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## Comparitive Study between Laparoscopic Hernioplasty and Open Hernioplasty

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### ABSTRACT

**Background:** A comparative study between Open and Laparoscopic Hernioplasty in the Department of General Surgery at Govt. Stanley Hospital, a Government run, 200 years old, 1280 bedded, under/post graduate and super specialty training institution, located in Chennai, Tamilnadu, the Southern part of India.

**Introduction:** Inguinal hernia repair is one of the most common operations performed in general surgery worldwide. Every fourth man is expected to have a hernia operation during his life time. It accounts for 75% of all abdominal wall hernias. 27% of men and 3% of women have a life time risk of developing inguinal hernia.

**Aims:** To compare Totally Extra peritoneal (TEP) Hernioplasty and Lichtenstein Open Hernioplasty in relation to primary and secondary outcome measures and determine whether laparoscopic repair of inguinal repair is equal or superior to Open Hernioplasty.

**Methods:** The study has been carried out over a period of 4 years from 2007-2010 after obtaining approval from the hospital Ethical Committee.

The study sample consist of 202 patients in each group who were repaired by Laparoscopic and Open method, respectively.

**Results:** The study clearly favours Laparoscopic Totally Extraperitoneal Repair over Open Repair with regards to postoperative pain, hospital stay, resumption of routine physical activities and work.

**Conclusion:** Laparoscopic repair of inguinal hernia is a safe, feasible and effective technique with less post operative pain, early return to routine activities, low recurrence rates, low post operative morbidity and low rates of wound and mesh infection in experienced hands.

**Keywords-**Inguinal hernia, Totally ExtraPeritoneal repair, Return to work.

## INTRODUCTION

“The history of hernia repair is the history of surgery” said- *Nyhus*

Inguinal hernia repair is one of the most common operations performed in general surgery worldwide. Every fourth man is expected to have a hernia operation during his life time. Inguinal hernia's account for 75% of all abdominal wall hernias. 27% of men and 3% of women have a life time risk of developing inguinal hernia.

Hernia surgery has undergone numerous refinements over the centuries with the sole aim of reducing recurrence. The evolution of modern hernia surgery is credited to *Bassini* rightly called “Father of Modern Herniorraphy” who advocated anatomical repair of the posterior wall of the inguinal canal with interrupted non-absorbable sutures – “Tension repair”.

The concept of “Tension free repair” advocated by *Lichtenstein* in 1984 reduced recurrence rates to less than 1% and has become the “gold standard” for open repair of hernia.

Following the wide spread application of laparoscopy to various surgical procedures *Ger* in 1982 reported the first laparoscopic repair by approximating the internal ring using clips.

*Arregui* in 1991 described the Trans-Abdominal Preperitoneal mesh repair - *TAPP* repair and in 1993 *Mckernan*, *Philips* and *Dulucq* described the Totally Extraperitoneal mesh repair - *TEP* repair, which is now considered as the “standard” in laparoscopic hernia repair.

Minimal invasive hernia surgery is gaining acceptance with nearly 20-30% of hernia surgeries being performed by laparoscopy worldwide.

Annually 7 lakhs hernia repairs are performed in USA, 1 lakh in France and UK and 23 lakhs in China. In India 17 lakh hernia surgeries are done yearly.

## AIM OF THE STUDY

To compare Totally Extraperitoneal (TEP) Hernioplasty and Lichtenstein Open Hernioplasty in relation to primary and secondary outcome measures and determine whether laparoscopic repair of inguinal repair is equal or superior to Open Hernioplasty.

## PATIENTS & METHODS

### SETTING:

The study has been carried out over a period of 4 years from 2007-2010 in the Dept.of General Surgery, Stanley Medical College and Hospital, a Government run, 200 years old, 1280 bedded, undergraduate, post graduate and super specialty training institution, located in Chennai, Tamilnadu, the Southern part of India.

### SAMPLE:

The study sample consists of 202 patients who were repaired by Laparoscopic method and 202 patients who were repaired by Open method.

**Selection criteria** was based on **NICE & EHS guidelines.**

**Inclusion Criteria:**

- 1) Healthy patients within the age group of 24-80 years.
- 2) All types of reducible unilateral inguinal hernia.
- 3) Reducible Recurrent and bilateral hernia.

**Exclusion Criteria:**

- Patients with complications of inguinal hernia.
- Patients unfit for general anaesthesia.

**Method of sample selection :**

The study sample was selected by convenience sampling.

All patients received a single dose of Injection Cefatoxime 1gm at induction of anaesthesia.

**Instruments:**

The instrument developed for this study consists of two parts

**Part – I**

Consists of a tool to collect background variables of the patients who underwent hernia repair.

**Part – II**

Consists of instrument to measure Surgeon related result, Patient centered Outcome, Chronic pain, Recurrence and Cost of surgery. Visual Analogue Scale, Verbal rating scale, Numerical rating scale and Inguinal pain questionnaire were used to assess the pain.

**Data Collection Procedure:**

All patients were duly explained about the merits and demerits of both repair procedures and based on their preference were divided into 2 groups viz: the “Open group and the Laparoscopic group and informed written consent was obtained from them.

The data was obtained from the patient and his medical records.

**Data Analysis**

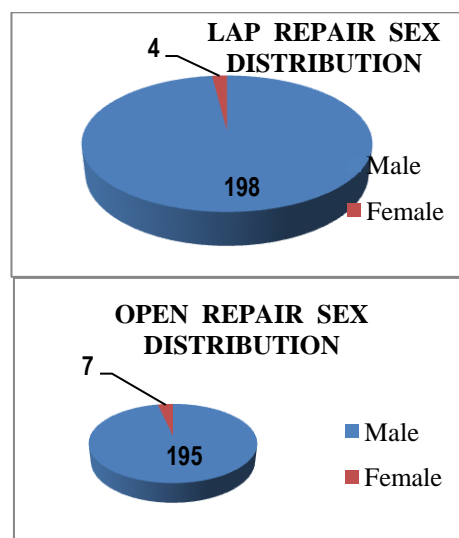
Descriptive and inferential statistics were used to analyse the data.

**RESULT & ANALYSIS**

**Patients Characteristics:**

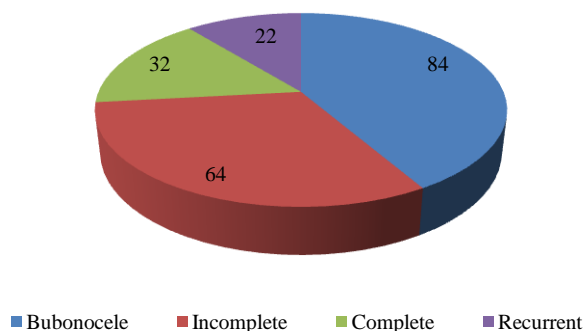
**Table 1:** Patient characteristic

VARIABLES		LAP REPAIR	OPEN REPAIR	p Value
Age		41±3.5	42±3.3	< .003
SEX	MALE	198 (98%)	195 (96.53%)	Not significant
	FEMALE	4 (2%)	7 (3.47%)	



**Figure 1:** Sex distribution in Lap & Open repair

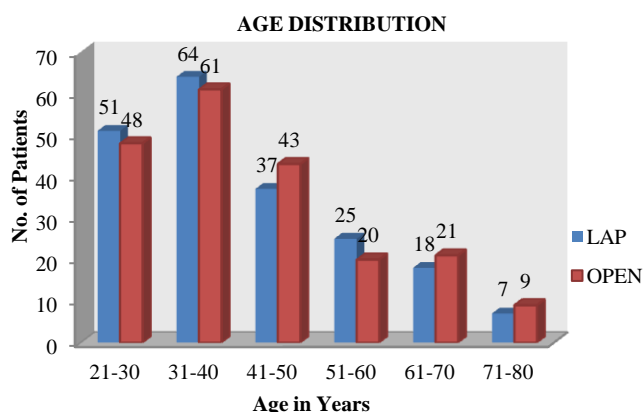
**HERNIA CHARACTERISTICS**



**Figure 2:** Hernia Characteristics

**AGE GROUP**

The mean age group was  $41 \pm 3.5$  in the Lap group and  $42 \pm 3.3$  in the Open group.



**Figure 3:** Age distribution

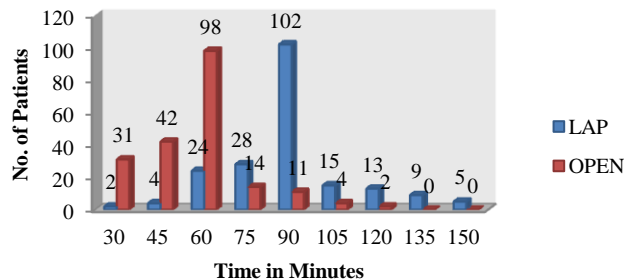
**OPERATING TIME**

**84.65%** (171) cases in the **Open group** and **14.85%** (30 cases) in the **Lap group** were completed in **60 minutes**.

**50.49%** (102 cases) in the **Lap group** took **120 minutes**.

Most of the **open cases** were completed within **45 - 90 minutes** while in the **Lap group** it took **75-120 minutes**.

**OPERATING TIME**

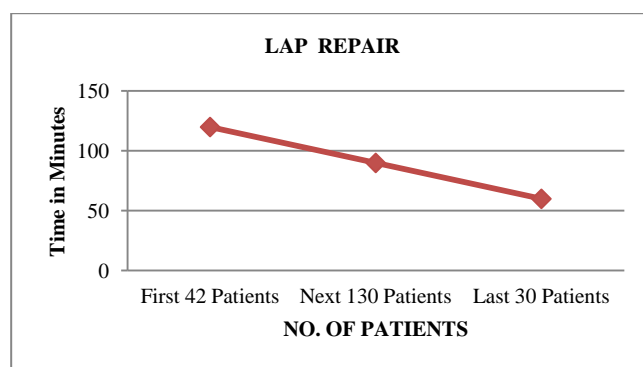


**Figure 4:** Operating time

**LEARNING CURVE**

During the early part of the study the operating time in **Laparoscopic repair** was **105-150 minutes** in the first **42 cases (20.79%)** and subsequently **75-90 minutes** for the next **130 cases (64.36%)** and finally less than **60 minutes** in the last **30 cases (14.85%)**.

In **Open repair** the operating time was 105 –120 minutes in the first **6 cases (2.97%)** and subsequently 75-90 minutes for the next **25 cases (12.37%)** and finally less than **60 minutes** in the last **171 cases (84.65%)**.



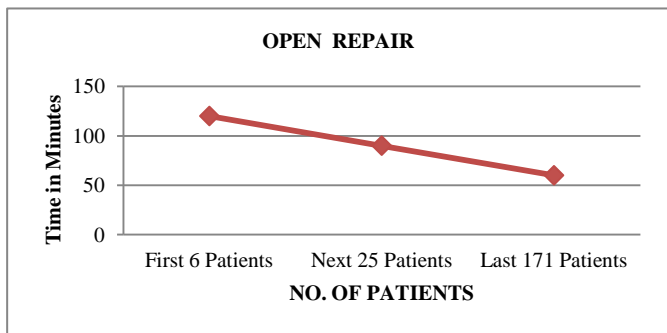


Figure 5: Learning curve for lap & open repair

**POST OPERATIVE PAIN**

POST OP PAIN was assessed 6<sup>th</sup> hourly on day one and then daily during the first week followed by every week for the remaining 3 months using a visual analogue scale.

Post operative pain was greatest in the open group 13.86% in comparison to 7.92% in Lap group on the 1st day.

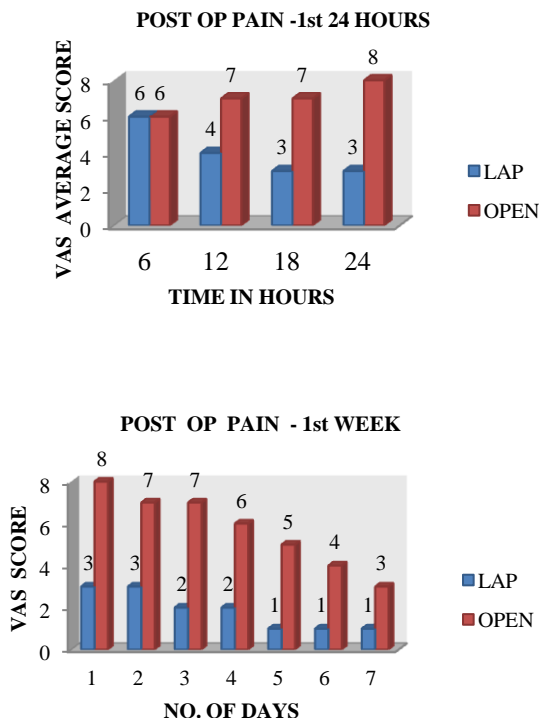


Figure 6: Postoperative pain

**HOSPITAL STAY**

97.5% (197 patients) were discharged in the Lap group within 1.5 days and 53.46% (108 patients) only in the Open group.

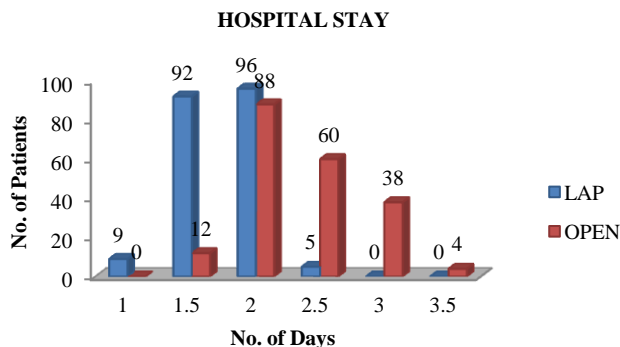


Figure 7: Length of hospital stay

**ABILITY TO PERFORM ROUTINE ACTIVITIES**

53.46% (108 patients) who underwent Laparoscopic repair were able to perform routine activities by the 2<sup>nd</sup> day whereas only 34% (68 patients) in the Open group were able to perform routine activities by the 5<sup>th</sup> day

**ABILITY TO PERFORM ROUTINE ACTIVITIES**

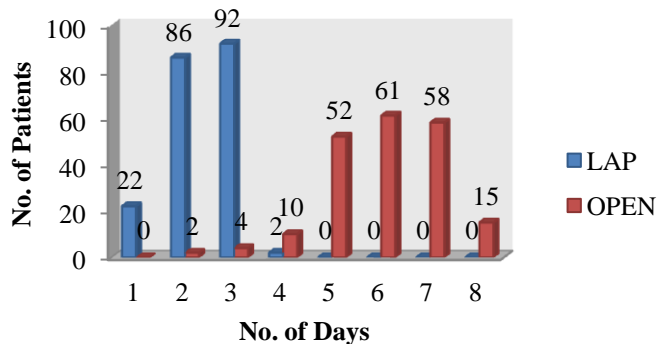


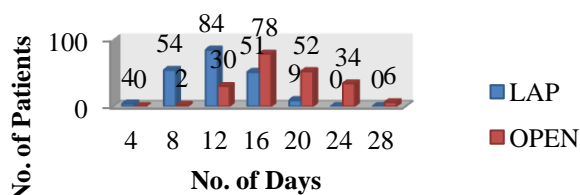
Figure 8: Ability to perform routine work

**TIME TO RETURN TO ROUTINE WORK**

70.29% (142 patients) in the Lap group resumed work on the 12th day whereas

54.45% (110 patients) in the Open group resumed work on the 16<sup>th</sup> day.

**TIME TO RETURN TO ROUTINE WORK**



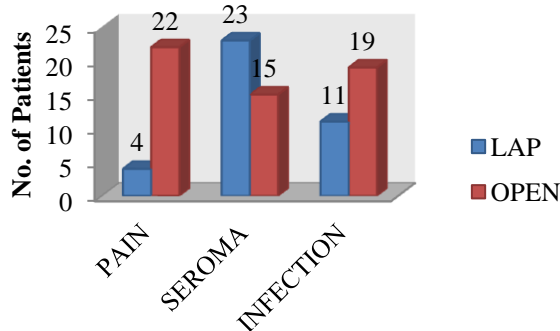
**Figure 9:** Time to return to work

**COMPLICATIONS**

Seroma was found more in the laparoscopic group 11.36% (23 patients) than in the Open group 7.42% (15 patients)

Wound infection and Orchitis was found to be higher in the open group 9.40% (19 patients) than in the Lap group 5.4% (11 patients)

**COMPLICATIONS**



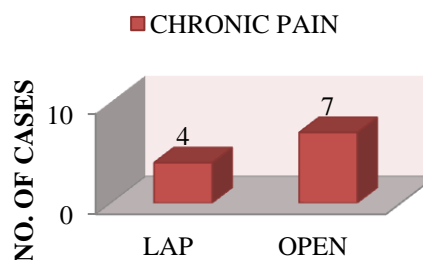
**Figure 10:** Complications

**CHRONIC PAIN**

Chronic pain is defined as pain or discomfort lasting for more than 3 months post operatively. 7 patients (3.46%) in the open group and 4 patients

(1.98%) in the Laparoscopic group suffered from chronic pain.

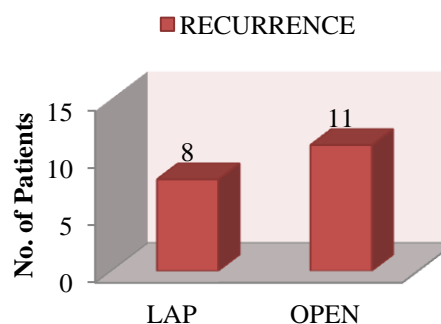
Methods used to assess chronic pain were Visual analogue scale (VAS) Verbal rating scale, Numerical rating scale, Inguinal pain questionnaire (IPQ).



**Figure 11:** Chronic pain

**RECURRENCE**

Recurrence was slightly more in the **Open group 5.40%** (11 patients) than in the **Laparoscopic group 3.96%** (8 patients) by the 2nd year of follow up.



**Figure 12:** Recurrence

**HOSPITAL COST**

Though the operative costs were **higher** following Lap Inguinal Hernia repair there was a decrease in overall hospital cost. Shorter hospital stay and

using reusable equipment reduced overall cost of procedure.

**Table 2:** Hospital cost lap vs open repair

Sl. No	Parameters	Lap (Rs.)	Open (Rs)
1.	Mesh	1500	1500
2.	Suture / Fixation device	5000	1500
3.	Operation Theatre charges	5000	2500
4.	Hospital Stay (750 per day)	1500	3000
5.	Medicines (ward)	1500	3000
6.	OT Medicine (surgical/anaesthesia)	4000	3000
7.	Fees – Surgeon/Anaesthetist	7500 2500	7500 2500
Total (Rupees)		28500	24500

**COST - BENEFIT RATIO**

**Table 3:** Cost benefit Analysis

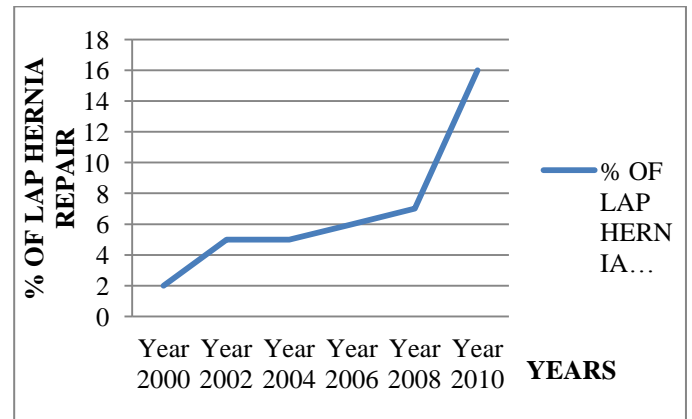
Cost	LAP	OPEN	Difference (Lap-Open)	p Value
Hospital cost	28500	24500	4000	<.001
Community cost(sick leave)	2400	4000	1600	<.001
Total cost	30900	28500	2400	<.001

Laparoscopic repair was found 7% to 9% costlier than Open repair.

**DISCUSSION**

Inguinal hernia repair has undergone an Evolution over 200 years and in the past 2 decades a Revolution.[1]

**LAP HERNIA REPAIR INCIDENCE**

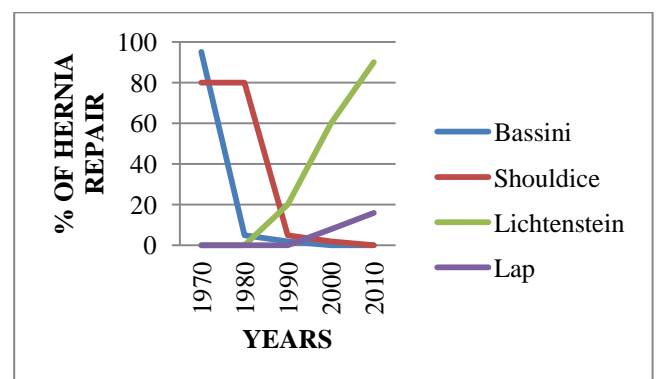


**Figure 13:** Incidence of lap hernia repair

Today only 16.38% primary and 22.48% recurrent inguinal hernias have been repaired laparoscopically. [1][2]

The uptake of laparoscopic inguinal hernia repair will reach 25% with an upper limit of 40%.

**CHANGING TRENDS IN HERNIA REPAIR**



**Figure 14:** Changing trends

## OPERATING TIME

Operating time of hernia repair varies considerably between surgeons and also between surgical centres and reduces with experience.

The operative time to perform unilateral primary inguinal repair has frequently been reported as longer for laparoscopic repair when compared to open repair.

FIRST AUTHOR	LAPAROSCOPIC	OPEN
McCormack <sup>22</sup>	14.8 minute longer (p<0.0001)	
Memon <sup>8</sup>	15.2 min longer (p<0.0001)	
MRC trial group <sup>5</sup>	58.4 minute	43.3 minute
Bringman <sup>9</sup>	50 minute	45 minute
Picchio <sup>23</sup>	49.6 minute	33.9 minute
Chung <sup>24</sup>	Laparoscopic longer in all groups	
Wright <sup>25</sup>	58 minutes	45 minutes
Our Study	75 – 120 minutes	45-90 minutes

Our results are supported by most published reports that consistently state that laparoscopic hernia repair takes longer to perform.<sup>[2][5]</sup>

## LEARNING CURVE

Learning curve has been defined as the number of operations required for the stabilization of operating times and complication rates for a surgeon embracing a new procedure (Voitk AJ, 1998).<sup>[4][5][8]</sup>

There are three phases of learning curve

- TRAINING PHASE
- INTERMEDIATE PHASE
- WELL DEVELOPED PHASE

Human performance of activities typically shows improvement when the activities are done on a repetitive basis. The time required to perform a task decreases with increasing repetitions. *Learning curves* summarise this phenomenon.

The proficiency of the surgeon in laparoscopy and the surgeons age play a role in reducing the learning curve.

Learning curve is **30-50 cases** for attaining **technical proficiency** and **250 cases** for **preventing recurrence**.

Learning curve seems to be **shorter for younger surgeons** than for senior surgeons above 45 years.

**Learning curve period** for a surgeon performing 1-2 laparoscopic hernia repairs per week will be **2-3 years**.

In USA 10 Laparoscopic and 50 Open hernia repairs have to be done independently during surgical residency.

Based on our study, we conclude that most unilateral Totally Extra peritoneal repair can be accomplished within one hour after a surgeon has attained sufficient proficiency in surgical skills and knowledge i.e. after 80 procedures. Laparoscopic Totally Extraperitoneal hernia repair carries a low morbidity and conversion rate even during the learning process.



## ANTIBIOTIC PROPHYLAXIS

Hernia repair is one of the so-called “clean operations”. Many surgeons, however, use antibiotics, especially in the mesh repair era, without strong evidence to support this policy.

Cochrane meta-analysis in 2005 concluded that antibiotic prophylaxis for elective inguinal hernia repair cannot be firmly recommended or discarded" and “further studies are needed, particularly for use in mesh repair”.

A single dose of antibiotic at induction reduces infection rate by 50% (Sarabria et al). Antibiotic prophylaxis is not routinely indicated in elective Open / Lap hernia repair. <sup>[15]</sup>

Antibiotic prophylaxis should be considered in

- Advanced age
- Recurrent hernia.
- Immuno-suppressive conditions.
- Long duration of surgery.
- Use of drainage tube.

In our study all patients received a single dose of Injection Cefatoxime 1gm at the time of induction of anaesthesia.

## ACUTE POST OPERATIVE PAIN

Acute post operative pain is considered to reflect the amount of surgical trauma caused by an operative procedure.

Pain is a cardinal symptom of inflammation. Mesh-induced inflammatory response is largely

local in nature and lacks substantial systemic inflammatory features.

Postoperative pain has adverse implications on morbidity, healthcare costs, and quality of life and has to be evaluated in a procedure and technique-specific manner. <sup>[14]</sup>

In conclusion, age and gender are the most significant predictive factors of pain after Totally extraperitoneal inguinal hernioplasty. Prosthetic stapling is also associated with a significantly higher pain score on coughing. Adjustment of the pain relief regimen in accordance with the patient’s age and gender may help to optimize postoperative analgesia and enhance recovery.

In our study, Post operative pain was greatest on the 1st day in the open group - 13.86% in comparison to - 7.92% in the Laparoscopic group. Younger age group and female patients were found to have more pain compared to the rest.

## RETURN TO ROUTINE ACTIVITIES

Immediate resumption of normal activities is recommended after hernia surgery as long as the patient can carry out the activity comfortably (Iles JD, dsz1972). Normal activity has not been shown to increase the risk of hernia recurrence or jeopardize wound healing (Bourke et al., 1978; Barwell NJ, 1981). A hernia recurrence rate of less than 1% was reported in over 2,000 patients who resumed normal activity immediately after operation (Lichtenstein et al., 1976). <sup>[1][7][10]</sup>

The time to resumption of daily activities was significantly shorter among those undergoing laparoscopic repair (2-3 days) than among those

undergoing open repair (5 days). More patients in the laparoscopic group were able to perform specific activities (e.g., climbing stairs and engaging in vigorous activities, such as shoveling or weight lifting) at two weeks than in the open group. At three months of follow-up, however, differences in activity level between the groups were not apparent. (Leigh Neumayer, M.D., Anita Giobbie-Hurder, M.S., Olga Jonasson, M.D., Robert Fitzgibbons, Jr., M.D., Dorothy Dunlop, Ph.D., James Gibbs, Ph.D., N Engl J Med 2004; 350:1819-1827 April 29, 2004)

Bourke et al., 1981; Taylor et al., 1983). In the past 2 decades, the reported convalescence period following inguinal hernia repair has been decreasing (Rider et al., 1993; Robertson et al., 1993).

Most of patients returned to work in 3 weeks as stated by reports in United Kingdom (Rider et al., 1993; Robertson et al., 1993).

AUTHOR	LAP (MESH)	OPEN (MESH)	Column2
Mc Cormack	290/2102	459/2399	p<0.0001
MRC trial	28.70%	36.70%	p=0.018
Bringman	VAS less for lap		p=0.015
Wright(no of pain medications)	2	2.5	p=0.008
Neumayer	VAS less for lap		
Stanley (present Study)	7.92%	13.86%	

In our study at Stanley Hospital patients who underwent open hernia repair returned to routine activity on the 5<sup>th</sup> day while those who underwent Laparoscopic TEP repair returned to routine activity on the 2<sup>nd</sup> day.

### RETURN TO WORK

In 1970s and 1980s, patients often took two to three months off work after inguinal hernia repair (Welsh et al., 1978; Semmence et al., 1980;

Fear of hernia recurrence is the main concern of patients with respect to early return to work (Kerry RL, 1971).

Lichtenstein et al. (1970) showed that sutured wound maintained a 70% strength of the intact tissue during the first two months following hernia repair.

Consistent with previous findings, **heavy-duty workers returned to work significantly later**

than sedentary workers (Rider et al., 1993; Thorup et al., 1994).

It was a misconception of the primary surgeon, as well as patients, that early activity might adversely affect recovery and increase risk of hernia recurrence. **Education of patients and primary health care physicians** concerning the appropriate time of return to work are therefore essential (Rider et al., 1993; Stock SE, 1993). Patients should be advised and encouraged to return to work once they feel comfortable (Taylor et al., 1983).

The decision of returning to work was mainly based on patients' own assessment of their physical condition. As prolonged sick leave may result in loss of income or even the job, **economic consideration is a major impetus in returning to work early.**

The open group returned to work at 11.5 days and to full activity at 26.7 days. The laparoscopic TEP group returned to work at 6.4 days and to full activity at 14.2 days ( $p < 0.001$  for both data). There was no statistically significant difference in the use of pain medication. The TEP group reported better functional status at 2 weeks than the open group. At 6 weeks, this difference was no longer statistically significant. This finding was universal among the reported trials and was confirmed by the analysis by **Memon et al.**

Another significant benefit of Totally Extra Peritoneal hernioplasty was an **earlier return to work** (Andersson et al., 2003; Bozuk et al., 2003; Bringman et al., 2003; Gokalp et al., 2003; Lal et al., 2003). This translates into a significant

economic savings to the society because of fewer working days lost (Heikkinen et al., 1998; Lal et al., 2003). Liem et al. (1997) proved that patients who underwent laparoscopic hernia repairs regained their physical performance faster and returned to full activity earlier than those after conventional hernia repairs.

**In our study, at Stanley Hospital** the open group returned to work after 16 days. The Totally Extra Peritoneal hernioplasty group returned to work by the 12<sup>th</sup> day. The TEP group reported better functional status at 2 weeks than the open group. At 6 weeks, this difference was no longer statistically significant.

## COMPLICATIONS

### SEROMA

**Seroma** is a collection of serum in a surgical wound. Its **Incidence** is 2.4% for Open Hernia Repair and 5.7% for Laparoscopic Hernia Repair.

It contains leukocytes and may also contain some red blood cells. The size of the collection relates to the amount of dissection done between tissue planes leading to increased interruption of lymphatics and blood vessels and the amount of dead space remaining in the wound. Greater frequency following mesh repair is due to both tissue trauma and foreign body reaction. Tissue trauma causes a reabsorption imbalance of fluids that escapes from damaged venous and lymphatic capillaries. Seroma is found to occur **more with laparoscopic repairs (12.2 %)** than after lichtenstein's repair (8.9 %) and the overall

incidence being in the range of **5-25%** (*Hernia surgery -Palanivelu*).

Formation of seroma in the wounds of patients after hernia repair is rather common and typically presents on the **third or fourth post operative day**. They are especially seen after repair of a large indirect hernia .Wound appears raised but not inflamed.

The presence of seroma itself is not necessarily a complication but it is regularly associated with postoperative pain and patient discomfort and, in particular, **mimics a recurrence**.

#### SEROMA ( COCHRANE REVIEW )

	LAP (TEP)	OPEN (MESH)	ODDS RATIO
Oulu	1/22	0/23	7.73
Madrid	1/39	2/25	0.3
Quebec	0/136	0/117	0
Denizlii	2/32	1/32	1.99

#### STEPS TO REDUCE / PREVENT SEROMA FORMATION

1. Minimizing dissection of the hernia sac from the cord structures,
2. Fixing the direct sac and inverting and tacking the lax transversalis fascia to the pubic bone.
3. Fenestrating the transversalis fascia in a direct hernia.
4. Putting a drain if there is excessive bleeding or after extensive dissection.

Most seromas resolve spontaneously over 4-8 weeks though in some cases it may persist even for months. Usually requires only conservative management.

Rarely Persistent / Symptomatic seromas may require ? aspiration or even surgical intervention is necessary.

**In our study** seroma was 11.39% in the Laparoscopic group and 7.43% in the Open group.

#### CHRONIC PAIN

Chronic pain is defined as pain which persists beyond 3 months following hernia repair.

**“Chronic pain is a disease by itself”** (Sternbach) whereas Acute pain is a symptom of disease. Chronic pain may be as a result of the healing process gone awry. It may be persistent and unrelenting and conveys no benefit to the individual who experiences it.

Chronic pain has been quoted in **0.5–6.7%** cases of inguinal hernia repair. Severe chronic pain has been reported in 3% of cases.<sup>[11]</sup>

Race, ethnicity, age, sex and psychological factors which are known to influence all types of pain also play a role in chronic pain of inguinal hernia.

**Table 4:** Predictive Factors For Chronic Pain

Preoperative Factors	Intra-operative Factors	Post operative factors
Pain, moderate to severe, lasting more than 1 month	Surgical approach with risk of nerve damage	Pain (acute, moderate to severe)
Repeat surgery		Radiation therapy to area
Psychologic vulnerability		Neurotoxic chemotherapy
Workers' compensation		Depression
		Psychologic vulnerability
		Neuroticism
		Anxiety

**Table 5:** comparison of chronic pain among open and lap mesh repair

AUTHOR	LAPAROSCOPY(%)	OPEN (%)
MRC GROUP	28.7	36.7
NEUMAYER et al	9.8	14.3
WRIGHT	1.3	8
DOECK	2	10
STANLEY ( present study)	1.98	3.46

**MAST COMPLEX:**

**Mesh Aponeurosis Scar Tissue** complex is formed due to host inflammatory response to the mesh material. [12]

MAST complex formation is the **same** for both heavy weight and light weight meshes. MAST complex response is largely **local in nature** and lacks substantial systemic inflammatory features.

**Persistence of the inflammatory response** after MAST complex formation results in entrapment of the surrounding structures viz nerves, vas and testicular vessels leading onto chronic pain.

Currently, pain is considered the most important complication. Three months postoperatively 20% of patients still have pain and 12% experience pain that limits daily activity.

One year postoperatively 1-3% still experience invalidating pain. The commonest types of pain are somatic and neuropathic. The cause of pain is sometimes difficult to determine and therefore difficult to treat.

**In our study** at Govt. Stanley Hospital chronic pain was 1.98% in the Laparoscopic group and 3.46% in the open group.

**TREATMENT OF CHRONIC PAIN**

**Preventive measures adopted** during surgery is the best form of treatment: [12]

1. Careful surgical technique / dissection.
2. Identification of all inguinal nerves during surgery and their preservation.

3. Prophylactic ilio-inguinal nerve resection does not reduce the risk of chronic pain after hernia surgery – European Hernia Society.

#### **Non surgical treatment:**

- Expectant management: Reassurance / Analgesics.

#### **Surgical treatment:**

- Neurectomy (1-3 nerves)
- Mesh removal.

In conclusion, the prevalence of chronic groin pain is low in patients following laparoscopic Totally Extra Peritoneal repair. The pain is mostly self-limiting without associated sensory symptoms, and usually confers negligible impact on functional activities. The long-term outcome of TEP appears promising.

#### **RECURRENCE**

The most important endpoint of hernia surgery is recurrence.

It requires a proper and thorough knowledge of anatomy and a thorough technique of repair to help keep the recurrence in endoscopic repair to a minimum. Recurrence rates are low with the use of mesh and not significantly different between open or laparoscopic techniques.

Recurrence rates after Totally Extra Peritoneal and Lichtenstein hernia repairs showed an overall low rate. There was a higher cumulative recurrence rate in the Totally Extra Peritoneal group during the initial 5 years. Further analysis, however,

revealed that this was probably due to incorrect surgical technique, which seems to be of greater importance for the laparoscopic than for the open technique. Rate of recurrence decreases as experience increases.

The incidence of recurrence rate was 0.35%. The recurrence rate for the first 200 repairs was 2.5%, but it decreased to 0.47% for the subsequent 1,254 hernia repairs. [Surg Endosc. 2009 Mar;23(3):482-6. Epub 2008 Sep 23. Laparoscopic totally extraperitoneal inguinal hernia repair: lessons learned from 3,100 hernia repairs over 15 years. Dulucq JL, Wintringer P, Mahajna A.]

#### **Causes of recurrence :**

#### **Evolution of technique :**

- Inexperience (learning curve)
- Incomplete dissection
- Missed hernia
- Missed lipoma (herniated preperitoneal fat) of cord or of direct hernia
- Inadequate reduction of direct hernia sac
- Inadequate dissection of proximal indirect sac from cord
- Rolling of mesh

#### **Mesh size and configuration**

- Too small
- Inadequate overlap of defect

- Migration
- Configuration (slit or keyhole)

- Issue of mesh fixation versus nonfixation

#### Mesh fixation

- Mesh poorly fixed laterally
- Mesh poorly fixed medially
- Clips pulled through
- Mesh never stapled

#### Mesh displacement

- Hematoma
- Seroma
- Migration
- Rolling of mesh
- Shrinkage

**Table 6:** Comparison Of Recurrence Rates In Various Studies

AUTHOR	LAP	OPEN
VA TRIAL(2004)		
Recurrence (2 yrs)	10.10%	4.10%
MRC GROUP		
Recurrence (1 yr)	1.90%	0
Recurrence (2 yrs)	2%	2%
CHAMPAULT	6%	2%
NEUMAYER	10.10%	4.90%
NICE (2004)	2.30%	1.30%
<b>STANLEY (present study) (2 yrs )</b>	<b>3.96%</b>	<b>5.40%</b>

In **our study** at Stanley Hospital recurrence at 2 yrs follow up was found to be 5.40 % in open group and 3.96 %. in the laparoscopic group.

Despite the correct and stable mesh position, there is still a limited risk of a late sliding of the retroperitoneal fat under/ in front of the mesh into the enlarged inner ring.

It is advised to avoid slitting of the mesh and increase its size to reduce the recurrence rate (Leibl *et al*). Generous dissection of preperitoneal space is required to eliminate potential herniation through the slit or strangulation of the cord structures completely and reduces the risk of genitofemoral neuropathy also.

## COST EFFECTIVENESS

There is an estimated loss of 10 million working days each year at some enormous cost due to recuperation following hernia surgery. An early return to work would have significant benefit to the society in general.<sup>[20][22]</sup>

The earlier return to work following laparoscopic hernioplasty should be an incentive to use this technique by both employers and healthcare commissioners and providers. Laparoscopic repair is more expensive than conventional repairs from a hospital perspective, but from a societal point of view 75 % of these extra costs can be offset.

Berggren et al showed that hospital costs for laparoscopic cholecystectomy were more expensive, but for the society it was more cost saving. The same also holds true for laparoscopic hernia repair.

In our study at Govt. Stanley Hospital the cost difference between Laparoscopic repair and Open repair was only 2400/- rupees.

It is suggested that laparoscopic hernia repair is more expensive to perform than open hernia repair. The primary reason for this relates to the cost of extra equipment used for the laparoscopic repair with secondary costs attributed to perceived increases in operating time for the laparoscopic procedure. From the Indian perspective, various factors come into play when analyzing the cost implications of laparoscopic repair of inguinal hernia. In most hospitals, except the larger corporate ones, the theatre time is charged on a per-case basis rather than by the hour. Thus,

increase in the operating time, particularly during the learning curve, does not necessarily mean additional expense for the patient. If the surgeon were to adopt cost-containment strategies such as use of reusable laparoscopic instruments [which is more or less the norm in India] as against disposable ones, use of indigenous balloons devices rather than commercially available ones, sparing use of fixation devices and reliance on sutures for fixation of the mesh, the cost of the laparoscopic hernia repair should be comparable to the open repair. It is likely that many surgeons are already practicing these strategies and passing on the benefits of laparoscopic repair to their patients. The awareness of and experience in how to deal with learning curve effects is increasing.

There is appreciably better quality of life after laparoscopic repair, though this concerns very short term effects but still patients are less disabled and function better both physically and socially. The fact that patients after laparoscopic repair are able to return to work earlier is not included in most of the large scale studies, but when it is done the cost difference between conventional and laparoscopic repairs will become even less.

A better quality of life in the recovery period and the possibility of replacing parts of the disposable kit with reusable instruments may result in the laparoscopic repair becoming dominantly better – that is, less expensive and more effective from a societal perspective.



**SUMMARY**

1. The **mean age group** of patients operated was  $41 \pm 3.5$  in the Laparoscopic group and  $42 \pm 3.3$  in the Open group.

2. The **operating time** of most of the open cases was within 45 - 90 minutes while in the Laparoscopic group it was 75-120 minutes. Operating time was found higher in the Laparoscopic group than in the Open group.

3. **Learning curve** was **42 patients** in the Laparoscopic group and 5 patients in the Open group.

4. **Post operative pain** was found lesser in the Laparoscopic group in comparison to the Open group. The pain was less in the Laparoscopic group but gradually decreased by the second week in the Open group. Patients in both groups became equal to all pain assessments during the 3rd month follow-up.

Laparoscopic repair produced less tissue trauma than open repair and therefore there was less acute phase inflammatory response leading onto less pain and earlier recovery in the Lap group in comparison to the Open group.

4. The average **hospital stay** was about 1.5 - 2 days in the Laparoscopic group and 2-4 days in the Open group.

5. **Ability to perform day to day activities** was found to be earlier in Laparoscopic repair than in Open repair 2-3 days in Lap repair and 5-8 days in Open repair.

6. **Returning to work** was earlier with patients in the Laparoscopic group than those in the Open group. Patients in the **Laparoscopic group** resumed work on the **12th day** whereas patients in the **Open group** resumed work on the **16th day**.

7. **Chronic pain** was found to be more in the Open group than in Laparoscopic group.

8. **Recurrence** was found to be slightly higher in the Open group than in the Laparoscopic group.

9. The **cost difference** between Laparoscopic repair and Open repair was only 2400/- rupees in this study.

**Table 7:** Impact of the study

No	Parameters	Lap Repair	Open Repair
1.	Anaesthetic	General / Regional	Local / Regional
2.	Operative Time	Longer	Shorter
3.	Learning Curve	Longer (42 patients)	Short (6 patients)
4	Post-op Pain	Less	Mild to moderate
5.	Return to routine activities	2-3 Days	5-8 days
6.	Return to work	1-2 weeks	3-4 weeks
7	Complication	Seroma, Epigastric vessel Injury	Wound infection, Orchitis
8	Chronic Pain	Less	More
9	Recurrence	Less Occurred during early part of learning curve	Slightly more
10.	Cost (Rupees)	30,900	28,500

## CONCLUSION

The final word on hernia will probably never be written. In collecting, assimilating and distilling the wisdom of today we must provide a base from which further advances may be made. --

*Sir John Bruce --*

The optimal surgical approach to inguinal hernia remains controversial despite 200 years of experience and the search for the gold standard of repair continues.

*- Surgical clinics of North America – Oct 2008*

Two revolutions have taken place in hernia surgery in the previous 2 decades, the first one being tension free hernia repair and the second being Laparoscopic hernia repair.

*--Dulucq 2009*

The study clearly favours Laparoscopic Totally Extraperitoneal Repair over Open Repair with regards to post operative pain, resumption of routine physical activities and return to work.

The frequency of chronic pain was found to be slightly lower in the Laparoscopic Totally Extraperitoneal Repair in comparison to Lichtenstein Repair in this study.

The incidence of recurrent hernia was slightly lower in the Laparoscopic Totally Extraperitoneal Repair in comparison to Lichtenstein Repair in this study.

Laparoscopic equipment was already existent in the department and use of reusable instruments brought down the cost factor in Laparoscopic

repair considerably. Laparoscopic Totally Extraperitoneal Repair was found to be only 7% to 9% costlier than Lichtenstein Repair in this study.

Open repair can be performed by all surgeons under any anaesthesia, as day care procedure. There is no steep learning curve and working cost is less. Increased post operative pain and more time to return to routine activities are the disadvantages.

Laparoscopic repair of inguinal hernia is a safe, feasible and effective technique with less post operative pain, early return to routine activities; low recurrence rates, low post operative morbidity and low rates of wound and mesh infection in experienced hands. Steep learning curve and slightly increased working cost are the disadvantages which have been overcome today by using re-usable equipment and mastering endo-pelvic anatomy.

Laparoscopic repair of inguinal hernia is nearly 20 years old and has come to stay. All conceivable groin hernias –Direct, Indirect & Femoral hernias can be treated simultaneously in laparoscopic repair. It is an effective alternative to open repair based on this study. Our mindset has to be tuned to accept Laparoscopic Totally Extra Peritoneal repair of inguinal hernia which is sure to become the gold-standard in the days to come!

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