



A COMPARATIVE STUDY OF POST OPERATIVE OUTCOMES OF INGUINAL HERNIA REPAIR PROCEDURES BY OPEN METHOD WITH OR WITHOUT MESH AND LAPROSCOPIC METHOD.

General Surgery

**Dr Biranchi
Narayan Lenka**

Assoc Prof, Hi-Tech Medical College And Hospital.

**Dr Rahul Kumar
Garg**

PG, HiTech Medical College And Hospital.

Dr Kushal Futane PG, HiTech Medical College And Hospital.

ABSTRACT

Introduction: Inguinal hernia: A hernia is defined as an area of weakness or disruption of the fibro muscular tissues of the body wall. Often hernia is also defined as an actual anatomical weakness or defect. 75% of abdominal wall hernias are groin hernias. 15% of males and 5.5% of females will develop groin hernia. A hernia is the bulging of part of the contents of the abdominal cavity through a weakness in the abdominal wall. External abdominal hernia is the most common form of hernia. Inguinal hernia is the most common groin hernia. Various materials were introduced but real progress was made by development of modern synthetic plastic in the form of sheets of woven or knotted mesh of polyamide, polyethylene & polypropylene. Lichtenstein popularized routine use of mesh & coined 'Tension-free' hernioplasty where instead of suturing anatomic structures entire defect is reinforced by sheet of mesh. Today worldwide it is method of choice as it is simple to perform, gives excellent results, lowest recurrence, low complication & early return to activity. **Aims And Objectives:** The main aim is to compare the post-operative outcomes of inguinal hernia repairs by open method with mesh (Lichtenstein's) or with undetached strip of external oblique aponeurosis in place of mesh or Modified Bassini's procedure and laparoscopic method (either TEP or TAPP). **Materials And Methods:** A prospective randomized cohort study comprising of minimum of 75 patients of age group 13-70 years admitted with inguinal hernia in General Surgery Department of Hi-Tech MEDICAL COLLEGE AND HOSPITAL from July 2020 to June 2022.

Inclusion Criterias:

- Age group 13-70 years.
- Clinically diagnosed inguinal hernia

Exclusion Criterias:

- Recurrent inguinal hernia
- Bilateral hernia
- Irreducible, obstructed, strangulated hernia

Conclusions: The study will help in evaluating and comparing the post op outcomes of inguinal hernia repair by different procedures (open) with or without mesh and laparoscopic method. It will help in anticipating the total operating time, pre-operative blood loss, total number of hospital days, chances of wound infection or hematoma or seroma and scrotal oedema. From this study, we can also rationalise the use of analgesics. It will also help us in deciding the best procedure to be undertaken for any particular case.

KEYWORDS

INTRODUCTION

Inguinal Hernia:

A hernia is defined as an area of weakness or disruption of the fibromuscular tissues of the body wall. Often hernia is also defined as an actual anatomical weakness or defect. 75% of abdominal wall hernias are groin hernias. 15% of males and 5.5% of females will develop groin hernia. A hernia is the bulging of part of the contents of the abdominal cavity through a weakness in the abdominal wall. External abdominal hernia is the most common form of hernia. Inguinal hernia is the most common groin hernia. Varieties of operative procedures have been described in hernia repair. Controversy is about which procedure is the best. The basic accepted principle remains the same –strengthening of the posterior wall of inguinal canal. The tide has shifted from plication, double breasting or darning of fascia transversalis to its reinforcement by prosthetic mesh, and in recent times, doing it by modern minimally invasive laparoscopic technique.

There are many ways of repairing an inguinal hernia defect with over 80 techniques described since 1887 when Bassini reported his method. Extensive clinical research has been undertaken to assess the outcome following inguinal hernia repair. High recurrence rates using fascia for inguinal hernia repair or suturing under tension prompted the development of minimal tension nylon darn and then prolene mesh to reinforce the posterior wall of the inguinal canal during hernia repair. Various materials were introduced but real progress was made by development of modern synthetic plastic in the form of sheets of woven or knotted mesh of polyamide, polyethylene & polypropylene. Lichtenstein group popularized routine use of mesh & coined 'Tension-free' hernioplasty where instead of suturing anatomic structures entire defect is reinforced by sheet of mesh. So it is both therapeutic as well as prophylactic. Today world wide it is method of choice as it is simple to perform, gives excellent results, lowest recurrence, low complication & early return to activity.

AIMS AND OBJECTIVES

The main interest is to compare the immediate post operative outcomes of inguinal hernia repairs by open method with mesh (Lichtenstein's) or with undetached strip of external oblique aponeurosis in place of mesh or Modified Bassini's procedure and laparoscopic method (either TEP or TAPP)

Specific Objectives Are:

- To measure the operative time taken
- Per-operative blood loss
- Hospital stay
- Wound infection
- Wound hematoma
- Scrotal edema
- Post-op urinary retention
- Post operative pain and requirements of analgesics
- Assessment of resumption of normal activities

MATERIALS AND METHODS

A prospective randomised cohort study comprising of minimum of 75 patients of age group 13-70 years admitted with inguinal hernia in General Surgery Department of Hi-TECH MEDICAL COLLEGE AND HOSPITAL From July 2020 to June 2022.

Patients will be recruited from general Surgery Outpatients Department fulfilling the inclusion criterias and excluded from exclusion criterias. A consent form will be signed by them before recruitment. Detailed history taking and clinical examination will be made. Patients will be subjected randomly to hernia repair by open method with or without mesh and laparoscopic method. Parameters to be noted during operation and follow up accordingly.

Inclusion Criterias:

- Age group 13-70 years.

b. Clinically diagnosed inguinal hernia

Exclusion Criterias:

- Recurrent inguinal hernia
- Bilateral hernia
- Irreducible, obstructed, strangulated hernia

Parameters To Be Studies:

- Time taken from skin incision to skin closure(in minutes).
- Per operative blood loss(in ml).
- Hospital stays(in days).
- Incidence of wound infection(by center for disease control criteria)
- Incidence of wound hematoma
- Incidence of scrotal edema
- Incidence of post operative urinary retention
- Incidence of post operative pain assessed by visual analog scale(vas)
- 0-no pain 10-unbearable pain on day 0,1,3,7,14
- Assessment of resumption of normal activities

Study Tool:

- History
- Clinical examination
- blood for complete hemogram,sugar,urea,creatinine
- Chest skiagram PA view
- ECG in 12 leads
- USG of KUB and inguino-scrotal region
- Open hernia repair with or without mesh
- Laparoscopic hernia repair
- CDC criteria for wound infection
- Visual analog score(VAS)

REVIEW OF LITERATURE

Historical Aspects

Anatomy of inguinal region was described accurately in 18th -19th century. From the late 1700s to the early 1800s, physicians such as Hasselbach, Cooper, Camper, Scarpa, Richter and Gimbernat identified vital components of the inguinal region, and their contributions are reflected in the current nomenclature.

Dawn of modern surgery began in 1865 with advent of Listerian principles of antiseptics. Marcy, an American surgeon & pupil of Lister, was first surgeon to introduce antiseptic techniques in repair of hernia. He was also the first surgeon to recognize role of fascia transversalis in the repair of hernia and closure of internal ring.²

Edoardo Bassini (1844-1924) is regarded as 'father of modern surgery'. He was the pupil of Lingi Porta, a famous surgeon of Pavia who cured Bassini's caecal fistula resulting from battle wound. He became interested in hernia surgery and published his results in 1889 of successful repair of 262 cases with low mortality and recurrence. Bassini technique of hernia repair is regarded as a milestone⁸.

Prosthetic materials were introduced in hernia repair for first time in 1900-1909 (Mitzele Goepel in Germany, Bartlett in USA, McGarin in Britain). They used silver wire filigree sheets. Tantalum metal sheets and tantalum gauge were introduced in 1940 in 1940 -1948 respectively⁷. Modern sheets of woven or knitted mesh of polyamide, polyethylene were introduced in 1950's. Polypropylene mesh was popularized by Usher in 1958. These mesh are universally available, flexible easily cut to required shape & are practically in destructible in the human tissues. Collagen tissue is laid down through the interstices of the weave so that material is incorporated into healthy new tissue. Prosthetic material repair has become procedure of choice and modern herniorrhaphy has rapidly become a simple tensionless operation.

Initially described by Lichtenstein, the repair involved placement of a Marlex mesh over the entire floor of the inguinal canal. The repair capitalized on the concept of the myo-pectineal orifice of Fruchaud, which was based on the notion that whatever the type of inguinal hernia, the defect lay in the integrity of transversalis fascia. Tension free repairs have a lower rate of recurrence than tissue repairs.

Laparoscopic technique of hernia repair was first proposed by Brown (1994) at Minnesota school. He successfully repaired inguinal, ventral, incisional & umbilical hernias by this method.

Groin hernia repair is one of the most common elective operations performed in general surgery. Tension-free prosthetic repair has been

introduced with reported recurrence rates of less than 1%. Preperitoneal prosthetic repair has been particularly recommended for bilateral and recurrent hernias. Laparoscopic hernia repair is similar to the open preperitoneal approach and can be performed via a trans-abdominal or totally extraperitoneal route.

Composition Of Hernia

As a rule, a hernia consist of three parts- sac, covering, contents.

Sac—diverticulum of peritoneum, consisting of mouth, neck, body, fundus. The neck is usually well defined but in direct inguinal hernia neck is wide and ill-defined. Strangulation of bowel is a likely complication where neck is narrow.

Coverings- derived from layers of abdominal wall through which sac passes.

Contents-omentum, intestine, a portion of circumference of bowel, bladder wall, ovary with or without tubes, Meckel's diverticulum, fluid.

Aetiology – multifactorial-

Presence of preformed sac—patent processus vaginalis.

- Repeated elevation of intra abdominal pressure-chronic cough, constipation, ascitis.
- Weakening of the muscles & tissues with time- old age, lack of physical exercise, adiposity, multiple pregnancies, chronic illness, operation. It has been suggested that abnormalities in collagen structures, reduction in polymerization, decreased amount of hydroxyprolene, leads to loss of binding of collagen fibres. This mechanism leads to recurrences and familial tendency.

Classification Of Hernia

1. NYHUS-

TYPE 1: Indirect hernia with normal deep ring.

TYPE 2: Indirect hernia with dilated deep ring.

TYPE 3: Posterior wall defect

- Direct.
- Pantaloon
- Femoral

TYPE4: Recurrent.

2. Gilbert-

TYPE 1: Snug internal ring through which a peritoneal sac passes out as indirect sac.

TYPE 2: Moderately enlarged internal ring which admits one finger but less than two finger. Once reduced it protrudes during coughing or straining.

TYPE 3: Internal ring with defect more than two fingers breadth. Hernia descends into scrotum or with sliding hernia. Once reduced it protrudes out without straining.

TYPE 4: Direct hernia with large full blow out of the posterior wall of the inguinal canal. The internal ring is also intact.

TYPE 5: Direct hernia protruding out through punched out hole/defect in fascia transversalis. Internal ring is intact.

TYPE 6: Pantaloon/double hernia.

TYPE 7: Femoral hernia.

Differential Diagnosis

Swelling:

Femoral hernia, Incisional Hernia, lymph gland enlargement, aneurysm, saphena-varix, soft tissue tumour, abscess, genital anomalies (ectopic testis)

Pain:

Adductor tendinitis, pubic osteitis, hip artrosis, bursitis ileopectinea, irradiating low backpain.

Women: femoral hernia, endometriosis.

OPERATIVE TECHNIQUES-

Successful surgical repair of a hernia depends on a tension-free closure of the hernia defect to attain the lowest possible recurrence rate.

All of the open anterior herniorrhaphy techniques begin with a transversely-oriented slightly curvilinear skin incision of approximately 6 to 8 cm positioned one to two fingerbreadths above the inguinal ligament. Dissection is carried down through the

subcutaneous and Scarpa's layers. The external oblique aponeurosis is identified and cleaned so that the external ring is identified inferomedially. Being careful to avoid injury to the iliohypogastric and ilioinguinal nerves, the aponeurosis is incised sharply and opened along its length through the external ring with fine scissors. The nerves underlying the external oblique fascia are then identified and isolated for protection. The soft tissue is cleared off the posterior surface of the external oblique aponeurosis on both sides and the spermatic cord is mobilized. Using a combination of blunt and sharp dissection, the cremaster muscle fibers enveloping the cord are separated from the cord structures and the cord itself is isolated. At this point, it is possible to accurately define the anatomy of the hernia. An indirect hernia will present with a sac attached to the cord in an anteromedial position extending superiorly through the internal ring. A direct inguinal hernia will present as a weakness in the floor of the canal posterior to the cord.

The Shouldice Technique

The Shouldice technique is commonly used for open repair of inguinal hernias and is the most popular pure tissue hernia repair. It is in essence the modern evolution of the Bassini repair performed in a multilayered fashion. Both operations use a tightening of the internal ring and closure of the transversalis fascia to the inguinal ligament as their primary tenets of hernia repair. After suitable exposure and isolation of the cord, a pair of scissors is passed posterior to the transversalis fascia beginning at the medial pillar of the internal ring and extending inferomedially to the pubic tubercle. In this way, the transversalis fascia is separated from the preperitoneal fat plane. Care must be taken at this stage to preserve the inferior epigastric vessels that reside in the preperitoneal space. The transversalis fascia is then opened with scissors along the entire inguinal floor from internal ring to pubic tubercle, and the posterior surface of the transversalis is cleaned of its preperitoneal attachments. As the first layer of the repair, the free edge of the lower transversalis flap is sutured in a continuous, imbricated fashion behind the upper flap to the posterior surface of the upper transversalis fascia and the lateral component of the posterior rectus sheath. This running suture layer is started medially at the pubic tubercle and carried up to and through the internal ring, thereby tightening the transversalis fascia around the cord at its entrance to the inguinal canal. The first layer is not tied but continued in a running fashion from lateral to medial as a second layer closing the upper transversalis flap to the base of the lower edge as well as the inguinal ligament. This second layer progresses medially to the pubic tubercle where it is tied to the original tail that started the first layer. The third layer of continuous suture starts at the tightened internal ring and brings together the conjoint tendon (the internal oblique and transversus abdominis aponeuroses) medially with the inguinal ligament laterally. This layer is run down to the pubic tubercle, and returns back to the internal ring as the fourth layer including the anterior rectus sheath medially with the posterior aspect of the external oblique aponeurosis laterally. The cord can now be relaxed gently on the new inguinal floor, and the external oblique aponeurosis is closed in one to two additional continuous layers extending down to the external ring to reapproximate this structure. The original descriptions of the operation by Shouldice used continuous stainless steel wire suture for all four layers of repair, although surgeons commonly use permanent synthetic suture today.

The Cooper Ligament Repair

The Cooper ligament repair begins similar to the Shouldice procedure, and exposure and isolation of the cord is performed. The transversalis fascia is then opened and cleaned posteriorly. At this time, Cooper's ligament is identified and dissected free of its fibrous and fatty attachments. The defects are repaired by using interrupted suture to affix the upper border of the transversalis fascia to Cooper's ligament beginning medially at the pubic tubercle and continuing until the femoral sheath is reached. At this point, the femoral canal is closed by carefully suturing Cooper's ligament to the femoral sheath. The repair is continued with interrupted sutures between the transversalis fascia and the iliopubic tract laterally until the entrance point of the cord is reached. In this way, the closure creates a new, and tighter, internal inguinal ring around the cord.

DESARDA TECHNIQUE:

Desarda technique is a new emerging method of tissue repair of inguinal hernia with repair with undetached strip of extrnal oblique aponeurois in place of mesh.

The Lichtenstein Technique

The Lichtenstein inguinal hernia repair was the first pure prosthetic,

tension-free repair to achieve consistently low recurrence rates in long-term outcomes analysis. This operation begins with the incision of the external oblique aponeurosis, and the isolation of the cord structures. Any indirect hernia sac is mobilized off the cord to the level of the internal ring. At this point, a large mesh tailored to fit along the inguinal canal floor is placed so that the curved end lies directly on top of the pubic tubercle. The mesh patch extends underneath the cord until the spermatic cord and the tails of the mesh patch meet laterally. Here, an incision is made in the mesh, and the cord is inserted between the tails of the mesh, thereby creating a new, tighter, and more medial internal ring. The tails are sutured together with one nonabsorbable stitch just proximal to the attachment of the cord. The mesh is then sutured in a continuous or interrupted fashion to the pubic tubercle inferiorly, the conjoint tendon medially, and the inguinal ligament laterally.

Rutkow and Robbins have reported interesting and effective advances in the Lichtenstein technique. The "plug and patch" repair, represents a tension-free herniorraphy and can even be performed without sutures. In this technique, the patch is placed in a similar fashion to the modern Lichtenstein repair as it lies along the inguinal canal from the pubic tubercle medially to beyond the cord laterally. In addition, a mesh plug in the form of an umbrella or cone is snugly fit up and into the internal ring. In this way, the repair goes beyond just a tightening of the internal ring, but serves to close the ring around the spermatic cord. Modifications of this operation exist and are practiced commonly by general surgeons. The patch and plug can be sutured to the surrounding inguinal canal tissue in an interrupted or continuous fashion. Alternatively, both prostheses can be placed in appropriate position with no suture affixment. In this way, the body's natural scarring mechanism will hold both pieces of mesh in place over time. Wide internal ring defects, often caused by large or chronic indirect sacs, may require one or two sutures to tack the plug in place to avoid slippage into the canal anteriorly or the retroperitoneal space posteriorly.

Laparoscopic Repair:

The laparoscopic approach to hernia repair has since evolved into a common and effective procedure. Today, the laparoscopic approach comprises approximately 20 to 25% of groin hernia operations. The most important difference between the laparoscopic and open approaches for inguinal hernia repair is anatomical: the laparoscopic approach uses mesh to repair the hernia defect in a plane posterior to the defect (either in the preperitoneal space or from within the peritoneal cavity), whereas the open approaches repair the hernia anterior to the defect.

Three different techniques exist for laparoscopic repair of groin hernias.

The Transabdominal Preperitoneal (TAP)

TAP repair involves standard laparoscopy with access into the peritoneal cavity and placement of a large mesh along the anterior abdominal wall, thereby repairing the hernia posterior to the defect. This technique was the first laparoscopic hernia repair to be performed. Ports are generally placed through the umbilicus and then laterally on either side of the rectus muscle. The hernia defect is usually well visualized from within the peritoneal cavity. After both inguinal regions have been inspected and laparoscopic adhesiolysis performed if necessary, the median umbilical ligament (the urachal remnant), the medial umbilical ligament (the remnant of the umbilical artery), and the lateral umbilical fold (the reflection of peritoneum over the inferior epigastric vessels) are identified. The parietal layer of peritoneum is then incised superior to the hernia defect and reflected inferiorly, thereby exposing the hernia defect, the epigastric vessels, Cooper's ligament, the pubic tubercle, and the iliopubic tract. The cord structures are then dissected free of their peritoneal attachments. In a direct hernia, the peritoneal sac is pulled back within the peritoneal cavity with gentle traction to separate the thin peritoneal layer from the equally thin layer of transversalis fascia anterior to it. In an indirect hernia, the peritoneal sac is retracted off of the cord structures and pulled back within the peritoneal cavity. Alternatively, in the setting of a large chronic indirect hernia, the sac can be divided distal to the internal ring so that only the proximal portion of the sac needs to be mobilized for the repair. A large polypropylene mesh patch is then placed between the peritoneum and the transversalis fascia that covers the inguinal floor, internal ring, and the femoral canal. The mesh is stapled or tacked to the pubic tubercle medially, Cooper's ligament inferiorly, and the anterior superior iliac spine laterally. The incised peritoneal flap is then closed over the mesh.

While the TAP repair has been shown to be effective, there is a risk that the prosthetic mesh will be in direct contact with the bowel, and significant concern has been raised about the potential for intra-abdominal adhesions postoperatively.²³ Enthusiasm for this technique has waned in recent years with the advent of extraperitoneal laparoscopic approaches to inguinal hernia repair.

The Total Extraperitoneal (TEP)

TEP approach to laparoscopic inguinal hernia repair is currently the most popular laparoscopic technique. This repair is performed entirely within the preperitoneal space and does not involve the peritoneal cavity when performed correctly. In this technique, the surgeon carefully develops a plane between the peritoneum posteriorly and the abdominal wall tissues anteriorly and thus insufflates the preperitoneal space. An incision is made inferior to the umbilicus, and the anterior rectus sheath on the ipsilateral side is incised. The rectus muscle is retracted laterally, and the preperitoneal space is bluntly dissected to allow placement of a balloon port to facilitate insufflation. Once the space has been insufflated, two additional ports are placed in the midline between the umbilicus and the pubic symphysis. In experienced hands, this approach provides for excellent visualization of the groin anatomy, and the dissection proceeds in a similar fashion to the TAP. The TEP repair allows a large prosthetic mesh to be placed through a laparoscopic port into the preperitoneal space, and it is then positioned deep to the hernia defect to repair the hernia from a posterior approach. There are few prospective, randomized data available to adequately judge short- and long-term results of the different laparoscopic inguinal hernia techniques. A recent systematic review found that among the several nonrandomized trials, TAP was associated with an increased rate of port site herniation and visceral organ injury. This review concluded that there are insufficient data from prospective, randomized trials to make firm conclusions about the relative effectiveness of the TEP and TAP procedures.

There are emerging data comparing laparoscopic techniques to open inguinal hernia repair, although the evidence is far from definitive. While there are multiple meta-analyses in the literature, only two truly compare the laparoscopic hernia technique with a tension-free open repair. A meta-analysis of 29 randomized trials in 2003 found that laparoscopic hernia repair was associated with earlier discharge from the hospital, quicker return to normal activity and work, and fewer postoperative complications than open repair. However, in these data there was a trend towards an increase in the risk of recurrence after laparoscopic repair. A separate meta-analysis reviewing 41 published randomized trials found no significant difference in risk of recurrence between the two approaches. Laparoscopic repair was associated with a quicker return to function and less postoperative pain, but also was found to have a higher risk of visceral and vascular injuries. A more recent multicenter, randomized trial that analyzed long-term hernia results in over 2000 patients in 14 Veterans Affairs hospitals found that laparoscopic hernia repair was associated with a higher recurrence rate among primary hernias, but was equivalent to open repair in recurrent hernias. In all of these studies, the laparoscopic repair was noted to take more time in the operating room. Finally, a recent study has reported a significant learning curve inherent in the laparoscopic approach.

Surgical Complications of Groin Hernia

1. Recurrence
 2. Infection
 3. Seromas and hematomas are frequent complications in the postoperative setting.
 4. Neuralgia : Postoperative groin pain, or neuralgia, is common to varying degrees following groin herniorrhaphy. Often, the neuralgia will follow the known distribution of the regional nerves, including the ilioinguinal, iliohypogastric, genital branch of the genitofemoral nerve, and the lateral femorocutaneous.
 5. Bladder Injury
 6. Testicular Injury
 7. Vas Deferens Injury
- The most worrisome sequel of vas deferens obstruction or transection is formation of anti-sperm antibodies in the serum, leading to infertility.
8. Stagnated Groin Hernia

RESULTS

Table 1: Mean Age Distribution Of Four Groups [n=80]

Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
GROUP1	25	52.2800	10.4504	36.0000	71.0000	53.0000	0.2104

GROUP2	15	51.0000	11.3892	34.0000	70.0000	50.0000	
GROUP3	20	49.2500	8.7772	34.0000	63.0000	49.0000	
GROUP4	20	48.9500	9.7359	28.0000	60.0000	43.5000	

$p=0.2104$, statistically not significant

Difference of mean age in four groups was not statistically significant ($p=0.2104$).

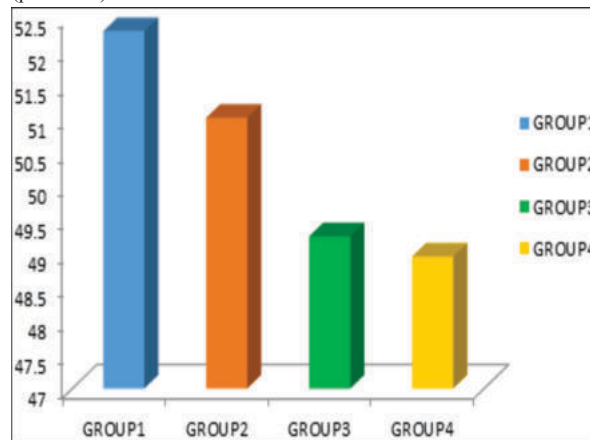


Figure 1:- Mean Age Distribution Of Four Groups

Mean age in different four groups of patients were-Lichtenstein:52, Desarda:51, TEP:49 and TAPP:48 years.

Table 2: Distribution Of Gender In Four Groups [n=80]

GROUP	Group 1	Group 2	Group 3	Group 4	TOTAL
Female	2	1	2	3	8
Row %	25.0	12.5	25.0	37.5	100.0
Col %	8.0	6.7	10.0	15.0	10.0
Male	23	14	18	17	72
Row %	31.9	19.4	25.0	23.6	100.0
Col %	92.0	93.3	90.0	85.0	90.0
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.8370$, Statistically not significant

Distribution of gender in four groups were not statistically significant ($p=0.8373$).

90% of the study population was male.

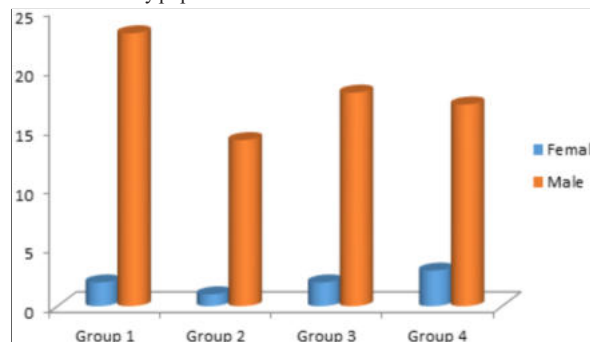


Figure 2:- Distribution Of Gender In Four Groups

In the current study 90% of study population was male and only 10% was female.

Male and female were equally distributed in different study groups.

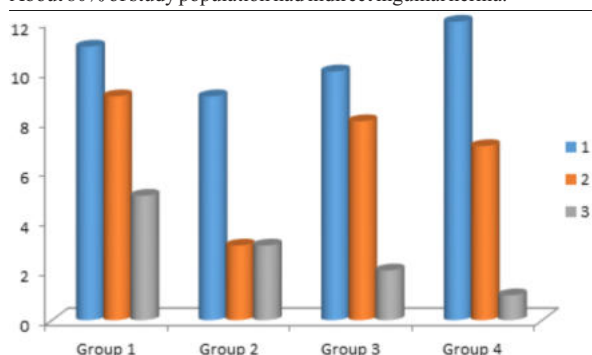
Association between pre-op diagnosis in four groups was not statistically significant ($p=0.6340$).

Table 3: Distribution Of Pre-Op Diagnosis In Four Groups [n=80]

GROUP	pre-op diagnosis	Group 1	Group 2	Group 3	Group 4	TOTAL
1	Row %	11	9	10	12	42
	Col %	26.2	21.4	23.8	28.6	100.0
2	Row %	9	3	8	7	27
	Col %	33.3	11.1	29.6	25.9	100.0
3	Row %	5	3	2	1	11
	Col %	45.5	27.3	18.2	9.1	100.0
TOTAL	Row %	25	15	20	20	80
	Col %	31.3	18.8	25.0	25.0	100.0

$p=0.6340$, statistically not significant

About 80% of study population had indirect inguinal hernia.

**Figure-3: Distribution Of Pre-Op Diagnosis In Four Groups**

About 86.3% of study population had indirect inguinal hernia (52.5% with normal deep ring and 33.8% with dilated deep ring) only 13.8% had direct inguinal hernia.

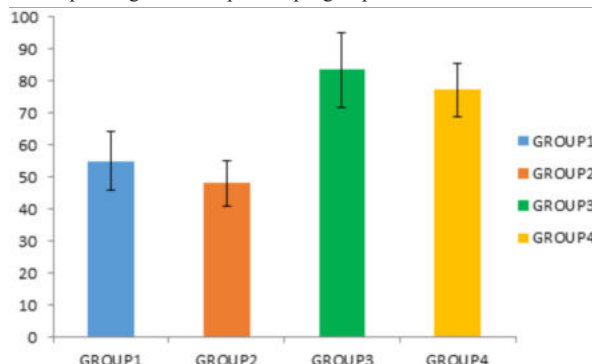
Table 4: Mean Operating Time In Four Groups [n=80]

Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
GROUP1	25	55.0800	9.3671	42.0000	75.0000	55.0000	<0.0001
GROUP2	15	48.0667	7.0150	35.0000	58.0000	48.0000	
GROUP3	20	83.6000	11.6321	68.0000	108.0000	83.5000	
GROUP4	20	77.2500	8.2326	60.0000	92.0000	78.0000	

$P<0.0001$, Statistically Significant

Difference of mean operating time in four groups was statistically significant ($p<0.0001$).

More operating time for laparoscopic group.

**Figure-4: Mean Operating Time In Four Groups**

Mean operating time in Lichtenstein group-55, Desarda group-48, TEP-83.6 and TAPP-77.25 minutes. There was shorter operating time

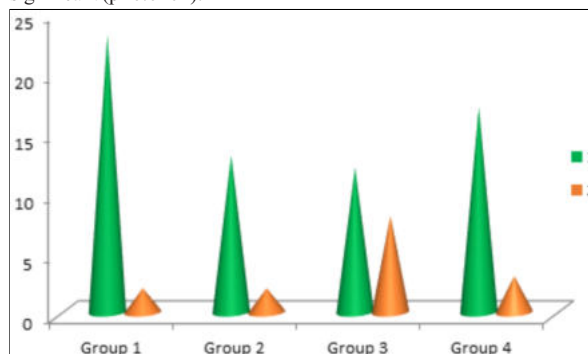
in Desarda than Lichtenstein group. In laparoscopic group there was shorter duration in operating time in TAPP than in TEP.

Table 5: Amount Of Per-Op Blood Loss In Four Groups [n=80]

GROUP	Per-op	Group 1	Group 2	Group 3	Group 4	TOTAL
1	Row %	23	13	12	17	65
	Col %	35.4	20.0	18.5	26.2	100.0
2	Row %	2	2	8	3	15
	Col %	13.3	13.3	53.3	20.0	100.0
TOTAL	Row %	25	15	20	20	80
	Col %	31.3	18.8	25.0	25.0	100.0

$p=0.0402$, Statistically significant

Correlation between pre-op blood loss in four groups was statistically significant ($p=0.0402$).

**Figure-5: Amount Of Per-Op Blood Loss In Four Groups**

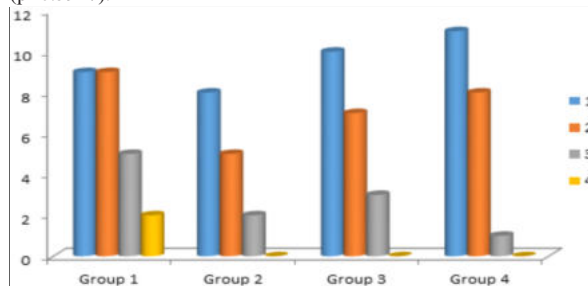
In 81.3% patients in study population had about 20 ml intra-operative blood loss (one soaked gauge approximately=20 ml of blood).

Table 6: Incidence Of Severity Of Pain On POD-0 In Four Groups [n=80]

GROUP	D0	Group 1	Group 2	Group 3	Group 4	TOTAL
1	Row %	9	8	10	11	38
	Col %	23.7	21.1	26.3	28.9	100.0
2	Row %	9	5	7	8	29
	Col %	31.0	17.2	24.1	27.6	100.0
3	Row %	5	2	3	1	11
	Col %	45.5	18.2	27.3	9.1	100.0
4	Row %	2	0	0	0	2
	Col %	100.0	0.0	0.0	0.0	100.0
TOTAL	Row %	25	15	20	20	80
	Col %	31.3	18.8	25.0	25.0	100.0

$p=0.5917$, Statistically not significant

Association between D0 in four groups was not statistically significant ($p=0.5917$).

**Figure-6: Incidence Of Severity Of Pain On POD-0 In Four Groups**

Comments:

on POD-0 most of the patients(36.3%) in four groups experienced mild pain based on VAS score, only 2.5% patients experienced severe pain. severity of pain in different groups of patients was equally distributed.

Table 7: Incidence Of Severity Of Pain On POD-1 In Four Groups [n=80]

GROUP					
D1	Group 1	Group 2	Group 3	Group 4	TOTAL
1	13	9	15	16	53
Row %	24.5	17.0	28.3	30.2	100.0
Col %	52.0	60.0	75.0	80.0	66.3
2	8	6	4	4	22
Row %	36.4	27.3	18.2	18.2	100.0
Col %	32.0	40.0	20.0	20.0	27.5
3	4	0	1	0	5
Row %	80.0	0.0	20.0	0.0	100.0
Col %	16.0	0.0	5.0	0.0	6.3
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.1449$, Statistically not significant

Association between D1 in four groups was not statistically significant ($p=0.1449$).

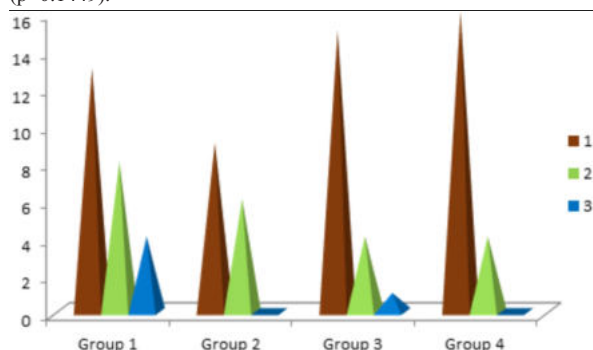


Figure-7: Incidence Of Severity Of Pain On POD-1 In Four Groups

There was decrease percentage of patients experienced mild pain on POD-1 compare to POD-0 (36.3% vs 27.5%). 6.3% patients in study population experienced moderate pain on POD-1, most of the patients were in the Lichtenstein group.

Table 8: Incidence Of Severity Of Pain On POD-3 In Four Groups [n=80]

GROUP					
D3	Group 1	Group 2	Group 3	Group 4	TOTAL
1	19	12	15	19	65
Row %	29.2	18.5	23.1	29.2	100.0
Col %	76.0	80.0	75.0	95.0	81.3
2	6	3	5	1	15
Row %	40.0	20.0	33.3	6.7	100.0
Col %	24.0	20.0	25.0	5.0	18.8
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.3257$, Statistically Not Significant

Association between D3 in four groups was not statistically significant ($p=0.1449$).

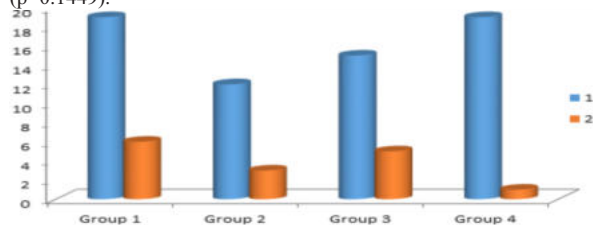


Figure-8: Incidence Of Severity Of Pain On POD-3 In Four Groups

On POD-3 only 18.8% patients in study population were experienced mild pain.

Table 9: Incidence Of Severity Of Pain On POD-7 In Four Groups [n=80]

GROUP					
D7	Group 1	Group 2	Group 3	Group 4	TOTAL
1	22	14	17	17	70
Row %	31.4	20.0	24.3	24.3	100.0
Col %	88.0	93.3	85.0	85.0	87.5
2	2	1	3	3	9
Row %	22.2	11.1	33.3	33.3	100.0
Col %	8.0	6.7	15.0	15.0	11.3
3	1	0	0	0	1
Row %	100.0	0.0	0.0	0.0	100.0
Col %	4.0	0.0	0.0	0.0	1.3
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.7700$, Statistically not significant

Association between D7 in four groups was not statistically significant ($p=0.7700$).

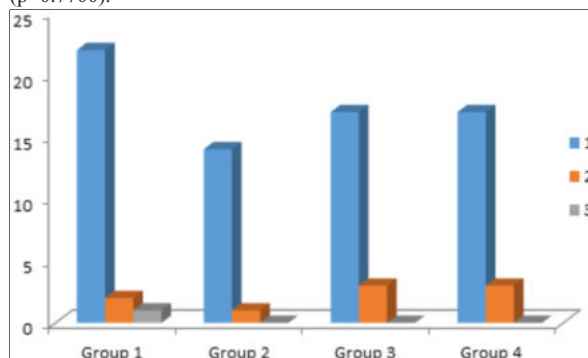


Figure-9: Incidence Of Severity Of Pain On POD-7 In Four Groups

On POD-7 only 11.3% and 1.3% of the study population experienced mild and moderate pain respectively and equally distributed in all four groups of patients.

Table 10: : Incidence Of Severity Of Pain On POD-14 In Four Groups [n=80]

GROUP					
D14	Group 1	Group 2	Group 3	Group 4	TOTAL
1	16	15	16	17	64
Row %	25.0	23.4	25.0	26.6	100.0
Col %	64.0	100.0	80.0	85.0	80.0
2	8	0	3	3	14
Row %	57.1	0.0	21.4	21.4	100.0
Col %	32.0	0.0	15.0	15.0	17.5
3	1	0	1	0	2
Row %	50.0	0.0	50.0	0.0	100.0
Col %	4.0	0.0	5.0	0.0	2.5
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.1745$, Statistically Not Significant

Association between D14 in four groups was not statistically significant ($p=0.1745$).

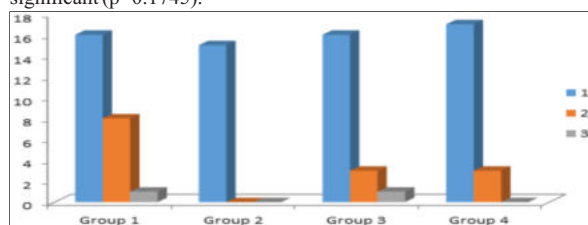


Figure-10: Incidence Of Severity Of Pain On POD-14 In Four Groups

On POD-14 17.5% patients in study population experienced mild pain ,more in Lichtenstein and TEP groups and 2.5% patients in all four groups experienced moderate pain,again more in Lichtenstein and TEP groups.

Table 11:Incidence Of Post-operative Urinary Retention In Four Groups [n=80]

GROUP					
Post-op	Group 1	Group 2	Group 3	Group 4	TOTAL
No	23	13	16	18	70
Row %	32.9	18.6	22.9	25.7	100.0
Col %	92.0	86.7	80.0	90.0	87.5
Yes	2	2	4	2	10
Row %	20.0	20.0	40.0	20.0	100.0
Col %	8.0	13.3	20.0	10.0	12.5
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.6559$, Statistically Not Significant.

Association between Post-op blood loss in four groups was not statistically significant ($p=0.6559$).

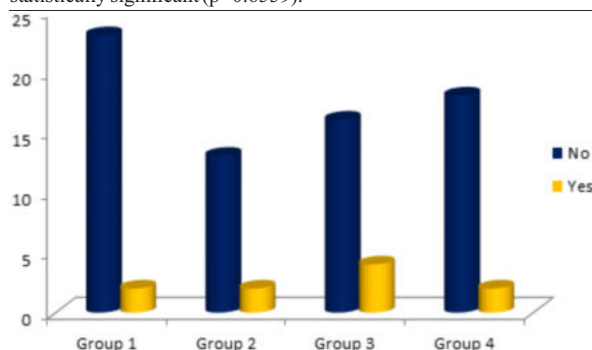


Figure11-Incidence Of Post-operative Urinary Retention In Four Groups

About 12.5% patients developed urinary retention in post-operative period and were equally distributed in four study groups.

Table 12: Association Of SSI In Four Groups [n=80]

GROUP					
SSI	Group 1	Group 2	Group 3	Group 4	TOTAL
No	23	14	19	18	74
Row %	31.1	18.9	25.7	24.3	100.0
Col %	92.0	93.3	95.0	90.0	92.5
Yes	2	1	1	2	6
Row %	33.3	16.7	16.7	33.3	100.0
Col %	8.0	6.7	5.0	10.0	7.5
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.9434$, Statistically Not Significant

Association between SSI in four groups was not statistically significant ($p=0.9434$).

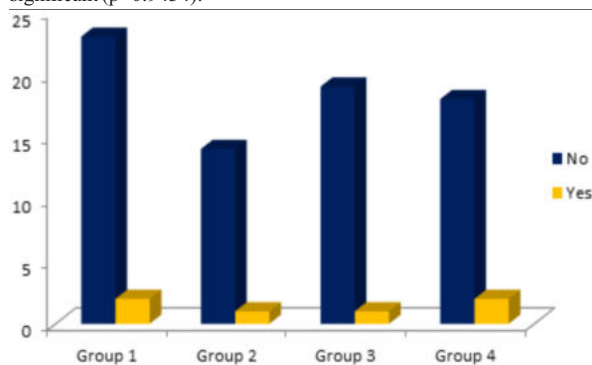


Figure12: Association Of SSI In Four Groups

Only 6 patients(7.5%) patients in the study population developed surgical site infection according to CDC criterias.

Table 13: Association Of Hematoma In Four Groups [n=80]

GROUP					
Hemato-	Group 1	Group 2	Group 3	Group 4	TOTAL
No	22	13	18	19	72
Row %	30.6	18.1	25.0	26.4	100.0
Col %	88.0	86.7	90.0	95.0	90.0
Yes	3	2	2	1	8
Row %	37.5	25.0	25.0	12.5	100.0
Col %	12.0	13.3	10.0	5.0	10.0
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.8370$, Statistically Not Significant

Association between hematoma in four groups was not statistically significant ($p=0.8370$).

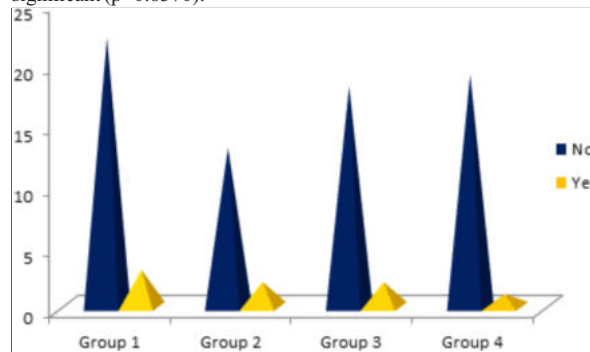


Figure 13: Association Of Hematoma In Four Groups

10% patients in study population developed wound hematoma and were equally distributed in all four groups.

Table 14: Association Of Scrotal Edema In Four Groups [n=80]

GROUP					
Scrotal	Group 1	Group 2	Group 3	Group 4	TOTAL
No	22	13	16	17	68
Row %	32.4	19.1	23.5	25.0	100.0
Col %	88.0	86.7	80.0	85.0	85.0
Yes	3	2	4	3	12
Row %	25.0	16.7	33.3	25.0	100.0
Col %	12.0	13.3	20.0	15.0	15.0
TOTAL	25	15	20	20	80
Row %	31.3	18.8	25.0	25.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0

$p=0.8961$, Statistically not significant

Association between scrotal in four groups was not statistically significant ($p=0.8961$).

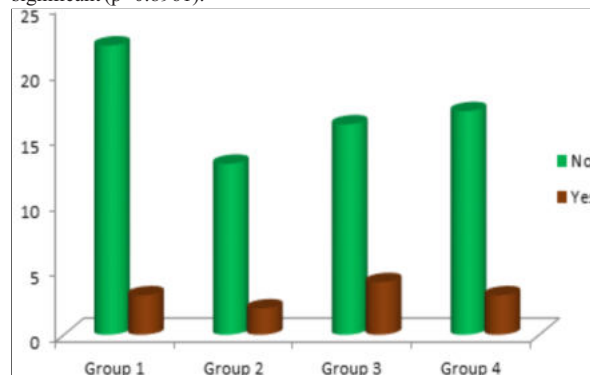


Table 14: Association Of Scrotal Edema In Four Groups

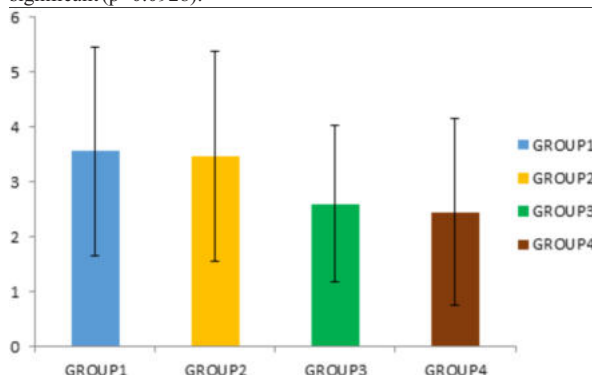
15% patients in the study population were developed scrotal oedema and were equally distributed in four groups of patients.

Table 15: Mean Post-Op Hospital Stay In Four Groups(days) [n=80]

Group	Num ber	Mean	SD	Minimu m	Maximu m	Media n	p- value
GROUP1	25	3.5600	1.8947	2.0000	8.0000	3.0000	0.0928
GROUP2	15	3.4667	1.9223	2.0000	8.0000	2.0000	
GROUP3	20	2.6000	1.4290	1.0000	6.0000	2.0000	
GROUP4	20	2.4500	1.7006	1.0000	6.0000	2.0000	

$p=0.0928$, Statistically Not Significant

Difference of mean hospital stay in four groups was not statistically significant ($p=0.0928$).

**Figure 15: Mean Post-op Hospital Stay In Four Groups(days)**

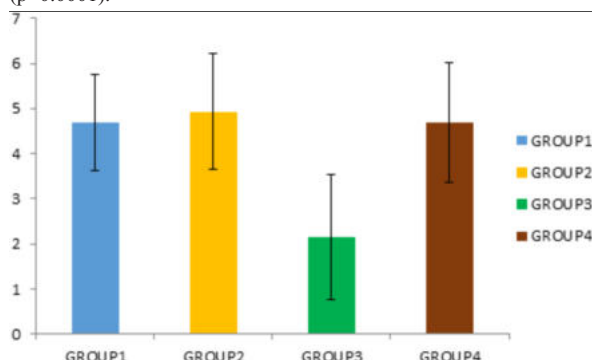
Mean post-operative hospital stay were 3.5 , 3.4 ,2.6 and 2.4 days in Lichtenstein, Desarda, TEP and TAPP groups respectively.

Table 16: Time For Resumption Of Normal Activities In Four Groups(weeks) [n=80]

Group	Num ber	Mean	SD	Minim um	Maxim um	Media n	p- value
GROUP1	25	4.6800	1.0693	4.0000	8.0000	4.0000	<0.0001
GROUP2	15	4.9333	1.2799	4.0000	8.0000	4.0000	
GROUP3	20	2.1500	1.3870	1.0000	5.0000	1.5000	
GROUP4	20	4.6800	1.3219	1.0000	5.0000	1.0000	

$P<0.0001$, Statistically Significant

Difference of resumption in four groups was statistically significant ($p<0.0001$).

**Figure 16: Time For Resumption Of Normal Activities In Four Groups(weeks)**

Time required to return to normal activities were(mean) 4.6 , 4.9, 2.15 and 4.68 weeks in Lichtenstein,Desarda,TEP and TAPP groups respectively and it was significantly shorter in TEP group of patients.

CONCLUSIONS

The purpose of the study was to compare the immediate post-operative outcomes of inguinal hernia repair by different methods-open or laparoscopic, with mesh or without mesh.

There were a total of 80 patients, selected after the exclusion criterias. 25 underwent open Lichtenstein's hernioplasty,15 underwent Desarda repair with out mesh,20 underwent TEP repair and 20 underwent TAPP repair . The results were taken and then analysed with the help of

students unpaired t-test and repeated measures ANOVA.

The results were as follows :

Per-operative Blood Loss:

There was no significant differences in amount of intra-operative blood loos in four different groups of patients

Post-operative Pain:

there was no significant differences in pain on POD-0,POD-1,POD-3,POD-7 and POD-14(based on VAS)

Others Post-operative Compomlications:

There were no significant differences in wound haematoma,scrotal edema,surgical site infectionor seroma formation in different groups of patients.

Operating Time:

No significant differences in operating time in Lichtenstein and Desarde procedures and also no difference in operating time between TEP and TAPPBut there was significant difference in operating time between open and laparoscopic methods.

Resumption To Normal Activities:

A significant difference in return to normal activities was present between open and laparoscopic groups

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