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Original Article

Laparoscopic inguinal hernia repair in the Armed Forces: A 5-year single centre study

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ABSTRACT

Background: Surgery for inguinal hernia continues to evolve. The most recent development in the field of surgery for inguinal hernia is the emergence of laparoscopic inguinal hernia surgery (LIHS) which is challenging the gold standard Lichtenstein's tension free mesh repair. Our centre has the largest series of LIHS from any Armed Forces hospital. The aim of this study was to analyze the short and long term outcomes at our center since its inception. **Methods:** Retrospective review of prospectively maintained data base of 501 LIHS done in 434 patients by a single surgeon between April 2008 and October 2013. Preoperative, intraoperative, postoperative and follow-up data was analyzed with emphasis on the recurrence rates and the incidence of inguinodynia.

Results: 402 (92.6%) patients had primary hernias and 367 (84.6%) patients had unilateral hernias. Of the 501 repairs, 453 (90.4%) were done totally extraperitoneal approach and 48 (9.6%) were done by the transabdominal preperitoneal approach. The mean operative time for unilateral and bilateral repairs was 40.9 ± 11.2 and 76.2 ± 15.0 minutes, respectively. The conversion rate to open surgery was 0.6%. The intraoperative, and early and late postoperative complication rates were 1.7%, 6.2% and 3%, respectively. The incidence of chronic groin pain was 0.7% and the recurrence rate was 1.6%. The median hospital stay was 1 day (1–5 days). **Conclusion:** We, in this series of over 500 repairs have demonstrated that feasibility as well as safety of LIHS at our centre with good short and long term outcomes.

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Introduction

Inguinal hernias (IH) are a common surgical problem. The estimated occurrence of hernia is around 5% in the general

population of which three fourths are IH.^{1,2} The repair of IH is a vexing problem which has caught the attention of surgeons since the 18th century and continues to intrigue and obsess them in a search for the ideal repair.

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The surgery for IH has continued to evolve from the times Marcy attempted the reduction of hernia sac and closure of the internal ring with carbolized catgut sutures.³ From the suture-tension tissue repairs and their many modifications to the tension free prosthetic repairs, the hernia surgery has come a long way. There are two mile stones in this quest for the ideal repair that has come up in the recent past. One is in the form of the Lichtenstein's tension free mesh repair (LR).⁴ LR became popular because of its short learning curve and low recurrence rates and has firmly established itself as the gold standard surgery for IH.⁵

With the advent of minimally invasive surgery in the late 20th century, it has made forays into IH surgery too. This forms the second major mile stone in the recent times. The two main techniques of laparoscopic inguinal hernia surgery (LIHS) in vogue are the totally extraperitoneal repair (TEP) and the transabdominal preperitoneal repair (TAPP). They have challenged the gold standard LR. Today, LIHS is recommended procedure for bilateral/recurrent IH.⁶ However the status with regards to unilateral IH is not clear. The recent NICE guidelines of 2004 recommends laparoscopic surgery as one of the treatment options for repair of IH.⁷

The main issues in IH surgery are recurrences and chronic groin pain.⁸ With the consistently reported low recurrence rates with LR, the focus is shifting to other complications and amongst them, the post-hernioplasty inguinodynia has become the major concern following these surgeries. The advantages of using a laparoscopic approach are less postoperative pain, earlier return to work, ability to deal with bilateral hernias through the same incisions, ability to address all defects of the myopectineal orifice, decreased rates of recurrences and better cosmesis.⁹⁻¹² These outweigh the disadvantages that include increased operative time, costs and the learning curve.^{13,14}

The LIHS started in the 1990s and is being rapidly adopted worldwide. In the Armed Forces, LIHS was pioneered by the first author and is being practiced since 2004. We, in this article present the results of LIHS repair performed by a single surgeon over a period of 5 years since it was started at our centre. We look at the short term as well as long term outcomes. To the best of our knowledge, this is the largest series of LIHS from any Armed Forces Hospital.

Material and methods

This is a retrospective review of a prospectively maintained data base of patients operated for IH at our centre. The study period was from April 2008 to October 2013. The follow up data was updated till December 2014.

The aim of this study is to evaluate the outcomes of LIHS at our centre over this period with a primary objective to evaluate the recurrence rates and chronic groin pain and secondary objective to evaluate the intraoperative and post operative complications.

Inclusion criteria

All adult patients with uncomplicated, unilateral or bilateral inguinal hernia were offered LIHS.

Exclusion criteria

Patients with a large infraumbilical midline scar, a complicated hernia or those unfit for general anesthesia were not offered LIHS.

Operative procedure

All cases were operated by the first author, who had an experience of over 150 LIHS prior to starting this surgery at our centre. Injection amoxicillin 1000 mg and clavulanic acid 250 mg was given intravenously as prophylaxis at the time of induction along with two additional postoperative doses. The procedure was done under general anesthesia. A 16 Fr Foley's catheter was inserted which was removed post procedure except in those above 60 years of age or in patients with lower urinary tract symptoms in whom it was kept in place for 24 h post surgery. TEP was the preferred method of LIHS and TAPP was done only in patients who were obese or in the occasional patient who had a very large hernia or irreducible hernia.

Technique of TEP procedure

A 10 mm paraumbilical port was made on the side of the hernia. In bilateral hernias, the port was made on the side of the larger sac. The rectus muscle was retracted laterally after incising the anterior rectus sheath and a preperitoneal access was obtained to place a 10 mm trocar for a 10 mm 30° telescope. A balloon dissector was used to create the preperitoneal space. Two 5 mm ports were placed in the midline, one just above the symphysis pubis and the other in between 10 mm port and 5 mm supra-pubic port. Pneumoperitoneum was created and the entire posterior floor was dissected. Reduction of sac was attempted in all cases but in case of adhesions, sac was divided at the deep ring. Genitofemoral and lateral cutaneous nerves were identified. Fascia over these nerves was kept intact. Peritoneum was teased down, proximal to the point where vas deferens turns medially. Triangle of doom and Hasselbach's triangle were defined. After the dissection, a rolled 10 × 15 cm polypropylene mesh or a 3-D mesh (Bard) was introduced via the 10 mm port. The mesh was spread to cover the entire myopectineal area on the affected side. In bilateral hernia, both meshes were placed so as to overlap each other in the midline. The mesh was fixed with tackers, medially on the Cooper's ligament and laterally near anterior superior iliac spine above the iliopubic tract. The 10 mm port fascia was closed using 1-0 PDS suture, and the port sites were closed with skin staplers or sutures.

Technique of TAPP repair

Pneumoperitoneum of upto 12-15 mm Hg was created with CO₂ using Veress needle or by an open method, just above umbilicus. A standard 10 mm trocar was placed above the umbilicus for insertion of laparoscope. A 10 mm 30° telescope was used. Two additional 5 mm trocars were placed at the level of umbilicus approximately 7-8 cm on either side of the umbilicus for effective triangulation. The peritoneum was incised 8 cm superior to the deep inguinal ring extending transversely laterally up to anterior superior iliac spine and

medially up to medial umbilical ligament without transgressing median umbilical ligament, to enable the formation of a peritoneal flap. The entire posterior floor was dissected and the anatomical landmarks defined as in TEP repair. After the mesh placement, intra-abdominal pressure was reduced to 8 mmHg and peritoneal flap was closed with tackers to cover the mesh completely. The pneumoperitoneum was released and the fascia of the 10 mm port closed with 1-0 PDS suture, and skin incisions closed with skin sutures or skin staplers.

Postoperative management

Injection of diclofenac 75 mg intramuscularly was given for postoperative pain relief and where there was a contra-indications, injection tramadol was given. Oral fluids were allowed 6 h postoperative and progressed to normal diet the next day. The patients were usually ready for discharge on post operative day 1. However, due to service requirements/logistical problems and socioeconomic considerations, the discharges were made much later in serving soldiers. The majority of ex-servicemen and the dependents of serving soldiers were discharged on first post operative day. For the purpose of calculating the post operative hospital stay, the time at which the patients were shifted out to non-acute ward was deemed as time of discharge.

Follow up

The patients were regularly followed up. Follow up was done at one week, three months, six months, and then yearly. The follow up data for those patients who subsequently did not report for further follow-up was obtained by the means of telephonic interviews.

Preoperative data

The demographic profile of the patients like age, sex, BMI was recorded. The duration of swelling, progression, reducibility and history of any complication were noted. The characteristic features of hernia like side (unilateral or bilateral), type, complicated or uncomplicated were recorded.

Intraoperative data

The operation time, type of hernia, contents, adhesions, any injury to cord structures, vas deferens, viscera or vascular structures were recorded.

Postoperative data

The incidence of urinary retention, seroma formation, ecchymosis, funiculitis, ischemic orchitis, wound infection and any other complications were noted along with the duration of hospital stay.

Follow up data

All patients during follow up were assessed and examined for presence of mesh infection, chronic groin pain, numbness, recurrence or any metachronous hernia.

Definitions

1. **Wound infections:** Defined as per the CDC classification.¹⁵
2. **Chronic groin pain:** Chronic pain after hernia surgery has been defined by International Association of the Study for Pain as “pain lasting for three months or more” i.e. pain persisting beyond the normal tissue healing time assumed to be 3 months.¹⁶

Results

Between April 2008 and October 2013, 501 LIHS were done in 434 patients by a single surgeon at the department of gastrointestinal surgery of our centre. Of these, 395 patients underwent TEP and 39 patients underwent TAPP. During this period, open hernia surgery was done in 18 patients. The reasons for open hernia surgery are given as Fig. 1.

Patient characteristics and clinical profile

Patient characteristics and their clinical profile are given as Table 1. The mean age of the patients was 48.3 ± 17.8 years and the majority of these were in the younger age group of 21–30 and 31–40 years (Fig. 2). Predictably, 98% of the patients were male. The mean duration of symptoms was 22.1 ± 9.7 months.

Hernia characteristics and their repair

Overall, there were 434 patients of IH of which, 402 (92.6%) were primary hernias. 367 (84.6%) patients had unilateral hernia whereas 67 patients (15.4%) had bilateral hernia. Overall, 501 repairs were done, the majority by the TEP method (453; 90.4%). All recurrent hernias after open surgery were managed by TEP (Table 2).

Intra operative factors and complications

The mean operative times for unilateral and bilateral hernias were 40.9 ± 11.2 and 6.2 ± 15.0 min, respectively.

Fig. 1 – Break up of inguinal hernia surgeries performed and reasons for open hernia surgery.

Table 1 – Patient characteristics and clinical profile.

Characteristics	Total (n = 434)
Age (years)	
Mean $\pm$ SD	48.3 $\pm$ 17.8
(Range)	(18–74)
Sex (%)	
Male	427 (98.3)
Female	7 (1.7)
BMI (Kg/m ²)	
Mean $\pm$ SD	22.9 $\pm$ 2.8
(Range)	(17.1–31.2)
ASA grade (%)	
ASA I	267 (61.5)
ASA II	143 (32.9)
ASA III	24 (5.5)
Presenting complaints	
Duration of symptoms (Months)	
Mean $\pm$ SD	22.1 $\pm$ 9.7
(Range)	(2–72)
Swelling	414 (95.4%)
Pain	279 (64.3%)
Co-morbidity	
COPD	43 (9.9%)
Hypertension	52 (11.9%)
Diabetes mellitus	23 (5.2%)
Seizures	03 (0.6%)
Rheumatoid arthritis	02 (0.5%)

We had a low conversion rate to open surgery (03; 0.6%). The reasons for conversion were a large peritoneal rent in one, bleeding from inferior epigastric vessels in another and difficulty in dissection in the third case. Overall, peritoneal breach occurred in 16/395 (4%) patients and was managed by insertion of the Veress needle to vent it. The overall incidence of intraoperative complications was 1.7%. There were no incidences of injury to major vessels, viscera or the vas deferens. In 3 patients (0.7%) there was an inadvertent injury to the testicular vessels which was managed with compression/electrocoagulation. In 3 patients (0.7%), there was an injury to inferior epigastric vessel requiring proximal as well as distal ligation to control the bleed out of them one converted to open surgery due to

Age distribution (Years) **Fig. 2 – Distribution of patients according to age groups.****Table 2 – Characteristics of hernia.**

	Total	TEP	TAPP
Total no of patients	434	395 (91%)	39 (9%)
Primary hernias	402 (92.6%)	363 (90.3%)	39 (9.7%)
Recurrent hernias	32 (7.4%)	32 (100%)	0
Unilateral	367 (84.6%)	337 (91.8%)	30 (8.2%)
Right	229	210	19
Left	138	127	11
Bilateral	67 (15.4%)	58 (86.6%)	09 (13.4%)
Total number of repairs	501	453 (90.4%)	48 (9.6%)

uncontrolled bleeding. Extensive surgical emphysema occurred in 2 patients which resolved on its own over the next 48 h (Table 3).

Postoperative factors and complications

The incidence of postoperative morbidity was 6.2%. 8 (1.6%) patients had urinary retention which was managed with recatheterization and a catheter free trial 48 h later. The incidence of direct surgery related complications was 4.6%. Ecchymosis occurred in 9 (1.8%) of repairs which resolved on its own. Funiculitis occurred in 5 (1%) and ischemic orchitis in 4 (0.7%) repairs, respectively. They were managed with scrotal supports and analgesics/anti-inflammatory medications. Seroma occurred in 4 (0.7%) repairs, three were managed conservatively and one needed aspiration. Only one patient had a port site infection which was managed by opening of sutures and dressings. The median hospital stay was 1 day (Range; 1–5 days). One patient who had undergone bilateral TEP developed intestinal obstruction on post operative day 3 due to a loop of ileum that had slipped beneath the lower edge of mesh into inguinal canal. Following a laparotomy, the loop of ileum was released, the mesh explanted and a tissue repair was done (Table 4).

Follow up/long term outcomes

The mean follow up period was 26 $\pm$ 7.0 months (Range; 14–68 months). All patients were followed for a minimum of 1 year

Table 3 – Intra-Operative Factors and complications.

	Total (n = 434)
Mean Operative time (Minutes)	
Unilateral	40.9 $\pm$ 11.2
Direct	36.2 $\pm$ 9.2
Indirect	46.1 $\pm$ 11.9
Bilateral	76.2 $\pm$ 15.0
Direct	66.8 $\pm$ 12.2
Indirect	96.4 $\pm$ 17.3
Conversion to open surgery	03 (0.6%)
Peritoneal breach in TEP (n = 395)	16 (4.05%)
Injury to viscera	Nil
Injury to vas deferens	Nil
Injury to testicular vessels	03 (0.6%)
Injury to inferior epigastric vessels	03 (0.6%)
Injury to major vessels	Nil
Extensive surgical emphysema	02 (0.5%)

duration. Of these, 365/372 (98.1%) patients and 256/285 (89.8%) patients completed their follow up for 2 and 3 years, respectively (Table 5).

The incidence of long term complications on follow up was 3%. No patient developed mesh infection. Chronic groin pain occurred in 4 patients (0.7%). Three of these were neuropathic and one was non-neuropathic. The non-neuropathic pain patient was managed with analgesics on an intermittent basis along with hot fomentation. Of the three neuropathic types, two responded to analgesics and neuromodulators. However, the third patient continues to be symptomatic despite these measures and nerve blocks. None of the patients developed port site hernia. Eight (1.6%) recurrences were noted during the follow-up. Half of them occurred early, between 3 and 6 months. The recurrence pattern is given as Fig. 3.

Discussion

The laparoscopic path to IH repair was born with the efforts of Ger in 1982 when a simple closure of internal ring with stapler was done.¹⁷ Since then laparoscopic repairs of groin hernia have evolved and standardized in to two main approaches: Trans Abdominal Pre-Peritoneal (TAPP; Arregui 1991)¹⁸ and Totally Extra-Peritoneal (TEP; Dulucq 1991).¹⁹ Early reports showed a higher recurrence rates with LIHS.²⁰ With evolving experience, LIHS has shown several advantages over open repair like less postoperative pain and morbidity, early recovery, rapid return to work and usual activities, low recurrence rate and better quality of life.⁹⁻¹² Thus, LIHS is now the preferred procedure for bilateral and recurrent IH and is one of the recommended options for unilateral hernias.^{6,7}

LIHS in the Armed Forces was done for the first time in 2004. As is with all beginnings, many doubts crept up on various fronts including feasibility, infrastructure, training and cost effectiveness. With sustained efforts and perseverance, LIHS is being more widely adopted in the Armed Forces now.

The preferred technique at our centre is TEP with TAPP being used in select cases only. The reported outcomes of the two techniques are similar with some reports of increased visceral injury with TAPP. This along with added advantage of non violation of intraperitoneal space has led to TEP being preferred to TAPP.²¹ TEP, however, has a longer learning curve. A couple of studies state that between 80 and 250 procedures are needed to overcome the learning curve.^{20,22}

The first author had an experience of over 150 TEP surgeries before he started the LIHS programme at our centre. Since

Table 5 – Follow up and long term outcomes.

	Total
Follow up (Months)	
Mean (Range)	26 ± 7.0 (14–68)
3 Months	434/434 (100%)
6 Months	434/434 (100%)
12 Months	434/434 (100%)
24 Months	365/372 (98.1%)
36 Months	256/285 (89.8%)
Mesh infection	Nil
Numbness in thigh	03 (0.6%)
Chronic groin pain	04 (0.8%)
Port site hernia	Nil
Recurrence	08 (1.6%)
Metachronous hernia (n = 367)	03 (0.8%)

then, over 500 repairs have been done in over 5 years with low incidence of complications [intraoperative (1.7%), early (6.2%) and late post operative complications (3%)], negligible conversion rates and comparable recurrence rates (1.6%). All these along with operative times are indices of the learning curve.

Our outcomes compare well with those in published literature. A large prospective multicentre randomized controlled trial (RCT) reported the intraoperative, postoperative and long term complications to be 2%, 16% and 18% respectively, following LR which was not significantly different from the LIHS arms.²³ Another large RCT reported the same rates to be 1.9%, 19.4% and 17.4% and 4.8%, 24.6% and 18% following LR and LIHS, respectively.²⁰ Large series have reported rates of 2.5–2.9 % intraoperative and 3.4–8.5% postoperative complication rates.^{21,24}

Surprisingly, we had a very low conversion rate in our series (0.6%). Swadia reported a conversion rate of 1.2% in their series of 1042 patients.²¹ Dulucq et al reported the same as 1.5% in their series of 2356 patients.²⁴ Other series report rates up to 3.6%.²⁵ The operative times reported by large series are between 17–45 min and 24–65 min for unilateral and bilateral repairs, respectively.^{21,24,26} The same in our series was 40.9 and 76.2 min respectively. The relatively longer operative times for the bilateral repairs is attributable to the fact that we did not have two monitors and hence some time was lost in repositioning the monitors to the opposite side.

The recurrence rate is a major parameter which needs to be compared with the gold standard LR. A recent meta-analysis

Table 4 – Postoperative factors and complications.	
	Total (n = 501)
Urinary retention (n = 434)	08 (1.6%)
Seroma	04 (0.7%)
Funiculitis	05 (1%)
Ischemic orchitis	04 (0.7%)
Ecchymosis	09 (1.8%)
Wound infections	01 (0.2%)
Intestinal obstruction	01 (0.2%)
Median Hospital stay (Days) (Range)	1.0 (1–5)

Fig. 3 – Recurrence pattern.

which compared open hernia repair with LIHS showed a recurrence rate of 2.7% for open repair as compared to 5.5% for LIHS after a follow-up of 28 months.²⁷ A more recent meta-analysis found the rates to be 3% and 3.8%, respectively.²⁸ Our series has shown a low recurrence rate of 1.6% after a mean follow up of 26 ± 7.0 months (Range; 14–68 months). Recurrences tend to occur early in mesh repair groups as compared to tissue repairs when they can occur even later. In our series most of the recurrences occurred between 3 and 6 months though we did have a couple of recurrences in the third year of follow-up.

The incidence of chronic groin pain, the other major issue in IH surgery, is variously quoted by different studies. The overall incidence of chronic pain after IH surgery has been quoted to be around 12%; 18% in patients having open surgery (range 0–75.5%), and 6% in patients undergoing LIHS (range 1–16%).²⁹ In our series, the incidence of chronic groin pain was only 0.7%.

One issue that needs mention is that of mandatory exploration of the contralateral side to detect and treat incidental occult inguinal hernias. Though there are some studies which push the cause for this approach citing 13–22% incidence of occult contralateral hernia, and the difficulties that may be encountered in dealing with these later due to previous inadvertent dissection and mesh induced fibrosis on the contralateral side.^{30,31} However, there is no level I evidence to this effect as yet. We, as a policy do not routinely explore the contralateral side. We believe that occult hernias may not develop into overt hernias and that we would like to deal with it as they would present at a later date, if at all. We, in our series, encountered only 3 (0.8%) metachronous hernias in the 367 unilateral repairs that we performed. All the three hernias were repaired by TEP method and we found no undue difficulty during the surgery. We believe that this would be a cost effective strategy.

Conclusion

There is an explosion of minimally invasive techniques in the field of surgery and IH repair is no exception. The advantages with this approach have led to a change in the expectation of the clientele we are treating. Thus, there is a need to adopt LIHS, compare it with the gold standard LR and adapt it to our setup if found feasible. We, in this series of over 500 repairs have demonstrated that feasibility as well as safety of LIHS at our centre with good short and long term outcomes.

Conflicts of interest

All authors have none to declare.

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