

Original Research Article

**Total Extraperitoneal (TEP) Repair for Inguinal Hernias: Our Initial Experience**Dr. Krushna kumar V. Kesan<sup>1</sup>, Dr. Arvind K. Ade<sup>2</sup>, Dr. Raj Gajbhiye<sup>3</sup>, Dr. Pravin Shekokar<sup>4</sup><sup>1</sup>Assistant Professor, Dept. Of Surgery, Government Medical College, Akola, M.S.<sup>2</sup>Professor and Head, Dept. Of Surgery, Government Medical College, Akola, M.S.<sup>3</sup>Professor and Head, Dept. Of Surgery, Indira Gandhi Government Medical College, Nagpur<sup>4</sup>Assistant Professor, Dept. Of Physiology, Government Medical College, Akola, M.S.**\*Corresponding author**

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**Abstract:** Laparoscopic surgery has led to many changes in the management of surgical patients. Laparoscopic herniorrhaphy has shown definite benefits over the open technique. The objective of this study is to study the feasibility, safety and efficacy of laparoscopic total extraperitoneal repair (TEP) and also to plot a learning curve for the procedure. The study of Laparoscopic (TEP) management of inguinal hernia was carried out at tertiary care hospital in Maharashtra. In all 86 patients between 10- 80 years of age with total 99 hernias (13 bilateral hernias) were subjected to laparoscopic repair. Laparoscopic TEP caused significantly less pain. Wound infection rate was minimal (6.98%) in the form of Erythema/ induration, stitch abscess, subcutaneous abscess. There was no life threatening major complication in any of patient. This has been mainly possible due to minimal invasive nature of laparoscopic surgery. As a result there is decrease in the post-operative pain and hence early ambulation of patients as compared to open surgery. Laparoscopic TEP is a safe and effective method of hernia repair but with a long learning curve and requires high technical skill.

**Keywords:** Inguinal Hernia, Laparoscopic hernia repair, Total Extraperitoneal Repair

**INTRODUCTION:**

Inguinal hernia results from a defect in the muscles through which the peritoneum protrudes, forming the sac. For inguinal hernia operation is treatment of choice [1]. The treatment of this common problem has seen an evolution from the pure tissue repairs to the prosthetic repairs and in the recent past to laparoscopic repair.

Laparoscopic herniorrhaphy has shown definite benefits over the open technique [2]. Several studies have shown the benefit of the laparoscopic hernioplasty over open hernioplasty in terms of less postoperative pain and morbidity, less wound complications, less post operative pain, early resumption of activity and work and better cosmetic results [3-5]. There are several distracting points also longer operative time, longer learning curve, higher hospital cost, a potential for serious life threatening accidents as compared with open surgery. However it continues to be the procedure with limited long term follow up and analysis.

Laparoscopic hernia repair is an advanced laparoscopic procedure [6, 7]. Currently, the two most popular laparoscopic techniques are TAPP and TEP. The ardent critique of the TAPP procedure is that it is an intra-abdominal procedure with significant potential morbidity. On the other hand the TEP procedure avoids intra-abdominal access. The morbidity rate of both these laparoscopic repairs was minimal and/or similar to other open repairs with comparable early recurrence rate.

Laparoscopic Total Extraperitoneal repair (TEP) is sophisticated technique and is technically more difficult to perform and is associated with longer learning curve. In experienced hands, the recurrence rate for TEP is less than 1% [1]. The objective is to study the feasibility, safety and efficacy of laparoscopic total extraperitoneal repair (TEP) and also to plot a learning curve for the procedure.

**AIMS AND OBJECTIVES:**

To study total extraperitoneal inguinal hernia repair (TEP) with regard to following parameters:-

1. Feasibility of the procedure (Failure or success of preplanned procedure).
2. Feasibility of the procedure in bilateral and recurrent hernia.
3. Operating time.
4. Intra-operative and postoperative complications including recurrence.
5. Postoperative recovery.
6. Learning curve.

#### **MATERIALS AND METHODS:**

Present study was carried out at the department of surgery, in tertiary care hospital of Maharashtra. The study extended over a period of 2 years. Design of the study was prospective, open labeled, interventional, randomized study.

#### **SELECTION OF PATIENT**

##### **Inclusion criteria**

- Inguinal hernias in age group 10-80 years in both genders undergoing elective inguinal hernia surgery, who can tolerate general anesthesia.
- All types of inguinal hernias including direct and indirect, unilateral and bilateral, complete and incomplete hernias.
- Recurrent inguinal hernias

##### **Exclusion criteria**

- Irreducible inguinal hernias and Obstructed and strangulated inguinal hernias
- Have an incarcerated hernia.
- Cannot tolerate general anesthesia
- Have bleeding disorders such as hemophilia or idiopathic thrombocytopenic purpura and those who are taking medicines like anti-coagulants such as Warfarin.
- Have had many abdominal surgeries
- Have severe lung diseases such as emphysema; the carbon dioxide used to inflate the abdomen may interfere with the breathing.
- Are pregnant and those who are extremely obese.

All patients were clinically evaluated as per care Performa and underwent routine investigations for anesthetic fitness on outpatient dept basis. The patient was explained about the disease process and its treatment. The patient was explained the various available modalities of treatment with their potential benefits and material risks and also explained about the possibility of conversion to open surgery if there are technical difficulties or in the interest of the patients' safety and well-being.

The patient was kept fasting overnight. Operative area was shaved prepared. An antibiotic prophylaxis consisting of intravenous doses of inj. ceftriaxone 1gm

was administered before anesthesia. After induction, complete reduction of the contents of the hernial sac by manual manipulation was performed. General anesthesia with good muscle relaxation was given to all the patients undergoing TEP.

#### **Equipment and Instruments:**

The core equipment required for laparoscopic procedures is the endo vision system, which consists of the telescope, endo vision camera, light sources, fibreoptic cable and video monitor. The other equipments used are CO2 insufflator, Suction-irrigation system, energy sources (cautery), trocars and cannulas.

All the instruments were used as per the specification given in the manual. Hopkins rod-lens telescopes are reusable and consist of an eyepiece in a jacket tube made of a non-corrosive material which encloses the rod-lens system, and an inbuilt fiberoptic light carrier with a connection for a fiberoptic light cable. The telescopes have colour cods that correspond to the angle of vision.

#### **Operative Techniques:**

During operative procedure initially dissecting balloon for creating extraperitoneal space was used in 10 cases (11.63%) and in later part in 76 cases (88.37%) extraperitoneal space was created directly with help of telescope to reduce the operative time.

#### **Port placement:**

A 10mm trocar (blunt tip) is introduced into the preperitoneal tunnel through the infraumbilical incision and is secured with stay sutures. Insufflation is begun with the pressure setting at 12 mmHg. A 10 mm 0 degree telescope mounted on the camera head is introduced through the sub umbilical port. Next, two working ports are placed in the preperitoneal space.

#### **Dissection of the extraperitoneal space:**

Dissection of the extraperitoneal space begins in the midline and extends inferiorly creating a shelf extending 2-3 cm in the retropubic space. The extraperitoneal space is now fully prepared for mesh insertion and fixation.

#### **Mesh preparation and fixation**

In present study, polypropylene mesh (prolene) of sizes 12x15 cm and 15x15 cm was used on each side.

#### **Wound Closure**

After removal of the 10mm trocar from the sub umbilical port, the two stay sutures on the anterior rectus sheath are tied to each other, ensuring complete sheath closure. The skin of all 3 ports is closed. Port sites are covered with wash proof dressings.

**Assessment of Postoperative Pain and Analgesic Requirement:**

Postoperative pain was recorded on visual analogue score (VAS) from 0 – 100 (0 – no pain to 10 – worst pain i.e. imaginable pain) at 0 min, 6 hours, 12 hours and 24 hours after surgery. Intramuscular diclofenac was given to all patients on first postoperative day, and then oral analgesics in form of diclofenac sodium 50mg tablet 12 hourly were administered 5 to 7 days postoperatively.

**Discharge:**

Patients were discharged on first or second postoperative day except in case of any complication or recurrence. The patients were clinically evaluated for any mesh displacement before discharge. Sutures were removed between 7-10 days. The wounds were checked and graded accordingly.

**Period of follow-up:**

Patients were followed up for a period ranging from the first three months to two years. Patients were evaluated on: 1<sup>st</sup> week, 2<sup>nd</sup> week, 1month, 2 month, 3 month.

**Management of Recurrence**

Patients where recurrence was suspected both immediate and early were kept under close supervision, if found they were operated by standard open anterior Lichtenstein’s repair.

**OBSERVATION AND RESULTS:**

The study of Laparoscopic (TEP) management of inguinal hernia was carried out at tertiary care hospital in Maharashtra. In all 86 patients were included in the study, in which total 99 TEP procedures were performed (out of 86 patients 13 patients were undergone bilateral TEP). There was no mortality or surgery related major complications in any of the patient.

Patients between ages 10 years to 80 years were included in the study with 84 males and 2 females. Minimum age of patient included in the study was 18 years and maximum was 79 years. Mean age of the patients included in the study was 42.17 ± 13.28.

**Table 1: Side of hernia**

S.No.	Side	No. of cases (n = 86)	Percentage (%)
1	Right	42	48.84
2	Left	31	36.05
3	Bilateral	13	15.11
		86	100

**Table 2: Type of hernia**

Sr. No.	Type of Hernia	Right (n = 42)	Left (n = 31)	Bilateral (n = 13)	Total (n = 86)
1	Indirect	31 (36.45%)	21 (24.42%)	5 (5.81%)	57 (66.28%)
2	Direct	9 (10.47%)	9 (10.47%)	8 (9.30%)	26 (30.23%)
3	Pantaloon (D + I)	2 (2.33%)	1 (1.16%)	-	3 (3.49%)

**Table 3: Type of hernia extent (i.e. individual indirect inguinal hernia)**

Sr. No.	Type	Right (n = 33)	Left (n = 22)	Bilateral (n = 5)	Total (n = 60)
1	Bubo nocele	19 (22.09%)	13 (15.12%)	3 (3.49%)	35 (40.70%)
2	Funicular	13 (15.12%)	7 (8.14%)	2 (2.33%)	22 (25.58%)
3	Complete	1 (1.16%)	2 (2.33%)	-	3 (3.49%)

**Table 4: Operating time**

Sr. No.	Procedure	Mean operating time (min)	Standard Deviation
1	Per Procedure	60.85	±12.18
2	Per side	52.86	±10.2

Operative time varied from 40min to 95min at various stages of learning curve. Mean operative time for each operative procedure was 60.85 ± 12.18 min,

but out of these 86 patients 13 were having bilateral hernia. Hence mean operative time for each TEP procedure was 52.86 min.

**Table 5: Operating time based on type and laterality**

Sr. No.	Side of hernia	Mean operative time (min)
1	Unilateral (D/I)	58.45
5	Bilateral	74.31

**Table 6: Ease of dissection**

Sr. No.	Ease of dissection	Number of cases (n = 86)	Percentage
1	Easy	53	61.63%
2	Some manipulation	29	33.72%
3	Extensive dissection	4	4.65%

During operative procedure dissection was easy in 53 cases (61.63%). Dissection was easy more with direct hernias than with indirect hernias. Some

manipulation was required in 29 cases (33.72%). Extensive dissection was required in 4 patients, 3 of which were having large sac.

**Table 7: Need for change of plan (conversion to open surgery)**

S.No.	Conversion to open	Number of cases (n = 86)	Percentage
1	Yes	7	8.14%
2	No	79	91.86%

Failure of preplanned procedure i.e. laparoscopic inguinal repair TEP was converted to open Lichtenstein repair in 7 patients, thus conversion rate

was 8.14%. Most of decisions for conversion to open surgery were taken in first half hour of surgery.

**Table 8: Cause for conversion**

S.No.	Cause for conversion	Number of cases	Percentage of total conversion
1	Excessive bleed	2	28.57%
2	Pneumoperitoneum	4	57.14%
3	Large sac of the hernia	1	14.29%
	Total	7	100%

**Table 9: Use of dissecting balloon / Telescope dissection**

S.No.	Creation of extraperitoneal space	Number of cases (n = 86)	Mean operating time
1	Balloon	10 (11.63%)	55.30
2	Telescope	76 (88.37%)	61.58

During operative procedure initially dissecting balloon for creating extraperitoneal space was used in 10 cases (11.63%) and in later part in 76 cases (88.37%)

extraperitoneal space was created directly with help of telescope to reduce the operative time.

**Table 10: Use of mesh fixation**

Sr. No.	Mesh fixation	Number of cases	Mean Operating Time (min)	Recurrence
1	Yes	74 (86.05%)	59.03	1
2	No	12 (13.95)	72.09	2

During operative procedure most of times mesh was fixed using Vicryl 2-0 using a prolene loop prepared on epidural or spinal needle. But mesh was not fixed in 12 cases (13.95%), out of which 2 patients had recurrence due to mesh displacement. Thus non fixation was responsible for recurrence hence subsequently

mesh was suture fixed in TEP procedure. Operative time was surprisingly less for non fixation group, this is because mesh was not fixed in early part of the study and at that time operating time was more (early part of learning curve), this led to this contradictory finding.

**Table 11: Postoperative pain (VAS score: 0 – best i.e. no pain, 10 - worst)**

Sr. No.	Time	VAS score (0 to 10)	SD
1	0 min	0.94	±0.86
2	6 hrs	2.03	±1.27
3	12 hrs	2.21	±1.42
4	24 hrs	3.49	±1.37

The post-operative pain following laparoscopic surgery was recorded on visual analog scale scoring from 0 – 10 i.e. no pain to imaginable pain, and VAS

score was recorded at 0 in, 6hr, 12hr and 24hrs. Laparoscopic TEP caused significantly less pain.

**Table 12: Intra-op complications**

S.No.	Complication	Number of cases (n = 86)	Percentage
1	Vascular injury	3	3.49%
2	Pneumoperitoneum	6	6.98%
3	Cord injury	0	-
4	Bowel injury	0	-
5	Bladder injury	0	-
6	Nil	77	89.53%

There was no major life threatening complication in any of the TEP surgery. The amount of bleeding occurring during the procedure was minimal in

most of cases and not a single patient required blood transfusion.

**Table 13: Post-operative complication**

Sr. No.	Complication	Number of cases (n = 86)	Percentage
1	Seroma / hematoma	8	9.30%
2	Urinary retention	5	5.81%
3	Neuralgias	3	3.49%
4	Testicular pain and swelling	1	1.16%
5	Mesh infection	0	-
6	Osteitis pubis	0	-
7	Nil	69	80.23%

Most common post-operative complication was seroma formation that occurred in 8 cases (9.30%), which was subsided within 7 to 10 days. 5 patients had urinary retention postoperatively, requiring

catheterization. Catheter was removed on next morning. 3 patients had neuralgia and 1 had testicular pain with swelling, all were managed conservatively. Not a single patient had mesh infection.

**Table 14: Post-operative recovery**

Sr. No.	Post operative recovery	Time taken (days)	Mean time taken (days)	SD
1	Post operative Stay	1 to 6	1.67	±0.91
2	Resumption to daily activities	1 to 7	2.86	±1.17
3	Resumption to work	8 to 24	13.06	±3.13

In our study out of 86 patients, maximum number of cases was discharged on second postoperative day. Post operative stay was more with cases that were converted to open surgery. Drain was

not kept in single patient. Maximum number of patients resumed their daily activities on 2 to 4 post operative day. Maximum number of patients resumed their work within 15 days of operation.

**Table 15: Postoperative wound infection**

Sr. No.	Grade of wound infection	Number of cases (n = 86)	Percentage
1	Erythema/ induration	2	2.33%
2	Stitch abscess	2	2.33%
3	Subcutaneous abscess	1	1.16%
4	Partial dehiscence	1	1.16%
5	Complete dehiscence	0	-
6	None	80	93.02%

The post-operative surgical site infection rate was found to be very less in case of TEP. There was no major wound related complication in any of patients.

Only 6 patients had minor wound related complications. They were treated with antibiotics.

**Table 16: Subjective cosmetic results**

S.No.	Subjective cosmetic results	Number of cases (n = 86)	Percentage
1	Does not matter	5	5.81%
2	Not satisfied	4	4.65%
3	Satisfied	77	89.53%

Subjective cosmetic results as accessed by the patients themselves showed that a very high number of patients (89.53%) were satisfied with the scars they got after laparoscopic TEP. Only 4 patients were not

satisfied with scars they got after the surgery and for 5 patients scar did not mattered. Thus in all patients of laparoscopic TEP were satisfied with scars they got after the surgery.

**Table 17: Objective cosmetic results**

Sr. No.	Objective cosmetic results	Number of cases (n = 86)	Percentage
1	Scars barely visible	57	66.28%
2	Small well healed scars	23	26.74%
3	Large well healed scars	4	4.65%
4	Complicated scars	2	2.33%

Out of 86 cases, scar of 57 patients (66.28%) was barely visible after 3 months. 23 patients (26.74%) were having small well healed scar. Large well healed and complicated scar was found only in 4 and 2 patients respectively. The main advantage was in case of bilateral hernias operated by laparoscopic TEP as they

can be done through the same number of port sites as for unilateral hernias. In open surgery group every bilateral case required a second incision for the other side. The scars of TEP were barely visible after 3 months. This resulted in increased patient satisfaction after TEP repair of bilateral hernias.

**Table 18: Late post-operative morbidity**

S.No.	Late post operative morbidity	Number of cases (n = 86)	Percentage
1	Chronic wound pain	6	6.98%
2	Paraesthesia	2	2.33%
3	Testicular atrophy	0	-
4	Hydrocele	0	-
5	Nil	78	90.70%

Chronic wound pain of some degree was present in 6 cases (6.08%) of laparoscopic TEP. In no patient this was unbearable, but mostly they complained of boring pain, a sensation of pricking in the groin.

Wound Paraesthesia as defined as hyper or hypo anesthesia in and around the scars was complained by 2 patients. Rest 90% of patients had not any late post-operative morbidity.

**Table 19: Recurrence**

S.No.	Recurrence	Number of cases	Percentage
1	Immediate	2	2.33%
2	Early	1	1.16%
3	Late	0	-
	Total	3	3.49%

Out of 86 patients that underwent laparoscopic TEP, only 3 patients had recurrence. 2 of them were diagnosed in immediate postoperative period, 1

recurrence was notified at third follow up at 1 month. Thus overall recurrence rate was 3.49%.

**Table 20: Cause for recurrence**

S.No.	Cause	Number of cases (n = 3)	Percentage of total recurrence
1	Mesh displacement	1	33.33%
2	Mesh size	1	33.33%
3	Mesh material	0	-
4	Technical experience	1	33.33%

**Table 21: Learning curve**

Sr. No.	Month	No. of cases (n)	Conversion to open (n)	Mean operating time (min)	Intraoperative complications (n)	Postoperative Complications (n)	Recurrence (n)
1	Oct 06	3	1	86.67	1	2	0
2	Nov 06	2	1	86.00	1	0	1
3	Dec 06	1	0	70.00	0	0	0
4	Jan 07	4	1	65.00	1	1	0
5	Feb 07	3	0	73.67	0	0	1
6	Mar 07	3	0	70.00	1	0	0
7	Apr 07	4	1	67.78	1	2	1
8	May 07	1	0	58.00	0	0	0
9	Jun 07	4	1	64.75	2	0	0
10	July 07	1	1	58.00	1	0	0
11	Aug 07	2	0	54.00	0	1	0



12	Sept 07	6	0	69.67	0	1	0
13	Oct 07	5	0	66.60	1	2	0
14	Nov 07	1	1	68.00	0	0	0
15	Dec 07	3	0	60.67	0	1	0
16	Jan 08	5	0	60.60	0	0	0
17	Feb 08	4	0	64.25	0	0	0
18	Mar 08	6	0	51.17	0	2	0
19	Apr 08	5	0	52.40	0	0	0
20	May 08	4	0	48.50	0	1	0
21	Jun 08	4	0	53.25	0	1	0
22	July 08	4	0	51.50	0	1	0
23	Aug 08	6	0	49.33	0	1	0
24	Sept 08	5	0	52.20	0	1	0

For surgical procedures, the learning curve may be defined by number of operations required for operating time and complications rates to become stable. In present study, we also mastered laparoscopic TEP with time. In initial 2 months mean operative time was around 86 min that gradually went on decreasing to attain a stationary level of around 50 min last 6 months. But it took around 40 surgeries and 14 months to attain that steady level. In the same fashion, there were 7 conversions in first 40 laparoscopic TEP performed in

first 14 months, after which conversion rate was zero in remaining 46 laparoscopic TEP.

In similar manner, intraoperative and postoperative complications were more in first 40 surgeries that gradually went on decreasing. All the 3 recurrences that occurred in our study were in, first 6 months in which in all 20 laparoscopic TEP were performed.

**Table 22: Results**

Sr. No.	Results	Number of cases (n = 86)	Percentage
1	Completely cured	77	89.53%
2	Recurrence	3	3.49%
3	Not reported for follow-up	6	6.98%
4	Mortality	0	-

Out of 86 cases, 77 cases were cured completely after laparoscopic TEP, 3 patients had recurrence (2 of them were treated with open Lichtenstein repair), 6 patients did not come for follow up. There was no mortality in the present study.

**DISCUSSION:**

In all 86 patients between 10- 80 years of age with total 99 hernias (13 bilateral hernias) were included in the study and was subjected to laparoscopic TEP who were fit for general anesthesia.

**Mean Operating time:**

Mean operating time was more (around 90 min) in early part of our study, decreased gradually as we mastered the technique and it was around 50 min in last 6 months of our study. The mean operating time of the study was 58.45 min and 74.31 min for unilateral and bilateral hernias respectively, and was comparable with that of previous studies in both unilateral and bilateral hernias.

Study	Year	No. of cases (n)	Mean Operating time (min)	
			Unilateral	Bilateral
Lal P <i>et al.</i> ;	2003	25	54	72
Colak <i>et al.</i> ;	2003	132	56.64	68.74
Sven Bring man <i>et al.</i> ;	2003	92	50.32	68.34
Body Anderson <i>et al.</i> ;	2003	81	61	82
Leigh Neumayer <i>et al.</i> ;	2004	989	57.32	70.21
Fumihiko Fujita <i>et al.</i> ;	2004	110	63.5	74.4
Present study	2008	86	58.45	74.31



**Need for change of plan:**

In our study in case of any difficulty we converted TEP into an open procedure. As with operating time, conversion rate was also following the same learning curve. 6 conversions occurring in first 26 operations

and only one conversion thereafter in remaining 60 operations (total 7 conversions and conversion rate of 8.14%). Conversion rate and causes for conversion were comparable and correlated with the previous certain studies are given in table.

**Need for change of plan (conversion to open surgery)**

Study	Year	No. of cases (n)	Total conversions (n)	Conversion rate (%)	Most common Cause for conversion
Lal P <i>et al.</i> ;	2003	61	11	18.3%	
Tahsin Colak <i>et al.</i> ;	2003	132	3	2.27%	pneumo peritonem
Thill V <i>et al.</i> ;	2007	848	9	1.1%	
Dulucq JL	2008	3100	36	1.2%	
Mazeh H <i>et al.</i> ;	2008	220	0	-	
Present study	2008	86	7	8.14%	

In present study, for creation of preperitoneal space two techniques were used, with the help of balloon (only for 10 initial cases) and in the remaining patients with the help of telescope. This finding in present study was contradictory to study conducted by S. Bringman *et al.*; in which he observed that operating time, conversion rate and recurrence rate was less for ballon method. This is because we used ballon method for creation of preperitoneal space only in 10 cases in early part of our study and left in later part.

**Fixation of mesh:**

In 86% of cases mesh was fixed and in remaning 14% mesh was not fixed out of them 2 patients had recurrence. As the sample size of non fixation group is too small no conclusion could be drawn. Surprisingly average operating time was more for no fixation group as no fixation method was practiced only in early part of study during which operating time was more.

Similarly various studies conducted by Jose Antonio *et al.*; favored mesh fixation in reducing recurrence rate. On the contrary Parshad R *et al.*; concluded that TEP without mesh fixation to be safe and feasible with no increase in recurrence rates.

**Postoperative pain:**

The post operative pain following laparoscopic surgery was lower than that of open surgery at any given time. This may be attributed to reduction in the size of incision, no need of extra or bilateral incisions in case of bilateral hernias, minimal dissection and less handling of cord structures.

Various other studies also observed VAS score at different point of time. But common timings among them are summarized as follows-

**(VAS score: 0 – no pain, 10 – imaginable pain)**

Study	Year	Mean VAS score			
		0 min	12 hrs	24 hrs	48 hrs
Tahsin Colak <i>et al.</i> ;	2003	2.73	3.20	2.4	4.42
Sven Bringman <i>et al.</i> ;	2003	2.3	2.8	1.5	-
Bodi Anderson <i>et al.</i> ;	2003				
Leigh Neumayer <i>et al.</i> ;	2004	2.8	-	3.2	4.40
Fumihiko Fujita <i>et al.</i> ;	2004	3.4	4.1	5.4	4.6
Mazeh H <i>et al.</i> ;	2008				
Present study	2008	0.94	2.21	3.49	

In our study VAS score in first 24 hrs is less as compared to previous studies. This difference is because of injectable analgesics that most of our patients have received in early part of their postoperative course.

There was no major complication in any of patient in our study. Incidence of intraoperative complications was only around 10%. (9 patients out of 86 included in the study) These complications were similar to those recorded by previous studies.

**Complication**

Incidence of postoperative complications was around 20% (17 patients out of 86 included in preset study). Most common postoperative complication in our patients was seroma formation (9.30%) that was

managed conservatively. Similar observations were made in previous studies, except study conducted by Bodi Anderson *et al* (2003) in which testicular pain was most common post operative complication.

**Complications of various studies:**

	Tahsin colak (2003) N= 132	Sven Bringman <i>et al.</i> ; N= 92	Bodi Anderson <i>et al.</i> ; N = 81	Leigh Neumayer <i>et al.</i> ; (2004) n= 989	Present study (2008) n= 86
Vascular injury	3	1	2	10	3
Pneumoperitoneum	4	3	2	15	6
Cord injury	0	0	0	1	0
Bowel injury	0	1	0	1	0
Bladder injury	0	0	0	0	0
Seroma / hematoma	5	4	7	90	8
Urinary retention	2	2	4	28	5
Neuralgias	1	2	5	42	3
Testicular pain and swelling	4	1	19	14	1
Mesh infection	0	0	0	1	0
Osteitis pubis	0	0	0	0	0

**Post operative recovery**

Most of patients in present study were discharged on 1st or 2nd postoperative day. Results of mean post operative stay was similar to those of previous studies but mean time of resumption to daily

activities and resumption to work was less as compared to previous other studies. This difference because most of patients in present study were from lower socioeconomic group who resumed their duties at the earliest.

	Post operative stay (days)	Resumption to daily activities (days)	Resumption to work (days)
P. Shrenk <i>et al.</i> ;	1.2	8.5	28.4
Mike S. L. <i>et al.</i> ;	1.4	6.8	14.5
Knook M T <i>et al.</i> ;	1	5	16
Tahsin Colak <i>et al.</i> ;	1.8	10.8	24.3
Sven Bringman <i>et al.</i> ;	0.94	6.54	14
Bodi Anderson <i>et al.</i> ;	0.64	5	8
Leigh Neumayer <i>et al.</i> ;	1	4	14
Mazeh H <i>et al.</i> ;	Day care	4.41	8.73
Present study	1.67	2.86	13.06

**Wound related complication:**

There was no major wound related complication in any of patients. Only 6 patients had wound related complications (Erythema, induration, stitch abscess and subcutaneous abscess). This low wound related complication is gift of minimal access surgery and similar rates were reported by most of previous studies conducted by Mike S. L. *et al.*; Knook M T *et al.*; , Tahsin Colak *et al.*; [5], and Leigh Neumayer *et al.*; [3].

Most of the patients of laparoscopic TEP were satisfied with scar they received and most of unsatisfied patients were those who were converted to open repair. These results were comparable with previous studies. In study by P. Shrenk *et al.*; around 70% of patients were very satisfied and around 29% were satisfied with the cosmetic results.

**Recurrence:**

In present study, in all 3 recurrences (3.49 %) occurred in follow up period due to mesh displacement, mesh size and technical inexperience. Most of studies

**Satisfaction with scar:**

had reported mesh displacement is most common cause for recurrence. Similar recurrence rate ranging from 1 – 4 % was reported by most of previous studies except P.

Shrenk *et al.*; Leigh Neumayer *et al.*; [3] who reported higher recurrence rate of 16.67% and 10.1% respectively.

Study	Year	N	Total Recurrences	Recurrence Rate (%)	Period of Follow up
Scheuerlein H	2003	1270	5	0.4%	2.3 years
Tahsin Colak <i>et al.</i> ;	2003	132	2	2.9%	12.04 months
Sven Bringman <i>et al.</i> ;	2003	92	2	2.2%	
Bodi Anderson <i>et al.</i> ;	2003	81	2	2.46%	
Leigh Neumayer <i>et al.</i> ;	2004	989	87	10.1%	
Dulucq JL	2004	3100	11	0.35%	
Staorink M <i>et al.</i> ;	2006	306	9	2.94%	
Thill V <i>et al.</i> ;	2007	848	13	1.5%	
Jayprakash <i>et al.</i> ;	2007	134	3	2.23%	24.5 months
Present study	2008	86	3	3.48%	3 mths - 2 yr

**Learning curve**

For surgical procedures, the learning curve may be defined by number of operations required for operating time and complications rates to become stable. Laparoscopic hernia repair is an advanced laparoscopic procedure and has a longer learning curve. In addition, Total Extraperitoneal repair (TEP) requires higher technical expertise for successful results. This learning curve can be plotted on parameters like

operating time, conversion rate to other procedure, rate of intraoperative and postoperative complications and recurrence rate. In present study, it required around 40 surgeries to attain a steady operative time, conversion rate, minimal complications and recurrences. Previous studies also reported this period as 40 to 50 surgeries. Learning curve in present study could be compared and correlated with previous studies conducted by Lal P *et al.*; [4].

Study	Year	No. of Cases	Conversion Rate	Operative Time	Complications	Recurrences
Andrus J. Voitk <i>et al.</i> ;	1998	98	5conversion in first 50 cases and 1 thereafter	Avg. 59 min in first 25 cases and avg. 37 min I last 25 cases	24 complications in first 50 cases	2 recurrences in first 40 cases
Lal P <i>et al.</i> ;	2004	61	5conversion in first 10 cases and 1 thereafter	-	0 complications	0 recurrences
Present study	2008	86	7conversion in first 40 cases and 0 thereafter	86 min for first 20 cases and 52 min in last 19 cases	18 complications in first 40 cases and 7 thereafter	3 recurrences in first 20 cases and 0 thereafter

**CONCLUSIONS:**

Laparoscopic TEP repair is safe operative technique with the following advantages;

1. Feasible in all types of hernia direct or indirect, complete or incomplete hernias.
2. Feasible in bilateral and recurrent hernia with added advantages over other types of hernia repair.
3. Less post operative pain.
4. Acceptable intraoperative and postoperative complications.
5. Less wound related complications.
6. Early postoperative recovery in form of less postoperative stay, early resumption to daily activities and early resumption to work.

7. Better subjective and objective cosmetic results.

The main shortcomings of TEP observed were,

1. Need for general anesthesia.
2. More operative time only in early part of study.
3. Need for conversion to other methods of hernia repair in early part of learning curve.
4. Long learning curve.

Thus laparoscopic TEP is a safe and effective method of hernia repair but with a long learning curve and requires high technical skill.

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