge of each of the two tails is fixed to the inguinal ligament just lateral to the completion knot of the lower running suture. This creates a new internal ring made of the mesh. The crossing of the two tails closes the gap between the tails and prevents recurrence lateral to the internal ring. In addition it results in a dome like configuration of the mesh and assures a tension free repair of the internal ring area.
The excess mesh on the lateral side is trimmed off , leaving at least 5cm of the mesh beyond the internal ring. This is tucked under the external oblique aponeurosis. The external oblique aponeurosis is closed over the cord with an absorbable suture. Skin is closed appropriately.

Complication
Complications such as infection, hematoma, seroma, occur in approximately 1% of the cases. The most serious complications associated with the technique are chronic neuralgia and testicular atrophy, which occurs in fraction of 1%.
The reported recurrence rate of the procedure is less than 1%.

Steps in laparoscopic mesh hernioplasty:
Trans abdominal pre peritoneal mesh hernioplasty[38]

Anesthesia – general anesthesia
Position – supine, Trendelenburg position with ipsilateral hand extended and contralateral hand tucked at the side or both hands tucked by the side of the patient
Port placement- Umbilical port trocar placed by open or closed method according to the choice of surgeon. Lateral ports – 10mm ipsilateral port and a 5mm contralateral port as mirror images of each other just lateral to the rectus sheath below the level of the umbilicus. For bilateral hernias, two 10 mm ports are placed laterally at the same site.
Procedure- Once the trocar is properly placed, the presence and the type of hernia is confirmed. The telescope is then placed on the ipsilateral side of the hernia and other ports are used as working ports by the surgeon. A curvilinear incision is made in the peritoneum beginning laterally and extending superomedially to the level of the obliterated umbilical vessels (medial umbilical ligament). A flap of peritoneum is created medially by blunt dissection to expose Cooper's ligament. Laterally, the loose areolar tissue between the muscular wall and the peritoneum is stripped away in the direction of the muscular wall, leaving the peritoneum naked. The dissection is done medially until the cord structures are identified and dissected free of the peritoneal flap. This is known as the parietalization of the cord structures. An indirect sac is usually reduced with blunt dissection, but if the sac is large it may be circumcised with an electro-cautery.
A suitable Prolene mesh is placed into the abdomen via the umbilical port and unfurled. The mesh is placed as flat as possible against the abdominal wall, broadly covering the indirect, direct, femoral spaces. The mesh is then stapled to the Cooper's ligament and to the superomedial and the superolateral corners with a stapler introduced through the umbilical ports. Stapling the peritoneal edges together then closes the peritoneal flap. The ports are closed with a delayed absorbable suture.

Port Placement for Laparocopic Hernia
T.A.P.P. Repair

Laparoscopic Pre –Peritoneal Mesh Herniarepair[42]
Anesthesia – general anesthesia
Position – supine, Trendelenburg position with ipsilateral hand extended and contralateral hand tucked at the side or both hands tucked by the side of the patient.
Procedure- TEP with peritoneoscopy
A veress needle at the umbilicus is used to establish a pneumo-peritoneum and once complete, a 10 mm trocar is placed. A 30^0 angled 10mm laparoscope is used to inspect the groin

bilaterally. Anterior palpation over the external ring, massaging towards internal ring, may reduce a clinically significant cord lipoma.

The first 5mm trocar is placed into the lateral aspect of the posterior rectus space just superior to the arcuate line on the index side. Through the first trocar, a blunt tipped grasper is used to develop the posterior rectus space by dissection of the posterior rectus sheath from the posterior aspect of the rectus muscles and the inferior epigastric vessels. Once the dissection is begun, the 5 mm laparoscope can be introduced into the posterior rectus space and blunt dissection continued with the tip of the telescope. The pneumo-peritoneum is released and the posterior rectus space is insufflated to 12-15 mm Hg. The posterior rectus sheath is developed across the midline by bluntly taking down the medial anterior attachments of the rectus sheath. Then, a second 10mm extra peritoneal trocar is introduced 2 cm inferior to the umbilicus. The telescope is repositioned to this midline port, and the blunt dissection is continued to identify the pubis and the Cooper's ligament. For unilateral repair, a 5mm extra peritoneal trocar is placed midway between the pubis and the umbilicus in the midline. If bilateral hernia is to be performed, this trocar is placed just superior to the arcuate line on the contralateral side. With the telescope in the infra-umbilical position, the surgeon uses two blunt instruments to clear the pubis and the Cooper's ligament of the attenuated adventitial attachments of the posterior rectus sheath; this allows entry in the space of Retzius. The femoral and the obturator spaces can be inspected. Laterally, the anterior attachments of the posterior rectus fascia limit access into the lateral inguinal space. To place a large piece of mesh that must extend laterally beyond the internal ring, these well developed fibers are taken down by scissors.

Other Methods of Trocar Placement

Total extra peritoneal approach (Mckernan's technique)- this method avoids the violation of the peritoneal cavity. A 2 cm infraumbilical incision is created and the rectus sheath is exposed. The rectus sheath is lifted and incised vertically exposing the rectus muscles. Retractors are placed beneath the rectus muscle and a tunnel is developed between the rectus muscle and the underlying posterior rectus sheath. A 10 mm trocar is inserted into this tunnel and further space is created by blunt probing or by balloon dissecter. The other working ports are placed in the midline lower to the umbilical port. First a 5mm port is placed approximately 1 finger breadth above the pubis and second 10mm trocar is placed half way between the upper trocar.

Complication In Laparoscopic Hernia Repair

Bladder Injury.

This can be totally prevented by keeping the bladder empty. Bladder injury usually occur during the following stages of surgery.-

At the time of introduction of the working port.

In the case of a large, direct hernia when the bladder slides into the hernia.

During reduction of a large direct hernia.

Bladder injury is recognized by the presence of urine in the extra-peritoneal space, which becomes soggy. Once recognized bladder injury is repaired laparoscopically by suturing the rent in the bladder in two layers. Post-operatively, a urinary catheter is left in situ.

Bowel Injury

Bowel injury is a rare in TEP repair as the procedure is done extra-peritoneally. Bowel injury can occur during reduction of the hernial contents. Injury to the sigmoid colon can occur in the case of a large / sliding left direct inguinal hernia. Identification of this situation and prevention of the injury is crucial.

Injury to the Vas Deferens
The vas is identified as a thick, white cord like structure that enters the inguinal ring along with the spermatic vessels. The vas may be injured while dividing the sac of an indirect inguinal hernia if it is not completely separated from the sac if the vas deferens is divided in a young patient, it should be repaired immediately. In the elderly patient, the cut ends should be clipped to prevent collection of the seminal fluid.

Vascular Injury
Bleeding From Muscular Branch (Rectus Muscle)
Occurs when the Hassons cannula is positioned. In this situation, blood trickles down along the cannula, stains the camera and obscures the vision. A gauze piece can be inserted along the side of the cannula to achieve haemostasis.

Bleeding From the Viens Over the Pubic Symphysis.
While separating the peritoneum, the veins over the pubic symphysis may cause bleeding which can be controlled by monopolar cautery.

Bleeding From the Inferior Epigastric Artery
Mild bleeding- controlled using a cautery.
Major bleeding- the artery should be clipped to control the bleeding.

Bleeding From the Spermatic Vessels.
Bleeding is controlled by using a cautery. If the bleeding vessel retracts behind the peritoneum, a 5 mm port is passed through the supra pubic port to visualize the retracted vessel, which is then tackled.

Bleeding From the Iliac Vessels.
Bleeding from the external iliac vessels is a dire emergency and leads to major bleeding. Immediate conversion to open surgery must be done to control the bleeding.

Postoperative Complications.
Seroma /hematoma
Usually occurs in the TEP repair, and frequently occurs in the inguinal region. The incidence varies from 5-25%. It usually subsides automatically in 2-6 weeks. If it persists beyond six weeks, aspiration can be done under aseptic precaution.

Neuralgia
This is usually transient. Neuralgia is caused by irritation of the genitofemoral nerve and/or the lateral cutaneous nerve of the thigh, and the intermediate cutaneous nerve of the thigh. The neuralgia may be due to mesh placed in that region or entrapment of the nerve in the fixation device. To minimize this incidence, the fascia over the psoas muscle shou8ld not be dissected and the mesh should not be fixed medially. No staples should be applied lateral to the cord structures.

Testicular swelling and pain
It is usually immediate post-operative and is due to excessive dissection of the sac of the indirect hernia from the cord structures.
Wound infection.
Mesh infection.
Osteitis pubis

Recurrence
The factors causing recurrence in the early post operative period are.
- migration or folding of the mesh into the defect.
-displacement of the mesh by a hematoma/ seroma
-use of small sized mesh
-folding of the mesh
-missed concurrent hernia.

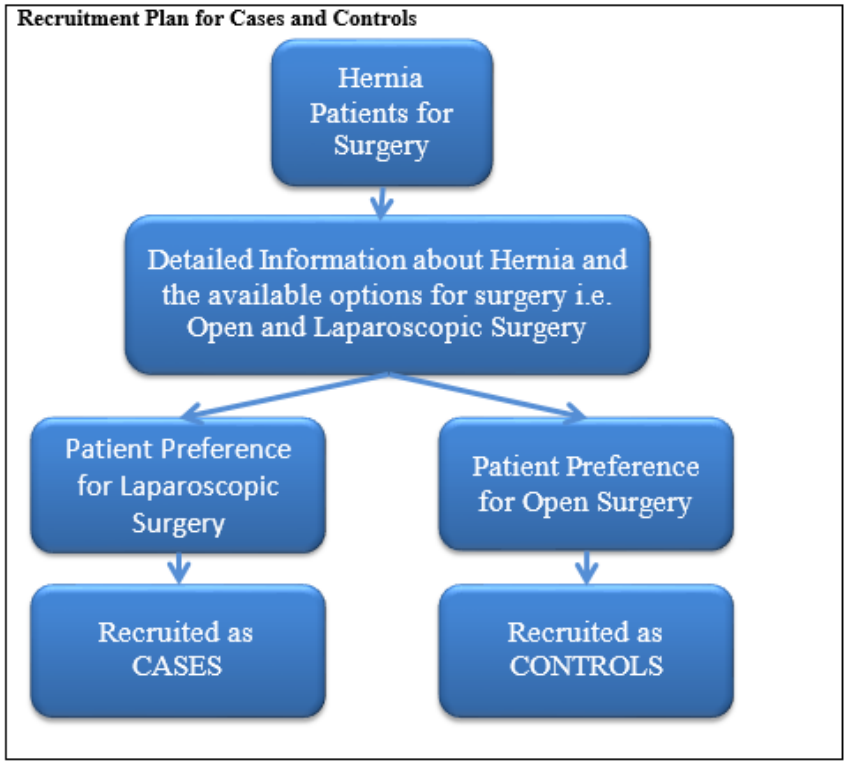
The Laparoscopic System

The Carbon Di Oxide Insufflator System

3. Methodology

Study Design: Non-Randomised Controlled Trial
Study Area: Breach Candy Hospital, Mumbai, India
Study Period: July 2009 - June 2011
Study Population: Patients of Unilateral Inguinal Hernia undergoing Surgery
Sampling Method: Continuous Convenient Sampling.
Study Participants: All Patients undergoing for Hernia Surgery will be recruited for the study. They will be apprised with their condition in detail and explained the 2 available procedures i.e. Open Surgery and Laparoscopic Surgery.

The patient preference will be considered in grouping them as Cases (i.e. Laparoscopic Surgery group) or Controls (i.e. Open Surgery).
Cases are those operated by Laparoscopy, Controls are those operated by Open Surgery.



Inclusion Criteria:
1. Age group of 18 - 70 years
2. Unilateral Hernia
3. First Time Diagnosed Hernia for a particular side

Exclusion Criteria:
1. Hernia extending into scrotum
2. Complicated Hernia (Incarcerated, Obstructed, Strangulated)
3. Recurrent Hernia of the same side
4. Refusal to consent
5. Pre-existing Diseases that rendered them unfit for Anesthesia (ASA Grade IV & V).

Ethical Considerations:
A written, valid, informed consent was obtained for the current study separate from the consent for Surgery and Anesthesia. Institutional Ethical Committee Clerance was obtained before commencing the study.

Recording of Data: This was done using a Questionnaire annexed at the end. (Annexure A)

Statistical Analysis Plan:
SPSS v20 is used for the descriptive & inferential statistical analysis for the various variables under study. SPSS v20 and MS Excel has been used for graphical display and presentation of data.
Primary Predictor variable:Type of Surgery

Secondary Predictor variables:
a. Duration of Surgery,
b. Type of Anesthesia,
c. Type of Pre-existing Co-morbidity

Primary Outcome Variable: Post-Operative Pain
Secondary Outcome Variable:
a. Duration of Hospital Stay,
b. Return to Work
c. COBSERVATIONS

Study Variables	**Instrument of Measurement**	**Type of Data**	**Method of Summarisation**	**Method of Comparision**
Age	Patient Self Reported	Quantitative Continuous	Mean ± SD	't' test
Gender	Patient Self Reported	Qualitative Bivariate	Count, Percentage	-
Type of Hernia	Examination	Qualitative Multivariate	Count, Percentage	Chi^2 / Fischer's Exact Test
Side of Hernia	Examination	Qualitative Nominal	Count, Percentage	Chi^2 / Fischer's Exact Test
Etiology	Patient Self Reported	Qualitative Nominal	Count, Percentage	Chi^2 / Fischer's Exact Test
Type of Pre-existing Co-morbidity	History Taking	Qualitative Multivariate	Count, Percentage	Chi^2 / Fischer's Exact Test
Type of Anesthesia	As Indicated and preferred by patient	Qualitative Multivariate	Count, Percentage	Chi^2 / Fischer's Exact Test
Type of Surgery	Patient Preference	Qualitative Bivariate	Count, Percentage	Chi^2 / Fischer's Exact Test
Duration of Surgery	Manual Reading of an Analog Clock	Quantitative Continuous	Mean ± SD	't' test
Post-Operative Pain	Visual Analog Scale (VAS)	Qualitative Ordinal	Mean ± SD	't' test
Duration of Hospital Stay	No. of Days	Quantitative Continuous	Mean ± SD	't' test
Return to Work (Days)	No. of Days	Quantitative Continuous	Mean ± SD	't' test

Table1: Demographic Distribution amongst Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Age, Mean ± SD	51 ± 18.52	52.6 ± 12.89	0.7
Gender Male, Count (%)	30 (100)	30(100)	-

Female, Count (%)	00 (00)	00 (00)	

(Figures in parentheses represent column wise percentages.)

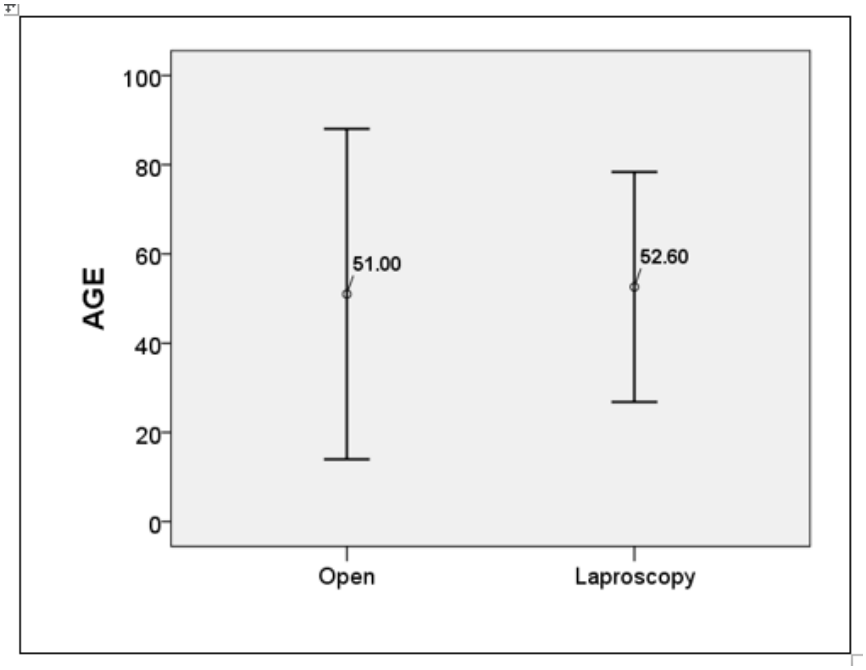


Fig 1: Age Distribution of Cases & Controls (p=0.7)

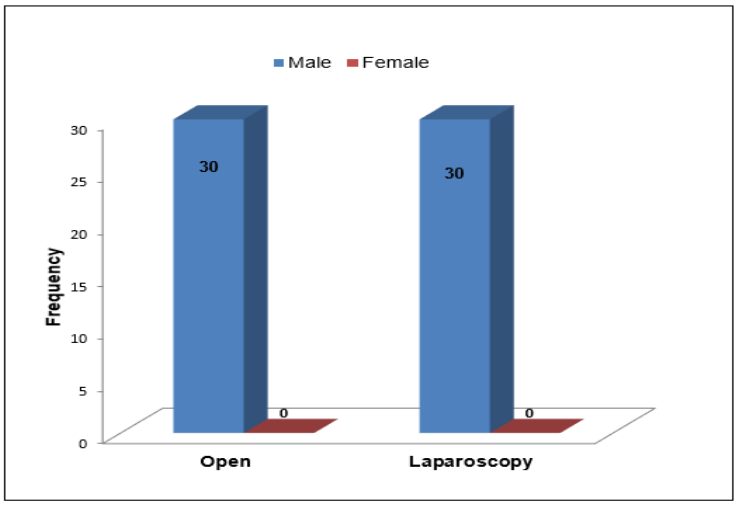


Fig2: Gender Distribution of Cases & Controls

Table2: Frequency distribution of occupation of cases and controls

Employed	9	8	17
Self Employed	12	17	29
Student	5	3	8
Retired	4	2	6

(p=0.58 by Fischer's Exact Probability Test)

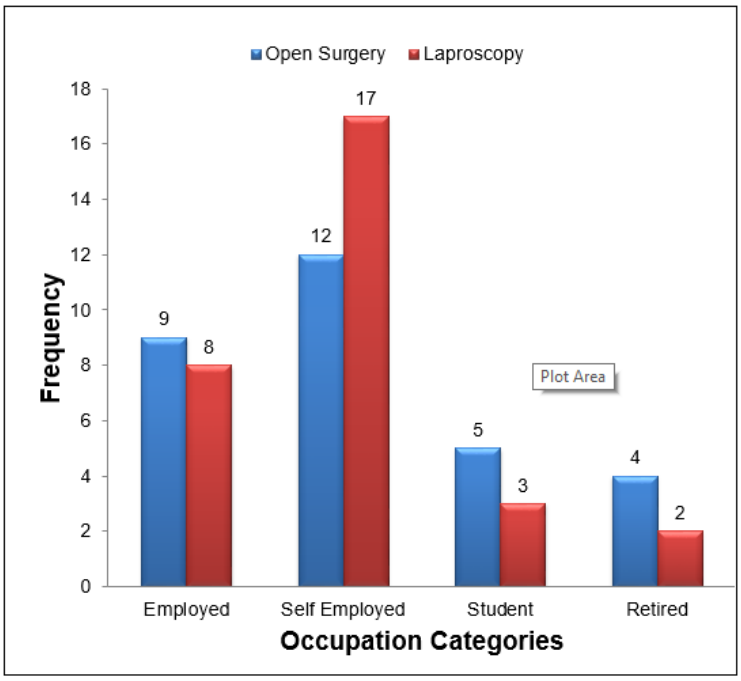


Fig3: Distribution of Occupation of Cases & Controls

Table 3: History of Etiology in all patients

Etiology	**Frequency (%)**
Lifting Heavy Weights	04 (06.7)
Congenital	06 (10.0)
Chronic Cough	11 (18.3)
BEP	04 (06.7)
Prolonged Standing	04 (06.7)
Constipation	12 (20.0)
Obesity	12 (20.0)
None	25 (41.7)

(Figures in parentheses represent column wise percentages.)

Table 4: History of Etiology in Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Lifting Heavy Weights	3 (10.00)	1 (3.33)	0.612
Congenital	5 (16.67)	1 (3.33)	0.195
Cough	5 (16.67)	6 (20.00)	1.00
BEP	2 (6.67)	2 (6.67)	1.00
Prolonged Standing	1 (3.33)	3 (10.00)	0.612
Constipation	8 (26.67)	4 (13.33)	0.333
Obesity	1 (3.33)	2 (6.67)	1.00
None	9 (30.00)	16 (53.33)	0.115

(Figures in parentheses represent column wise percentages.)

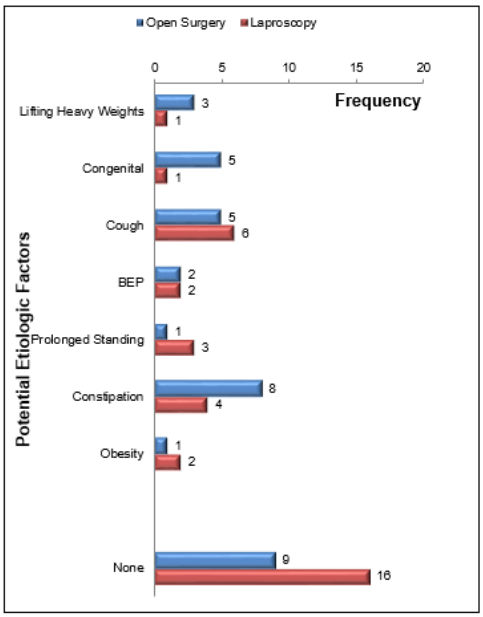


Fig 4: Potential Etiologic Factors in Cases & Controls

Table 5: Comorbidity profile of the study participants

Comorbidity	**Total**	**Percentage**
HTN	14	23.33
DM	4	6.67
Asthma/Bronchitis	3	5.00
CVS Disease	4	6.67
Diverticular Disease	1	1.67
Hypercholesterol	1	1.67
Hyperthyroidism	1	1.67
Parkinson's Disease	1	1.67
None	35	58.33

(Figures in parentheses represent column wise percentages.)

Table 6: Comorbidities in Cases and Controls

	Open Surgery (n=30)	Laproscopy (n=30)	p value
Co-morbidity			
HTN, Count (%)	08 (26.67)	06 (20.00)	0.76
DM, Count (%)	03 (10.00)	01 (03.33)	0.61
Asthma, Count (%)	01 (03.33)	02 (06.67)	0.99
CVS Disease, Count (%)	04 (13.33)	00 (00.00)	-
Diverticular Disease, Count (%)	00 (00.00)	01 (03.33)	-
Hypercholesterolemia, Count (%)	01 (03.33)	00 (00.00)	-
Hyperthyroidism, Count (%)	00 (00.00)	01 (03.33)	-
Parkinson’s Disease, Count (%)	01 (03.33)	00 (00.00)	-

(Figures in parentheses represent column wise percentages.)

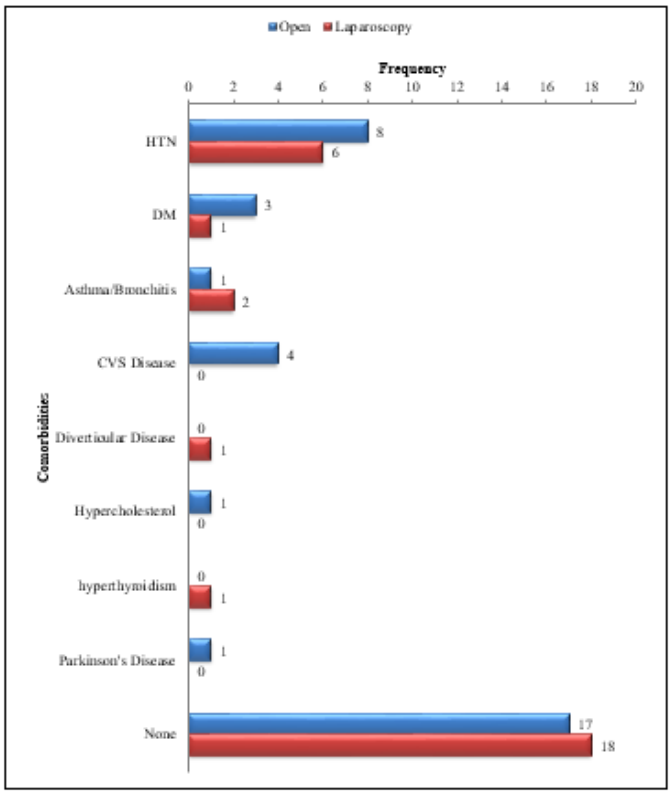


Fig 5: Co-morbidity Profile in Cases & Controls

Table 7: Significant Past History in Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Past H/o Hernia, Count (%)	02 (06.67)	05 (16.67)	0.42
Past H/o Major Surgery	03 (10.00)	00	-
Significant Family History	04 (13.33)	00	-

(Figures in parentheses represent column wise percentages.)

Table 8: Description of Hernia in Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Hernia Type			0.78
Direct, Count (%)	16 (53.33)	19 (63.33)	
Indirect, Count (%)	12 (40.00)	09 (30.00)	
Direct + Indirect, Count (%)	02 (6.67)	02 (6.67)	
Hernia Side			0.179
Right, Count (%)	22 (73.33)	16 (53.33)	
Left, Count (%)	08 (26.67)	14 (46.67)	
Bilateral, Count (%)	00	00	

(Figures in parentheses represent column wise percentages.)

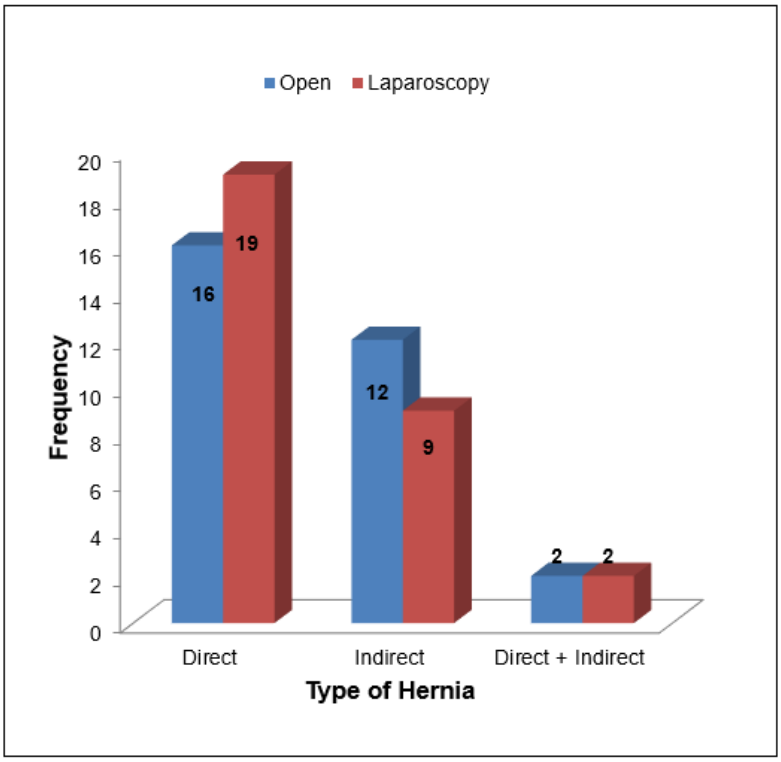


Fig 6: Types of Hernia in Cases & Controls (p=0.78)

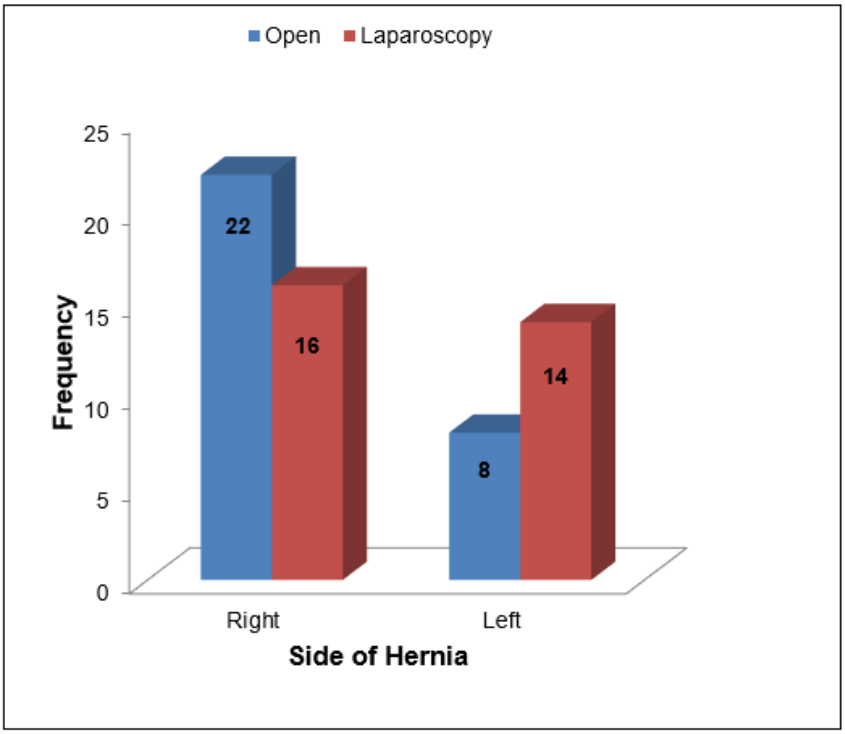


Fig 7: Side of Hernia in Cases & Controls (p=0.18)

Table 9: Intra-operative parameters in Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Anesthesia			-

Local Local + Sedation Spinal General	02 (06.67) 20 (66.67) 05 (16.67) 03	0 0 0 30	
Intraop Complications	00	00	-
Drain	01	00	-
Duration of Surgery, Mean ± SD	63.83 ± 10.72	88.83 ± 8.87	<0.001**

(Figures in parentheses represent column wise percentages.)
* Significant difference at 0.05 level, ** Significant difference at 0.01 level

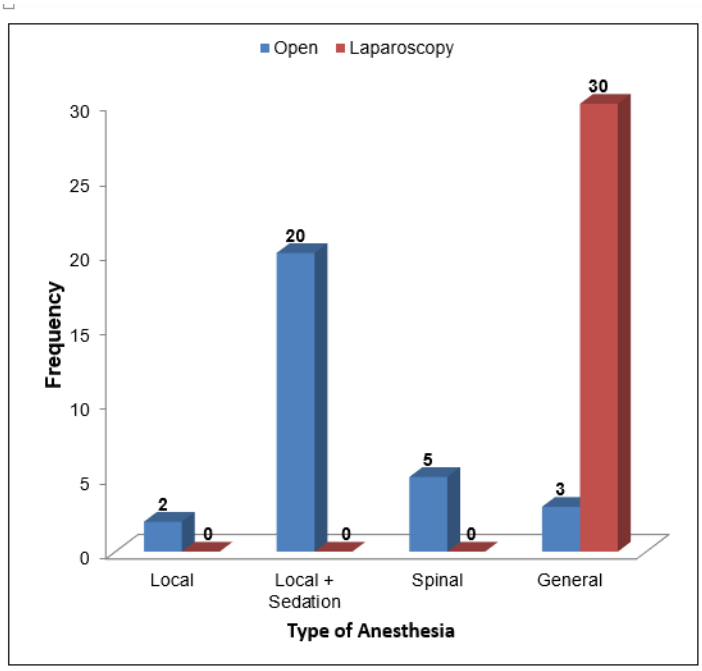


Fig 8: Type of Anesthesia used in Cases & Controls

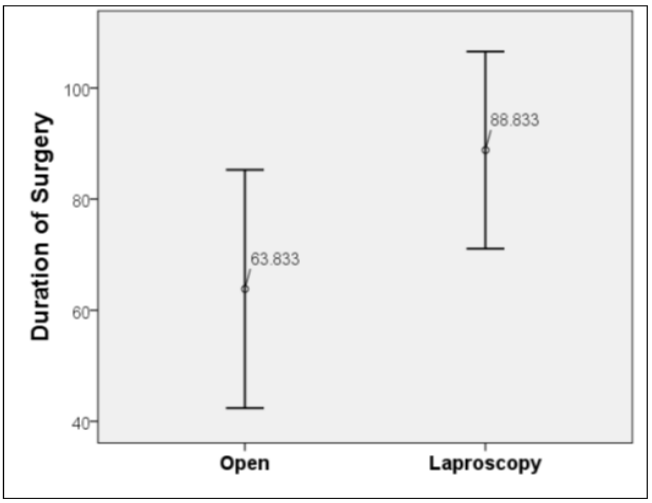


Fig 9: Type of Anesthesia used in Cases & Controls (p<0.001)

Table 10: Post-operative parameters in Cases and Controls

	Open Surgery (n=30)	**Laproscopy (n=30)**	**p value**
Post-Anesthesia Complications	00	00	-

VAS after 6 hrs, Mean ± SD	3.93 ± 1.17	2.9 ± 1.13	0.002**
VAS Average, Mean ± SD	3.87 ± 0.94	1.8 ± 0.96	<0.001**
Duration of Hospital Stay (Days), Mean ± SD	3.03 ± 0.67	2.93 ± 0.64	0.56
Return to Work(Days), Mean ± SD	6.9 ± 1.16	6.6 ± 2.27	0.52

* Significant difference at 0.05 level, ** Significant difference at 0.01 level

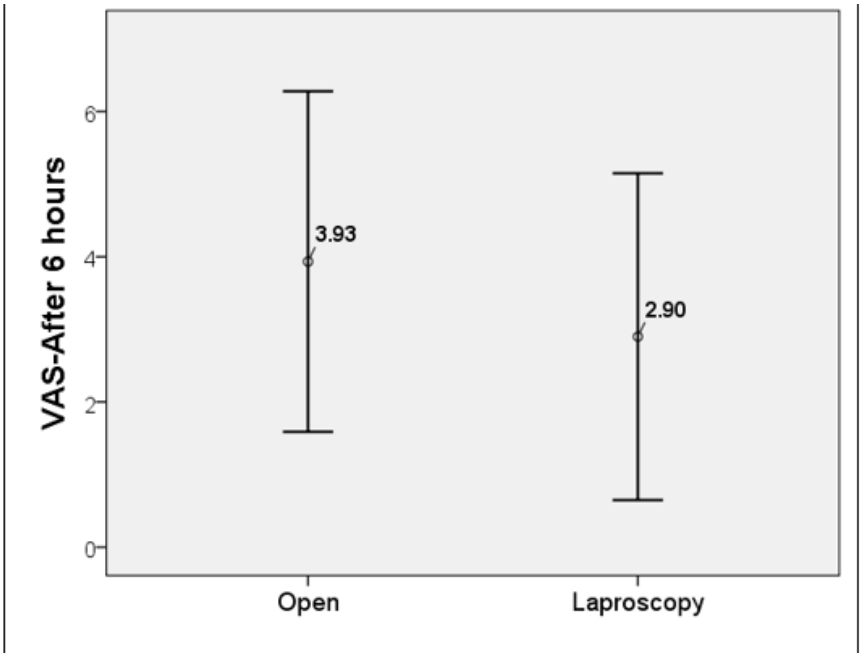


Fig 10: Acute Pain Assessment by Visual Analog Scale in Cases & Controls (P=0.001)

3. Discussion

In the India, Lichtenstein repair is most popular as it is easier to perform with low rate of recurrence. Also, amongst the open elective inguinal hernia repairs, the Lichtenstein technique is considered as the gold standard. However, it requires extensive dissection in the inguinal canal and involves manipulation of at least one or two inguinal nerves[48]. Moreover, there is a need for extensive suturing and risk of long-term mesh-related complications to the surrounding cord structures. To improve overall quality of life and especially postoperative chronic pain, a laparoscopic repair might have several benefits. Role of laparoscopic surgery is very well defined in bilateral or recurrent hernias but in unilateral hernias role of laparoscopic surgery is not very clear till date. For unilateral first-time hernias, either laparoscopic or open repair with mesh can offer excellent results [49]. The current study was a non-randomised controlled trial conducted at Breach Candy Hospital, Mumbai. The underlying aim was to assess the differences in the unilateral inguinal hernia repair when done laparoscopically as compared to the conventional open repair.

Demographic Factors:

It was observed that the mean age of the 30 controls (i.e. Open Surgery Patients) was 51 ± 18.52 years and that of the 30 cases (i.e. Laparoscopy Patients) was 52.6 ± 12.89 years (p=0.7 using ‘t’ test; Table 1, Figure 1). Also, only Male gender has been taken in the current study (Table 1, Figure 2).

The Study participants belonged to various occupation categories as shown in Table 2 and Figure 3. Again there was no significant difference in the distribution of occupation amongst cases and controls (p=0.58 by Fischer's Exact Probability Test).
Thus, both the controls and the cases are comparable for their baseline demographic characteristics.

Potential Etiological Factors:

Amongst the various conditions evaluated for etiology of the unilateral hernia, Constipation (20%) and obesity (20%) were the most common (Table 3). 13.3 % patients gave history of chronic cough and 10% reported as congenital. Besides, 6.7 % gave history of lifting heavy weights, 6.7 % reported prolonged standing and another 6.7 % had Benign enlargement of prostate. 5 % patients were also smokers (Table 3).

Analyzing the differences in history of etiology between cases and controls (table 4, Figure4), it was seen that majority of Open Surgery patients either had constipation (26.67 %) or congenital hernia (16.67 %) or a history of chronic cough (13.33 %). On the other hand, 53.33 % of the laparoscopy group patients had no positive history of the etiological factors evaluated. Of the remaining 46.67 % patients, majority had cough (13.33 %), constipation (13.33 %) or prolonged standing (10 %). Fischer's exact test used to assess the differences in cases and controls returned no significant difference in the occurrence of etiological factors in the 2 groups (table 4, Figure4).

Co-morbidity Profile:
The most common co-morbidity seen was Hypertension in 23.33 % patients (Table 5). Other co-morbidities present were Diabetes Mellitus (6.67 %), other cardiovascular diseases (6.67 %), Asthma/ bronchitis (5 %), Diverticular disease (1.67 %), Hypercholesterolemia (1.67 %), Hyperthyroidism (1.67 %) and Parkinson's disease (1.67 %) (Table 5). Again, there was no significant difference between cases and controls with respect to occurrence of co-morbidities by using the Fischer's Exact Test (Table 6, Figure5).

Past History:
There were a total of 7 patients who had had a previous history of Hernia surgery done. 5 of these 7 (71.43%) underwent Laparoscopic Hernia Repair of their current unilateral inguinal hernia while the remaining 2 went for open surgical repair (Table 7). Thus, 2 patients in the open surgery group and 5 patients in the Laparoscopy group had a past History of contra lateral unilateral hernia (p=0.42 by Fischer's Exact Test, difference not significant).

There were 3 other patients who had a history of a major surgery in the past, all of whom underwent open surgical repair for their current unilateral inguinal hernia (Table 7). A significant family history was also observed in 4 patients all of whom opted for open surgical repair (Table 7).

Description of Hernia:
53.33 % of the controls (i.e. open Surgery Patients) and 63.33 % of Cases (i.e. Laparoscopic Repair Patients) had a Unilateral Direct Hernia. On the other hand, 40% of Controls and 30 % of Cases had Unilateral Indirect Hernia. There were 2 cases in each group of Controls and Cases i.e. 6.67%each who had both Direct and Indirect Hernia. However, there was no significant difference observed between the various types of hernia (p=0.78, Table 8, Figure 6). Similarly, 73.33 % of controls and 53.33% of Cases had a Right sided Hernia whereas 26.67% of controls and 46.67% of Cases had a left sided hernia. Bilateral Hernias were excluded from the current study. Again, the differences observed are not significantly different (p=0.179, Table 8, Figure 7) thus conforming that the controls and cases are comparable for the hernia type and hernia side as well.

Observations till now are indicative of the fact that both the cases (Laparoscopy group) and controls (Open Surgery group) are comparable for their Demographic Factors, Etiologic Factors, Co-morbidity Profile, Past History, Type of Hernia and Side of Hernia. All these thus ensure baseline comparability between cases and controls which further strengthen the findings of the study. This further eliminates the probability of a selection bias and thus strengthens internal validity of the study.

4. Conclusion

No definitive evidence exists regarding the superior safety and efficacy of one method over another, but it appears that a significant number of patients are unaware of this [60].
This study highlights the fact that Laparoscopic repair for unilateral inguinal hernia requires about 25 minutes more time than the open surgical repair. However, the typical patient is unlikely to prefer a particular surgical procedure based on such a time difference. Even the base cost differential between laparoscopy and open surgical repair is not very steep to influence the choice of surgery. The recurrence rates with both the surgeries are also similarly low. Thus, the 2 main factors likely to affect the procedure of choice are post-operative pain and recovery.
The current study emphasizes the fact that the laparoscopic procedure causes lesser post-operative pain probably because it entails lesser tissue dissection. However, there was no significant difference in the post-operative recovery time as both the duration of hospital stay and time to return to work was similar in laparoscopy and open surgery group. One reason of absence of difference in recovery time could be due to the effect of occupation type which makes our study group highly heterogeneous.
A larger multicentric review of laparoscopic surgeries with an adequate sample size to power the results could not be emphasized more to reach a conclusive & decisive protocol.

5. Bibliography

1. Read R. Historical survey of the treatment of hernia. In: Nyhus L, Condon R (eds) Hernia. (3e). Philadelphia: Lippincott, 1989: 3–17.
2. Martin Kurzer, Allan E Kark. Inguinal hernia repair -an update. In - Irving Taylor, Collin Johnson. Recent advances in surgery 28. The Royal Society of Medicine Press Ltd. Chapter 6:75-86.
3. Gilbert AI, Micheal F Graham, Walter J Voigt. Inguinal hernia anatomy and management. www. Medscape Today; article 420354_2 (10/4/2000).
4. Gould J. Laparoscopic versus open inguinal hernia repair. Surg Clin North Am. 2008 Oct; 88(5):1073-81, vii-viii.
5. Tran H. Robotic single-port hernia surgery. JSLS. 2011 Jul-Sep;15 (3):309-14.

6. Lau WY. Surgical history. History of treatment of groin hernia. World J Surg.2002, 26, 748-749.
7. Ger R, Monroe K, Duvivier R. Management of indirect inguinal hernias by laparoscopic closure of the neck of the sac. Am J Surg 1990; 159: 370-3.
8. Marcy HO: The cure of hernia. Journal of The American Medical Association 1887;8: 589-592.
9. Amid PK, Shulman AG, Lichtenstein IL. Critical scrutiny of the open tension free hernioplasty. Am J Surg 1993; 165:369-371.
10. Gilbert AI; Inguinal hernia repair: biomaterial and sutureless repair. Persect Gen. Surgery 1991:2:113-129.
11. Gilbert AI. Suture less repair of the inguinal hernia. Am J Surg 1992;163: 331-335.
12. H Brendan Devlin. Inguinal hernia in adults. In -Rob and Smith's operative surgery: alimentary tract and abdominal wall 4th edition:455.
13. Amid P K, Shulman AG, Lichtenstein IL; A critical evaluation of the Lichtenstein tension free hernioplasty. Int Surg 1994; 79: 76-9
14. Read RC; Blood protease and anti-protease imbalance in patients with acquired herniation: Problems of general surgery : 12;41-46,1995.
15. BrooksDC. A prospective comparison of laparoscopic and tension-free open herniorrhaphy. Archives of surgery. April 1994; 129;361-6.
16. Aitola P, Airo I, Matikainen M. Laparoscopic versus open preperitoneal inguinal hernia repair: a prospective randomized trial. Ann ChirGynaecol.1998; 87(1):22-5.
17. Chung RS, Rowland DY. Meta-analysis of randomized control trials of laparoscopic versus conventional inguinal hernia repairs. Surgical endoscopy1999; 13 :689-694.
18. Leigh Niemeyer, Anita Giobbie-Hurder, Olga Jonasson, Robert Fitzgibbons, Jr., Dorothy Dunlop, James Gibbs, et.al. Open Mesh versus Laparoscopic Mesh Repair of Inguinal Hernia. The New England Journal of Medicine. 2004 April 29;350(18):1819-27.
19. Wilson MS. Deans GT, Brough WA. A prospective trial comparing the Lichtenstein with laparoscopic tension free mesh repair of inguinal hernia; Br JSurg 1995; 82: 274-7.
20. Kazol R, Lange PM, KosirM et. al. A prospective, randomized, study oflaparoscopic versus open inguinal hernia repair :an assessment of postoperative pain. Arch surg1997; 132:292-295.
21. Liem MSL, Van Der Graaf Y, ZwartRC,et al. A randomized comparison ofphysical performance following laparoscopic and open inguinal hernia repair.Br J of surgery 1997;84: 64-67.
22. Liem Mike S.L., Yolanda van der Graaf, Cees J. van Steensel, Roel of U. Boelhouwer, Geert-Jan Clevers, Willem S. Meijer et.al. Comparison of Conventional Anterior Surgery and Laparoscopic Surgery for Inguinal-Hernia Repair. The New England Journal of Medicine 1997; vol 336;22: 1541-1547.
23. The MRC laparoscopic groin hernia trial group. Laparoscopic versus open repair of groin hernia: A randomized comparison. The Lancet. 17/July1999.354:185-90
24. Juul P, K. Christensen. Randomized clinical trial of laparoscopic versusopen inguinal hernia repair. BJS.1999; VOL 86;3:316-319.
25. Grant A. Laparoscopic versus open groin hernia repair: meta-analysis of randomized trials based on individual patient data. The EU Hernia Trialists Collaboration. Hernia, April 2002, vol6;1: 2-10.
26. M. A. Memon , N. J. Cooper , B. Memon , M. I. Memon , K. R. Abrams. Metanalysis of randomized clinical trials comparing open and laparoscopic inguinal hernia repair. British Journal of Surgery2003; vol 90(12): 1479 –1492.

27. Schmedt CG, Sauerland S, Bittner R. Comparison of Endoscopic proceduresversus Lichtenstein and other open mesh techniques for inguinal hernia repair. A meta-analysis of randomized control trials: Surgical endoscopy 2005; 19:188-199.
28. Fumihiko Fujita, Brian Lahmann, Koji Otsuka, Sergey Lyass,Jonathan R. Hiatt, Edward H. Phillips, Quantification of Painand Satisfaction Following Laparoscopic and Open Hernia Repair. ArchSurg. 2004; 139:596-600.
29. Dedemadi G, Sgourakis G, Radtke A, Dounavis A, Gockel I, Fouzas I, Karaliotas C, Anagnostou E. Laparoscopic versus open mesh repair for recurrent inguinal hernia: a meta-analysis of outcomes. Am J Surg. 2010 Aug; 200(2):291-7.
30. Schultheis ME, Robert J Fitzgibbons, Thomas H Quinn. Musculoskeletal and neurovascular anatomy of the inguinal pre-peritoneal space. In- Bruce VMacfadyen, Jr. et.al. Laparoscopic surgery of the abdomen. Springer 2004:265-272.
31. Read R. Why do human beings develop groin hernias? In- Fitzgibbons RJG, AG, ed. Nyhus & Condon's hernia. Philadelphia: Lippincott Williams &Wilkins, 2002. pp.3-8.
32. Sorensen LT, Jorgensen LN, et al. Smoking is a risk factor for recurrence of a groin hernia. World J of surgery.2002; 26(4):397-400.
33. Read RC. The metabolic role in attenuation of the transversalis fascia found in patients with groin herniation. Hernia 2,17: 1998.
34. Peacock EE Jr, Madden JW. Studies on the biology and treatment of recurrent hernia.II. Morphological changes. Ann Surg 1974;179:567-571
35. Abrahamson J. Etiology and pathophysiology of primary and recurrent groin hernia formation. Surg Clinic of North America 1998:78(6) 953-72 vi.
36. Engeset J and Youngson G.G. Ambulatory peritoneal dialysis and hernia complications. Surg clinics of N.A 64;385, 1984.
37. Amid P.K. Lichtenstein tension free hernioplasty. In- Francesco Corcione. New procedures in open hernia surgery. Springer international edition:1-12
38. Steven M Yood, Demetrius Litwin. Laparoscopic groin hernia repair: Trans-abdominal preperitoneal approach. In-Bruce V Macfadyen, Jr.et.al. Laparoscopicsurgery of the abdomen. Springer 2004:288-294.
39. Jonathan D Spitz, Maurice E Arregui. Laparoscopic totally extraperitoneal repair for inguinal hernias. In- Bruce V Macfadyen, Jr.et.al. Laparoscopic surgery of the abdomen. Springer 2004:295-302.
40. C Palanivelu. Totally extraperitoneal hernioplasty. In- C Palanivelu Operative manual of