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## RESEARCH ARTICLE

### LAPAROSCOPIC TRANSABDOMINAL PRE-PERITONEALVERSUS OPEN TENSION FREE REPAIR OF INGUINAL HERNIA

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#### ABSTRACT

Laparoscopic inguinal hernia repair began in the early 1990s as laparoscopy gained a foothold in general surgery. Inguinal hernias account for about 75% of all abdominal wall hernias, and with a lifetime risk of 27% in men and 3% in women. Repair of inguinal hernias is considered one of the most commonly performed surgical procedures all over world. Inguinal hernia repairs are also of the most common operations done in general surgery. In addition to the conventional open repairs, minimally invasive approaches are becoming increasingly preferred in the management of groin hernia repair. Although open, mesh-based, tension-free is still the standard, laparoscopic herniorrhaphy, when performed by adequately trained surgeons, produces very good results comparable to those of open repair.

#### INTRODUCTION

Inguinal Hernia is the most common hernia, accounting for about 90% of all hernias. Hernia repair is the most common surgery performed in general surgery (Dulucq, 2006). Most of abdominal wall hernias should be treated surgically, either by conventional methods, which include high ligation of the sac and reinforcement of the inguinal floor by Bassini's repair, or by MC Vay's repair. Eventhough this method resulted in significant perioperative morbidity, high recurrence rate and long hospital stay (Lichtenstein, 1989). Inguinal herniorrhaphy is one of the most common operations that are performed by general surgeons. The first sound technique for the repair of inguinal hernia was Performed by Bassini in 1887. Since that time, more than 70 methods have been described (Satod, 2008). Nowadays, only three surgical techniques have been scientifically validated and can be recommended for clinical application. The Shouldice technique, a form of suture repair, Open anterior flat mesh repair according to Lichtenstein, and Laparoscopic/endoscopic posterior flat mesh repair (Matthems, 2005). Repair of inguinal hernia using laparoscopy is becoming increasingly accepted in surgical practice, using either an extraperitoneal or a transabdominal approach for placement of the mesh (Ersin, 2006). Laparoscopic repair of inguinal hernia have been developed in recent years, in order to reduce the recurrence rate, the postoperative morbidity and

mortality and the patient become able to return to work faster than after conventional inguinal herniorrhaphy (Filipi, 1992). Following the advancement in laparoscopic surgery, laparoscopic hernia repair has become one of the most common laparoscopic operations. Several studies have showed a definite advantage of laparoscopic intervention over open repair with respect to reduced postoperative pain and earlier return to work and usual activities (Kiruparan, 1998). Laparoscopic approaches for inguinal hernia, including transabdominal preperitoneal repair (TAPP) and the totally extraperitoneal approach, become very effective and widely accepted in elective inguinal hernioplasty. In contrast to the open approach, the laparoscopic approach has ancomperable rate of intraoperative complications, including visceral and vascular injuries, and a lower rate of postoperative complications, such as hemorrhage and chronic neuroglial disorders. In Japan, TAPP is performed three times more frequent than the totally extraperitoneal approach (Kiruparan, 1998). There are two standardized techniques of laparoscopic inguinal hernia repair: transabdominal preperitoneal (TAPP) repair which described by Arregui *et al.* (Arregui, 1992), in 1992, and total extraperitoneal repair that described by Mckernan and Lawa (Mckernan, 1993) in 1993. TAPP is relatively easy to learn but its disadvantage is breaching of the peritoneal cavity. Advantages of Laparoscopic Inguinal Hernia Repair: Less pain in the postoperative period, reduced the amount of required analgesic and narcotic drugs, early return

to usual activities and better cosmesis, short hospital admission, no groin incision so the incidence of infection of abdominal stab wound is less than of the inguinal incision, the inguinal canal is not opened and the risk of injury to the structures within the spermatic cord, including the ilioinguinal and genitofemoral nerves is minimal, the highest possible ligation of the sac and the ability to treat both hernial opening without an additional major exposure, and the stapled preperitoneal prosthetic repair is further supported by the increased intra-abdominal pressure holding the mesh to fascia thus reducing migration (Fitzgibbons, 2006).

Drawbacks of Laparoscopic Inguinal Hernia Repair: requirement of general anesthesia, difficult dissection, possibility of major vascular injury such as inferior epigastric vessels or obturator artery, bladder injury and trocar site hernia (Fitzgibbons, 2006).

#### According to unified classification

- I Indirect, small
- II Indirect, medium
- III Indirect, large
- IV Direct, small
- V Direct, medium
- VI Direct, large
- VII Combined-pantaloon "Both direct and indirect sac".
- VIII Femoral (Zollinger, 1999).

Intact internal ring with small sac.

Enlarge internal ring up to 2 finger breadth. Disrupted internal ring – inguino-scrotal presentation.

Fifth finger sized "porthole".

Thumb-sized. "Entire direct floor".

## MATERIALS AND METHODS

Present study Was conducted in Aswan University Hospital from May 2018 to March 2019. The study consisted 50 patients treated with hernioplasty 25 cases of laparoscopic hernioplasty (group A) and 25 cases of open hernioplasty (group B) in the Department of General Surgery, group A 20 patient was male and 5 patient was female (fig 1 table 1), group B 22 patients was male and 3 patients was female (Fig 2 –Table 1). Written consent taken from all the cases. Clearance from ethical committee of the hospital was taken for laparoscopic hernia repairs.

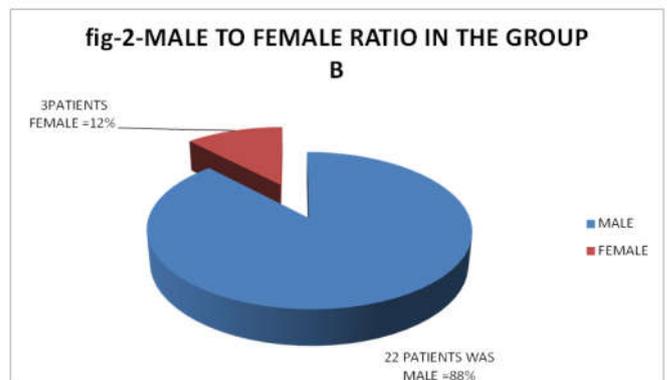
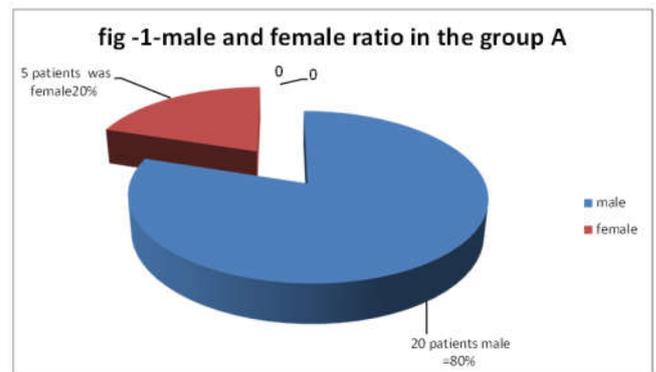
**Inclusion criteria:** All patients of both sex, who were 18 years of age or older with a diagnosis of inguinal hernia, either bilateral or unilateral and were medically fit to undergo the procedure were included in the study.

**Exclusion criteria:** Patients with age less than 18 years of age, contraindication to general anaesthesia or contraindications to laparoscopy like Patients with prior or planned pelvic operations (for instance, radical retropubic prostatectomy) or pelvic irradiation should undergo open repair. Patients with recurrence from a prior laparoscopic repair usually should undergo open repair, although good results with a TAPP approach have been reported. Finally, patients with a strangulated hernia should undergo open repair because laparoscopic repair is more dangerous, and a primary sutured hernia repair without mesh may be necessary if the field is contaminated. Incarcerated hernia is a relative contraindication

because traction on the intestines risks injury and contamination of an otherwise sterile field patients with complicated inguinal hernia like obstruction, strangulation or gangrene. Patients who have undergone previous lower abdominal surgeries. Preoperative evaluation of patient for laparoscopic repair includes: cardiac evaluation such as 2D ECHO if required. Pulmonary function test (PFT) for assessment of pulmonary function in some patients, and ultrasonography to rule out prostate enlargement. If the patient is not fit for general anaesthesia, laparoscopic repair is not advised, and patient is advised to go for open Lichtenstein's repair. Operative steps and per operative complications were noted in detail and tabulated. Post-operative assessment with respect to post-operative pain, hospital stay, and other complications were included. Patients were followed up for a period of minimum six months after surgery. That is one week after surgery, once in a month for 3 months, and once in three months thereafter. At the end of the study comparison was made between open Lichtenstein's repair and laparoscopic repair regarding safety and efficacy, duration of surgery with hospital stay and cost effectiveness, postoperative morbidity and patient satisfaction. The following data items were sought for all trials: Operative time, Haematoma, seroma, wound Superficial Infection, vascular injury, visceral injury length of hospital stay (Days), time to return to usual activities (Days), persisting pain and numbness defined as groin pain for 6 months after the operation and hernia recurrence.

**Table 1. Total number in both groups**

	Group A	Group B
Male	20	22
Female	5	3
Total	25	25



**Operative steps for transabdominal preperitoneal (TAPP) repair:** Three trocars are used for a TAPP repair: one 11-mm subumbilical port and one 5-mm ports placed in the same

transverse plane as the subumbilical port, approximately 5-7 cm away. Another 5-mm ports are just cephalad and medial to the anterior superior iliac spines. A 10-mm, 30°-angle laparoscope should be used to inspect the groin anatomy. The inferior epigastric vessels, the spermatic vessels, and the vas deferens should be identified. These three structures form the so-called “Mercedes-Benz” sign. The peritoneum is incised several centimeters above the myopectineal orifice, from the edge of the medial umbilical ligament laterally toward the anterior superior iliac spine. Working inferiorly, in a motion similar to opening a piece of pita bread, the surgeon should bluntly dissect the peritoneum off the transversus abdominus and transversalis fascia until the pubis, Cooper’s ligament, and iliopubic tract are seen.

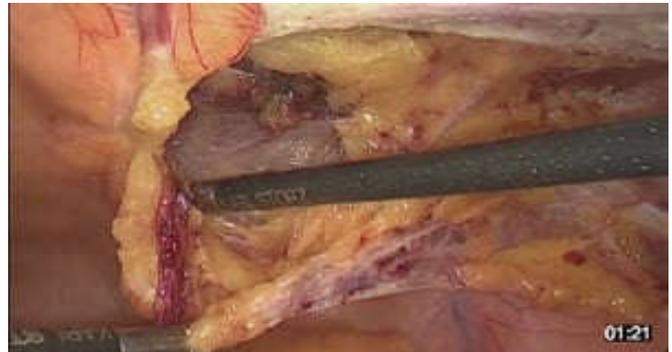
Right groin anatomy. The intersection of these three structures forms the “Mercedes-Benz” sign. D direct hernia, F femoral hernia, I indirect hernia, Inf inferior epigastric vessels, Sper spermatic vessels, Vas vas deferens. An indirect hernia sac is usually found on the anterolateral side of the cord. When dissecting the sac, it is important to minimize trauma to the vas deferens and the spermatic vessels. If the sac is sufficiently small, it should be completely dissected free from the cord and returned to the peritoneal cavity., a large sac will be encountered, in which case it should be dissected and divided beyond the internal ring. The subsequent peritoneal defect should be closed with an endloop suture, because the intestine can herniate into the preperitoneal space through the peritoneal defect and become obstructed. The distal end of the transected sac should be left open to avoid formation of a hydrocele. The vas deferens and spermatic vessels are isolated and dissected free from the surrounding tissues circumferentially, creating a window inferiorly, to allow for passage of the lower tail of the mesh. When fixing the mesh laterally, it is important to feel the tip of the device on the outside of the abdomen with the opposite hand to ensure that fixation occurs above the iliopubic tract. This avoids injury to the lateral femoral cutaneous nerve.



**Fig. 3. Lap view of RT side direct hernia**

It is also important to completely dissect the preperitoneal space so that the edge of the mesh does not fold, Bard 3DMax mesh used in most case which is not folded . The mesh should be placed with a slight overlap of the midline to ensure adequate coverage of the myopectineal orifice. Finally, the peritoneal flap is placed back in its original position to cover the mesh. We use closely spaced tacks so that intestines cannot herniate through the peritoneum into the preperitoneal space. Direct hernia sacs are reduced. When the peritoneum of a direct hernia sac is being reduced, a “pseudosac” may be present, which is actually adherent transversalis fascia that invaginates into the preperitoneal space during the dissection.

This layer must be separated from the true hernia sac in order for the peritoneum to be released back into the peritoneal cavity. Once the pseudosac is freed, it will typically retract anteriorly into the direct hernia defect. For direct hernias, we use a preformed, contoured mesh (Bard 3D Max Mesh) and anchor it with two tacks to Cooper’s ligament and with one tack laterally above the iliopubic tract (Fig. 5). Again, peritoneum is replaced over the mesh and anchored with tacks.



**Fig. 4. Preperitoneal dissection**



**Fig. 5. Mesh fixation**



**Fig. 6. After fixation of mesh**

**Open tension free repair of inguinal hernias; the Lichtenstein technique:** The patient is placed in the supine position under spinal anesthesia . The groin is prepared in the usual fashion. Before the incision, a bolus dose of a second-generation cephalosporin is given intravenously. Incision make in the skin, subcutaneous tissue, and external oblique aponeurosis the spermatic cord is elevated from the posterior wall of the inguinal canal.

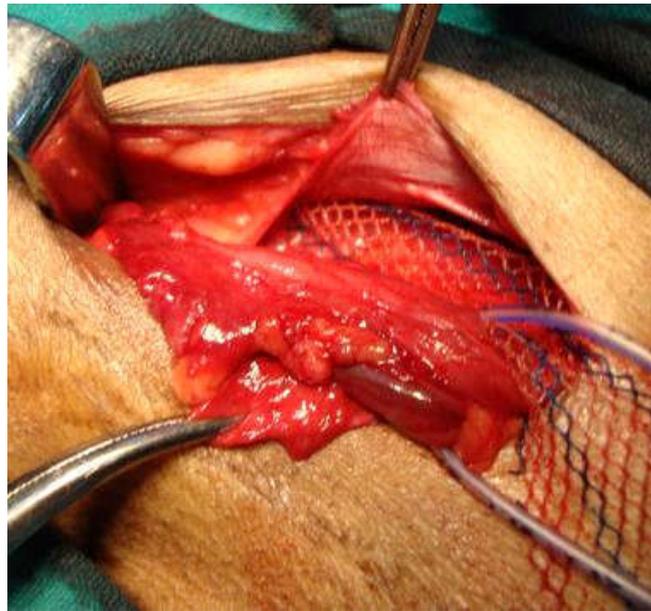


Fig. 7. Open repair of Rt side inguinal hernia



Fig. 8. Open repair of inguinal hernia

In indirect hernias, the hernial sac is identified, dissected to the internal ring and opened to allow examination of its contents. The sac is ligated and its distal portion is usually excised. However, in large indirect inguinal hernias, where the sac descends down to the scrotum, the distal part of the sac may be left open to prevent the formation of a hydrocele, thus allowing spontaneous obliteration. A polypropylene mesh (5× 10cm) is trimmed to fit the floor of the inguinal canal, and its apex is first fixed to the pubic tubercle using a No2/0 Prolene suture. The same continuous suture or interrupted sutures the lower border of the mesh to the free edge of the inguinal ligament, after an opening is made into its lower edge to accommodate the spermatic cord. The continuous suture extends up just medial to the anterior superior iliac spine. Interrupted Prolene sutures then suture the two cut edges of the mesh together around the spermatic cord. The infero-medial corner of the mesh is then attached well overlapping the pubic tubercle. The mesh is then by interrupted sutures (Prolene2/0). After meticulous hemostasis, a closed suction drain is placed beneath the external oblique aponeurosis, especially in large inguinal hernias, where an extensive dissection was performed during the plastic reconstruction. The aponeurosis of external oblique is then closed using absorbable sutures (Vicryl No 2). Regarding peri-operative care of the patient, prophylactic antibiotics is usually given for 48 – 72 hours postoperatively. In high-risk patients (i.e. obese patients), low molecular weight heparin is usually administered to prevent deep venous thrombosis the night before surgery and its administration is continued during

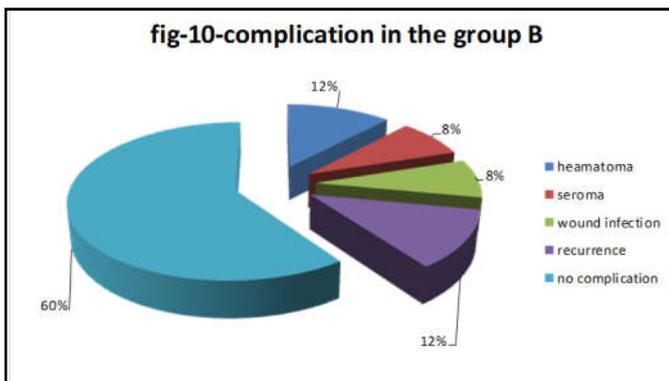
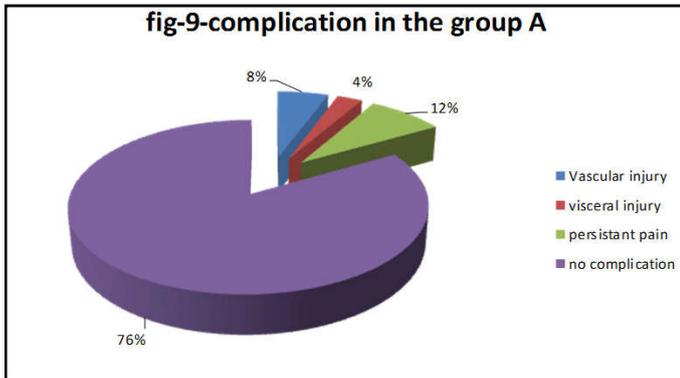
the hospitalization of the patient. The patient is mobilized about six hours after surgery. Postoperative anesthesia consists in the administration of paracetamol or NSAIDs or a combination of these two analgesics. The usual duration of the hospitalization is 2 days. When a closed suction drainage was used, it is removed the day of discharge.

**Operative Complications in group A:** Accidental injury of inferior epigastric artery occurred in two patients (8%) by grasper and controlled with clips, serosal tears of small bowel occurred in one patient (4%) and stitched with vicryl 3.0 laparoscopically with repair of intestinal injury. No wound infection in this group. Persistent pain may occur due to injury of the femoral branch of the genitofemoral nerve and the lateral cutaneous nerve of the thigh are the nerves most at risk during laparoscopic inguinal herniorrhaphy. 7 patients (28%) suffer from persistent pain in the form of numbness and burning pain in the inguinal region and treated with non steroidal anti-inflammatory drugs. The nerve irritation resolves in two months after surgery, no recurrence of hernia in the group A during the period of follow up.

**Operative Complications in group B:** Seroma developed in two patients (8%) after 3 days and treated with open the wound and I v antibiotic. Wound infection happened in 2 patients (8%) and treated with daily dressing and antibiotic. Testicular Hematoma occurred in 3 patients in indirect inguinoscrotal hernia and treated conservatively with anti edematous anti-inflammatory drugs for 3 weeks. Hernia recurrence happened in 3 patients (12%) after 2 months of follow up.

**Table 2. Post operative complication for both groups**

	Group A	%	Group B	%
Operative time	85minutes	-	110minutes	-
heamatoama	NO	-	3	12%
Seroma	NO	-	2	8%
Wound infection	NO	-	2	8%
Vascular injury	2	8%	No	-
Visceral injury	1	4%	No	-
Hospital stay	30 hours	-	50hours	-
Return to activity	3 days	-	One week	-
Persistant pain and numbness	3	12%	-	-
Hernia recurrence	no	-	3	12%

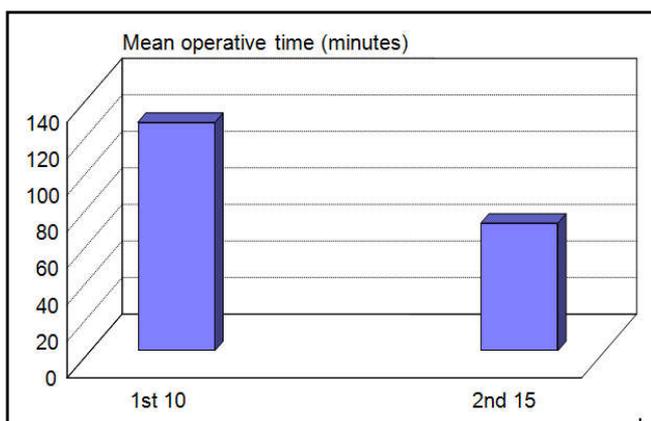


**Table 3. Shows the average operative times**

Operative time in minutes	Operative time Mean	+SD	F	P
1 <sup>st</sup> 10	125	12.5	3.9	<0.01**
2nd 15	69.8	24		

\*\* Highly significant test  $p < 0.01$

This table shows that 1<sup>st</sup> 10 hernias take stay for longer time intra-operatively compared to second group with highly significant difference in between by using one way ANOVA test.



**Fig. 11. Operative time for group A**

**Operative Time for group A:** Operative time was ranging between (60-130) minutes with a mean time 85 minutes. The operative times were longer for bilateral hernias than unilateral hernias, longer in oblique hernias than direct hernias, and longer in recurrent hernias. The operative time for the first 10 cases is longer due to early learning (130minutes) but with more experience the operative time is decreased.

**DISCUSSION**

TAPP has been associated less postoperative complications and pain than open mesh repair (Schmedt, 2005 and Novitsky, 2007). However, if TAPP performed by inexperienced surgeons it will carry a risk of operative complications<sup>(14)</sup>. The conventional TAPP techniques are demanding and associated with a significant learning curve, and the risk of recurrences are not common when the operation is performed by competent surgeons. The main technical challenges of TAPP are the difficulty to extensively dissect the peritoneum and inguinal floor, including Cooper’s ligament, around the medial umbilical fold, and the difficulty in identifying the surgical anatomy during the dissection<sup>(15)</sup>. Success of hernia treatment determined by high patient satisfaction, low cost, low rate of recurrence, and rapid return to usual activity<sup>(7, 8)</sup>. However, the question about the most appropriate technique still confuses the community of general surgeons. Many studies was done to compare the laparoscopic and open techniques for inguinal hernia repair. The advantages of laparoscopic hernia repair over traditional open repair in terms of less post-operative pain, shorter hospital stay, early return of activity and improved cosmetic have been readily apparent and accepted. Despite excellent short term and long-term outcome after TAPP repair, the use of laparoscopy in hernia repair is still limited<sup>(9)</sup>.

Visual Analogue Scale (VAS) was used for assessment of Post-operative pain scores<sup>(14)</sup>. In the current study post-operative pain is significantly less in group A in comparison to group B. The pain scores were obtained using visual analogue scale at interval of 12 hours, 24 hours and 48 hours following surgery revealed that the percent of patients after laparoscopic repair who had mild pain is 75%, 15% patients with discomforting pain and 10% patients with distressing pain. Whereas, only 3.33% of the patients of open hernia have mild pain with 43.33% of patients having discomforting pain and 43.3% of patients having distressing pain. 10% of the patients with open hernia repair had horrible pain (pain score 7-8) but no patient in laparoscopic pain had horrible pain. A 2003 Cochrane database systematic review demonstrated less persisting pain, and less persisting numbness in the laparoscopic groups.

Therefore, there is a lot of evidence that laparoscopic hernia repair associated with less postoperative pain and with similar or less risk of persisting pain than open mesh repair. In the present study post-operative pain is significantly less in laparoscopic group than open Lichtenstein’s group. The difference between either group was statistically significant. No one of the patients in either group had serious vascular or visceral injuries. A thorough knowledge of the anatomy and the operative approach, together with advanced laparoscopic skills will reduce the possibility of complications. With experience and technical improvements, the complications are now minimal in the laparoscopic repair and studies indicate comparable complication rates between open and laparoscopic

repairs. In the current study, the mean post-operative hospital admission was 2 days for laparoscopic hernia repair group, whereas it was 4 days for Open Lichtenstein's repair. Thus the mean post-operative hospital stay was significantly less in laparoscopic repair than open hernia repair with  $p < 0.0001$  which was extremely significant. So, from the present study it can be concluded that laparoscopic hernia repair is associated with less postoperative hospital stay and also better comfort than open hernia repair. Time to return to daily activities was found to be one day shorter for laparoscopic group than those undergoing open repair of hernia. However, at 2 months of follow up, there was no difference in the level of activity between the laparoscopic and open group. In the present study patients who underwent laparoscopic hernia repair were able to return to their normal daily activities earlier in a mean period of 7.5 days than those patients who underwent open repair returned to their normal daily activities in a mean period of 11.63 days with  $p < 0.001$  which is extremely significant. This is a big advantage for lap hernia, which has been repeated in our study. However, as mentioned before, there might not be any difference between both groups as regard the level of activity on long-term follow up. One of the major criticisms of laparoscopic hernia repair is their cost and that it is more expensive to perform than open hernia repair. The main reason for this relates to the cost of equipment used for the laparoscopic repair and secondary costs attributed to perceived increases in operative time for the laparoscopic procedure.

### Conclusion

Laparoscopic transabdominal preperitoneal repair (TAPP) is widely accepted in elective inguinal hernioplasty. TAPP repair is a feasible and safe technique, resulting in less postoperative pain associated with rapid recovery and satisfaction rate as documented by less post-operative pain, earlier mobilization and discharge from the hospital, as well as early return to usual activities and less postoperative complications; we recommend it as a procedure of choice especially in recurrent and bilateral cases.

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