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Laparoscopic versus open ventral hernia repair

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Abstract
Background: successful hernia repair is achieving a cost-effective repair with a low recurrence rate, minimal operative and acute and chronic post-operative pain with a rapid return to normal activities.
Objective: The aim of this work is to compare the effectiveness and safety of laparoscopic and open repair of ventral hernia and to discuss important controversial issues for both procedures like.
Methods: This study has been conducted at Al Azhar university hospitals in Assiut and cairo from January 2015 to January 2016. This study conducted on 50 unselected patients suffering from ventral hernia. Laparoscopic ventral hernia repair performed on 25 unselected patients and open repair for 25 consecutive unselected patients. The open surgical operations were performed using prosthetic mesh, whereas the laparoscopic repairs were performed using the mesh repair technique in all cases.
Results: In this Prospective comparative study, the outcomes for 25 unselected patients who underwent laparoscopic ventral hernia repair were compared with those for 25 consecutive unselected patients who underwent open repair.
Conclusions: Laparoscopic surgery is a successful treatment option offering significant advantages to patients compared with open ventral hernia repair.

- laparoscopic ventral hernia repair was safe and resulted in shorter duration of stay in hospital, less complications, early ambulatory period and less recurrence, early return to work. Hence, it should be considered as the procedure of choice for ventral hernia repair.
- The laparoscopic approach may be more suitable for straight forward hernias, and open repair reserved for more complex hernias.

Keywords: open repair, laparoscopic hernia repair, ventral hernia

Introduction

Ventral Hernia is not classified as one single type of hernia; rather, it is a collective term that includes a group of hernias that occur in the anterior abdominal wall. The most common types of Ventral Hernias are Incisional Hernia, Umbilical, Epigastric and Spigelian hernia [9].

Ventral hernias produce a lump or a bulge in the abdomen. Its size usually increases through a period. It may disappear upon lying down and eventually recur and enlarge when one stands, lifts a heavy object, or pressure is placed on the abdomen. Ventral hernia is reducible if it diminishes in size as response to manual pressure or upon lying down. It is irreducible or may even be incarcerated if reduction fails and an intestinal part bulges through the hernia sac. Manifestations of these types of hernia include a distended and bloated looking abdomen, and abdominal pain upon lifting object, coughing, standing too long, and straining. If the hernia is incarcerated, more severe abdominal pain, constipation, vomiting and nausea, can be experienced. However, when strangulation of the hernia is eminent, severe, excruciating abdominal pain is noted, along with tachycardia, high grade fever, protracted vomiting and profuse sweating [22].

Classification of Ventral Hernia

Unfortunately, a universal classification system for abdominal wall hernias has not been accepted. The benefits of such a system would be uniformity between studies comparing technique and the subsequent exchange of homogenous information [29].

According to reducibility and complications, can be classified into

1. 1. Reducible 2. Irreducible 3. Obstructed 4. Strangulated

CHEVREL AND MODIFIED CHEVREL CLASSIFICATION (2000)

Chevrel and Rath proposed a classification for incisional hernias in 2000. This classification is attractive, because it is simple, and the data required to reach the classification are readily obtained. Three parameters were utilized. Firstly, the localization of the hernia of the abdominal wall, divided into median (M1: supraumbilical, M2: juxta umbilical, M3: sub umbilical, M4: xiphopubic) and lateral (L1: subcostal, L2: transverse, L3: iliac, L4: lumbar) hernias. Secondly, the size of the hernia, it was postulated that the width of the hernia defect is the most important parameter, which was divided into four groups (W1: <5cm, W2: 5-10 cm, W3: 10-15 cm, W4: >15 cm). As a third parameter of this classification, subgroups were made for incisional hernias and recurrences: the number of previous hernia repairs was recorded as (R0: no recurrence, R1:1st recurrence, R2, R3…). Although apparently easy to use, this classification has not been commonly used.

Modified Cheverel Classification

- According to localization:

1. Vertical:
   - Midline above or below umbilicus. - Midline including umbilicus right or left. - Paramedian right or left.
2. Transverse:
   - Above or below umbilicus right or left. - Crossing midline or not.
3. Oblique:
   - Above or below umbilicus right or left.
4. Combined (midline + oblique; midline + parastomal; etc.).
   - According to size:
     - Small: (< 5cm in width or length). - Medium: (5-10 cm in width or length). - Large: (> 10 cm in width or length).
   - According to recurrence:
     - Primary incisional hernia. - Recurrence of an incisional hernia
   - According to the situation at the hernia gate:
     - Reducible with or without obstruction. - Irreducible with or without obstruction.
   - According to symptoms:
     - Asymptomatic. - Symptomatic [8].

EHS CLASSIFICATION FOR PRIMARY AND INCISIONAL ABDOMINAL WALL HERNIAS (2009): In 2009 the European Hernia Society (EHS) proposed separate classification schemes for primary and incisional abdominal wall hernias [28].

Classification of primary abdominal wall hernias

The classification of primary abdominal wall hernias contains the M (midline) and L (lateral) categories, but otherwise is considerably different from that of incisional hernias. Midline hernias include umbilical and epigastric defects. The lumbar and Spigelius's line defects are referred to lateral hernias. Hernias are divided by size in small (2 cm), medium (2–4 cm) or large (more than 4 cm) [33]. The only way to cure ventral hernia is surgery, and that can be done only when the hernia has increased in size or has started to discomfort the patient. During the procedure, the projecting tissue or organ is pushed back into the abdominal cavity. The discomfort portion of the peritoneum that projects is removed; the abdominal wall which was opened will be closed and mesh will be set to reduce the risk of it occurring again [17]. A wide spectrum of surgical techniques has been developed and recommended, ranging from sutured techniques to the use of various types of prosthetic mesh. Laparoscopic repair was a novel approach introduced in the 1990s. There is no consensus as to the "ideal" operation for repair of a ventral hernia yet. Consequently, different techniques are adopted. The current techniques adopted are best grouped as follows:

1. Anatomic repair of the abdominal wall, either with layer-by-layer reconstruction or mass closure technique.
2. Overlap techniques, which are either vertical or transverse Mayo overlap.
3. Darn techniques using either strips of fascia Lata or nylon and Maingot's keel repair, which is essentially extraperitoneal darn of the rectus sheaths.
4. The Nutall operation.
5. Components separation of anterior abdominal wall muscles.
6. Prosthetic repair. 7. Laparoscopic repair [43].

Patients and Methods

In this Prospective comparative study, the outcomes for 25 unselected patients who underwent laparoscopic ventral hernia repair were compared with those for 25 consecutive unselected patients who underwent open repair. The open surgical operations were performed using prosthetic mesh, whereas the laparoscopic repairs were performed using the mesh repair technique in all cases.

The patients were divided randomly in Group A and Group B, having 25 patients in each group

- Group A: Representing open mesh repair group and
- Group B: laparoscopic repair group.

Patients of both groups were observed per-operatively for duration of surgery, postoperatively for length of hospital stay and intensity of postoperative pain, complications and recurrence within 12 months.

Methodology

The patients underwent surgery if they were had abdominal ventral hernias. Factors involved in the surgeon's choice of a mesh repair were hernia defect larger than 4 cm, recurrent hernia, and hernia in a morbidly obese patient.

All the patients were offered laparoscopic and open repair options. Once the decision was made, laparoscopic repair was performed by the laparoscopic surgeons. Patients with repair of ventral and incisional hernias not involving mesh were excluded, as were those with intrabdominal sepsis, peritonitis, and infection, as well as those for whom it was not possible to insert a trocar or establish a pneumoperitoneum safely. All the patients underwent routine preoperative laboratory studies (complete blood count, blood chemistries and respiratory functions), chest radiography, and electrocardiogram. Bowel preparation was started 24 h before surgery if the patient had a recurrent incisional hernia. Prophylactic short-term antibiotic therapy using first-generation cephalosporin and antithrombotic prophylaxis with antiembolic stockings were administered routinely. Nasogastric suction and bladder catheterization were used for the duration of the operation

Technique of open repair with mesh

The established technique of surgical treatment of ventral abdominal hernia is the prefascial prosthetic implantation.

The following technique of on lay implantation was done:

1. Excision of the skin scar (if present).
2. Dissection of the hernial sac with broad preparation of the fascial edge.
3. Opening of the hernial sac.
4. Inspection of the abdomen to identify adhesions and additional fascial gaps.
5. Detachment of adherent gut tissue.
6. Closure of the hernia gap by fascia adaptation with continuous polypropylene suture (prolene no.1, Ethicon) with stitch (tissue bite) intervals of approximately 1 cm.

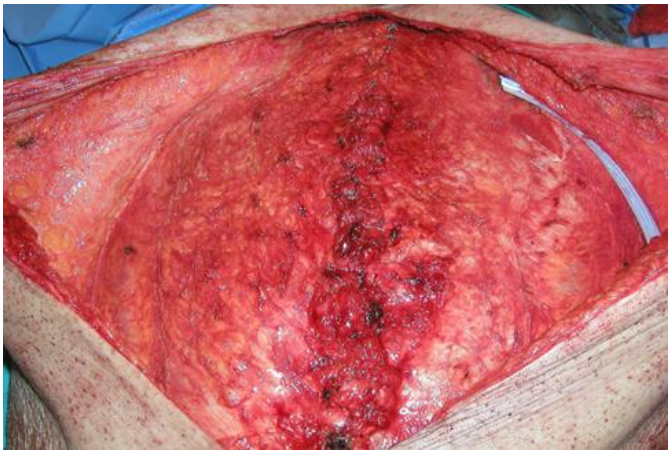


Fig 1: Closure of the fascial defect

7. On lay implantations of the prepared polypropylene mesh (prolene mesh). The distance from suture line is 5 cm in all directions. The implant is fixed to the aponeurosis without tension, with interrupted non- absorbable suture (prolene 2/0). The technique of fixation is a circular suture after fixing the four edges of the implant.

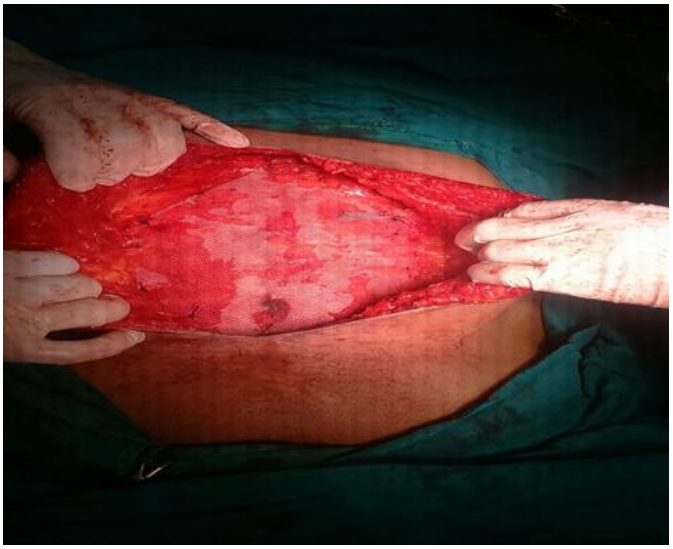


Fig 2: On lay Mesh Positioning and Fixation

Use of one or two suction drains, careful subcutaneous closure, and skin closure using skin stapler.

Technique of laparoscopic repair of ventral hernias

The patient is placed in the supine position on the surgical table with the arms extended the legs extended and abducted. The abdomen was prepped routinely, bladder and gastric decompression was employed in all cases. Laparoscopic repairs are performed under general anesthesia via 10-12 mm amera port and two to three 5 mm working ports. A 30-degree scope was used. The surgeon stands on the right side of the patient for defects located on the left side, and for midline and right defects the surgeon stands on the opposite position. The video monitor is positioned in front of the surgeon. A direct cut down approach is utilized for initiating pneumoperitoneum, with 10 mm camera port being placed as far away from the defect as possible. After induction of pneumoperitoneum direct view laparoscopic (300) is inserted to facilitate the incision of the other trocar cannulas. The number and position of working ports are individualized according to size, location, and number of defects present. In the repair of very large defects, two working ports for the surgeon and two for the assistant are usually required. Smaller defects such as umbilical and epigastric hernias can be repaired with only two or three working ports. The hernia and its contents must be viewed from different angles via the working ports throughout the procedure. One or two of the working ports must be 10 mm to accommodate the 10-mm laparoscope. The specific placement of the ports is dependent on the location of hernia. For midline, ventral hernias, a 10-mm camera port is inserted laterally via the open technique and two 5 mm ports are inserted.

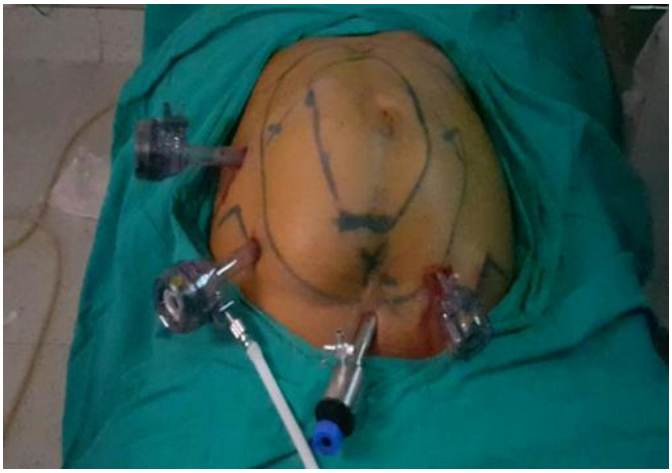
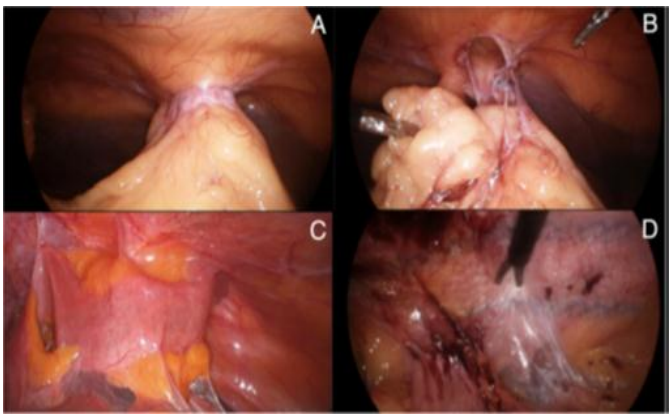


Fig 3: Port Sites in Large Ventral Hernia, for non-midline hernias a 10-mm camera port is inserted sub or supra- umbilically or laterally on the opposite site of the abdomen, and two 5 mm ports are inserted laterally away from the hernia with an intra- abdominal pressure of 14 mm Hg the entire abdominal cavity is explored under direct vision. Examination is made of abdominal wall defects, hernia contents, and adhesions.



a) Incarcerated segment of greater Omentum in ventral hernia;
b) Reduction of hernia sac content;
c) Dense adhesions between small bowel and abdominal wall; d) Sharp dissection between prosthetic material and underlying viscus.

Fig 4: Adhesiolysis in LVHR

Abdominal wall defects are freed of peritoneal and visceral adhesions, the surgeon works with dissecting and grasping forceps, scissors, and counter pressure on the outside of the abdominal wall is often very helpful. No cauterization should be done that may injure the bowel wall. Perforation of the

intestine is the most serious injury associated with laparoscopic ventral hernia repair. Then the hernia content is reduced and the defect in the fascia is outlined, a minimum of 3.5 cm from the border of the defect should be cleared of adhesions. After Adhesiolysis, the sac contents are gently reduced into the peritoneal cavity, while the peritoneal sac is left in situ. Closure of large hernia defects is done with non-absorbable sutures, even if only a limited closure is possible.

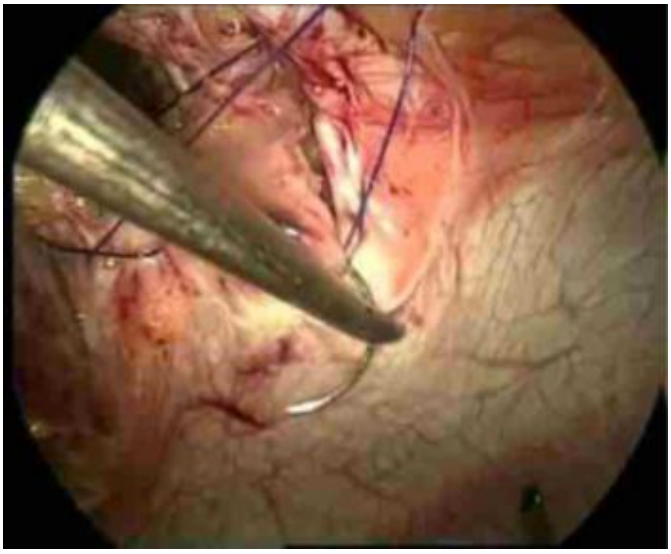


Fig 5: Closure of the Hernial Defect

Next step is to determine the borders of the hernia, which may sometimes be difficult; once the hernia defect has been defined the proper size of the mesh is determined. This is done by pushing an intra- abdominal instrument against a palpating finger on the abdomen and working out the hernia or by placing needles through the abdominal wall and confirming the position of the hernia defect. (Preoperatively an attempt should be made to palpate the edges of the defect and trace it on the abdominal wall with a marking pen). Once the hernia is marked out on the skin, the appropriate size of the mesh is then cut, Leaving a 3 –5 cm cuff or margin lateral to the fascial defect all the way around. Transfixing horizontal mattresses sutures prolene (2/0), are placed around the edge of the patch at 6 cm interval, the smooth side (which lies against the viscera) is marked, and sutures are placed, tied, and cut (leaving tails approximately 4 to 6 inches long) at 4 to 6 spots equidistant around the entire piece of the biomaterial, and numbered on the patch surface and around the traced edge of the patch on the abdominal wall. The mesh is rolled side to side after placing the suture ends down in reverse order to facilitate retrieval, and the mesh is brought in to the abdomen by using one of the graspers.

After unrolling the mesh, it should be accurately spread to overlap the edges of the defect by at least 3 to 5 cm, with the anti-adhesive surface facing the bowel. then individual sutures are brought up through 2 mm incisions in the skin with 11 blade at the 4-6 predetermined locations drawn in the pattern on the abdominal wall and tied subcutaneously using the suture passer. The sutures are tied down, with the knots lying in the subcutaneous tissue. This is repeated with each of the 4 to 6 sutures placed in the biomaterial. The process anchors the biomaterial to the entire thickness of the abdominal wall and prevents migration of the biomaterial down into the defect over time. In between the sutures, the peripheral edge of the mesh is tacked into position with 5 mm tacks or stapled with special hernia stapler. These are placed at 1 cm intervals Closure of the skin incisions is done without drains.

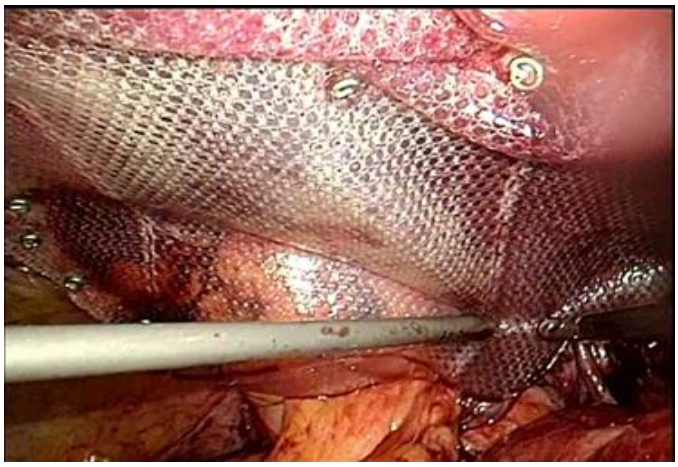


Fig 6: Tacking of the Mesh

Data collection and analysis

We recorded the following information for data analysis: patient age, gender, co morbidities, previous abdominal operations, and previous attempts at hernia repair, number and size of the hernia defects, size of the prosthetic mesh, final diagnosis, operating time, pain score, hospital stay, complications, and recurrences. At follow-up assessment (Within 12 months), a clinical examination for Complications, hernia recurrence, and pain score also were recorded.

Statistical analysis

Chi-square analysis and Fishers exact test were used to compare the relationships among categorical variables.

For the cases in which we were comparing means of continuous variables for two groups, we used the t-test to determine whether means were significantly different. A p value less than 0.05 were considered to represent statistical significance for all comparisons.

Results

This study included 50 patients with incisional or primary ventral hernias. Half of these patients were operated upon laparoscopically using proceed mesh and the other group with open surgery using polypropylene mesh with the following result:

Table 1: Comparison between the two groups according to demographic data

	Laparoscopic repair (n=25)		Open repair (n=25)		Test of sig.	P
	No.	%	No.	%		
Sex						
Male	13	52.0	13	52.0	0.000	1.000
Female	12	48.0	12	48.0		
Age (years)	57.7 ± 3.1		55.4 ± 4.5		t=2.105*	0.041*
Wall defect size (cm)	11.4 ± 9.7		12.6 ± 9.2		t=0.449	0.656
BMI (kg/m2)	29.3 ± 3.6		27.1 ± 1.9		t=2.702*	0.010*

This table shows that sex, wall defect size was insignificant between two groups p-value 1.000, 0.656 respectively, in contrary age and BMI were higher in laparoscopic repair group with significant differences between two groups p-value0.041, 0.010 respectively.

Table 2: Comparison between the two groups per co morbidity

Co morbidity	Laparoscopic repair (n=25)		Open repair (n=25)		P value
	No.	%	No.	%	
Diabetes (DM)	5	20.0	4	16.0	1.000
Hypertension (HTN)	2	8.0	3	12.0	1.000
Ischemic Heart Disease (IHD)	0	0	0	0.0	-

This table shows that D.M was the commonest co morbidity in both groups followed by HTN but with insignificant differences between two groups pvalue1.000

Table 3: Comparison between the two groups per risk factors

Risk factors	Laparoscopic repair (n=25)		Open repair (n=25)		P value
	No.	%	No.	%	
Chronic cough	3	12.0	5	20.0	0.702
Constipation	2	8.0	1	4.0	1.000

This table shows that the commonest risk factor in both groups was chronic cough followed by constipation, these risk factors were insignificant between two groups p-value 0.702, 1.000 respectively.

Table 4: Comparison between the two groups according to types of hernia

	Laparoscopic repair (n=25)		Open repair (n=25)		P value
	No.	%	No.	%	
Types of hernia					
Incisional	14	56.0	20	80.0	0.231
Umbilical	6	24.0	4	16.0	
Paraumbilical	2	8.0	1	4.0	
Epigastric	3	12.0	0	0.0	

Regarding types of hernia this table shows that the commonest type was incisional hernia then umbilical hernia then paraumbilical hernia then epigastric hernia, types of hernia were insignificant between two groups with p-value 0.231

Table 5: Comparison between the two groups according to different parameters

	Laparoscopic repair(n=25)	Open repair (n=25)	P
Duration of operation (min)	100	120	<0.001
Laparotomy size (cm)	No	16 ± 7	<0.0001
Analgesic requirements(days)	3	7	<0.001
Antibiotic requirements(days)	2	7	<0.001

This table shows that duration of operation was shorter in laparoscopic repair group than open repair group with significant differences between two groups p-value <0.001 Regarding laparotomy size it was highly significant between two groups p-value <0.0001 , analgesic requirements was higher in open repair group than laparoscopic group with significant differences between two groups p –value<0.001 Antibiotic requirements were higher in open repair group than laparoscopic group with significant differences between two groups p-value <0.001

Table 6: Comparison between the two groups according to complications.

Complications	Laparoscopic repair(n=25)		Open repair (n=25)		P Value
	No.	%	No.	%	
Bleeding	2	8.0	5	20.0	0.417
Bowel injury	0	0.0	2	8.0	0.490
Wound infection	1	4.0	4	16.0	0.349
Recurrence	0	0.0	1	4.0	1.000
Seroma formations	2	8.0	4	16.0	0.667

This table shows that common complications in both groups was bleeding, that was higher in open repair than laparoscopic repair followed by seroma formations which was higher in open group than laparoscopic group.

Table 7: Comparison between the two groups per patient's outcome

	Laparoscopic repair (n=25)	Open repair (n=25)	Test of sig	P
Post-operative hospital stay (days)	3	7		<0.0001
Time of refeeding	1st postop. day	3rd postop day		<0.0001
First peristalsis (days)	1.1 ± 0.7	2.1 ± 0.9	t=4.385*	<0.001*
First defecation (days)	1.6 ± 1.3	3.1 ± 1.6	t=3.639*	0.001*
Permanence of drain (days)	No	2.3 ± 1.6		<0.0001
Post-operative pain (Visual Analogue Scale) (VAS) pain scale	1.7	6.6		<0.0001
Return to normal activities (days)	8	20.0		<0.0001

This table shows that post-operative hospital stay was longer in open repair with significant differences between two groups p-value <0.0001, regarding time of refeeding it was shorter in laparoscopic group than open group with significant differences between two groups p-value <0.0001. First peristalsis and first defecation was earlier in laparoscopic group than open group with significant differences between two groups p-value <0.001, 0.001 respectively Permanence of drain was 2.3 days in open group and no drain in laparoscopic group p-value <0.0001, regarding post-operative pain was higher in open group than laparoscopic group with highly significant differences between two groups p-value <0.0001 Return to normal activities was earlier in laparoscopic group than open group with significant differences between two groups p-value<0.0001.

Discussion

Ventral and incisional hernia repair is one of the most common operations performed in every day clinical practice. Incisional hernia is a common long-term complication of abdominal surgery and is estimated to occur in 11–20% of laparotomy incisions. However, open hernia repair can be a major operation with considerable morbidity caused by infectious complications [25]. Although significant improvements have been achieved in the field of incisional hernia concerning operative technique and the use of prosthetic materials, recurrence rates remain high at 32% to 63%. Risk factors associated with recurrence, such as hernia size, unfortunately cannot be influenced. The quest for more effective and less invasive techniques continues. Laparoscopy has proved to be a safe, effective, efficient, and less painful technique for many types of surgery and has become the current "gold standard" for cholecystectomy, for example [11]. Laparoscopic incisional hernia repair is a widely used and accepted operative technique, assuming general advances of laparoscopy are also valid for this group. Studies have shown that in the short term laparoscopic repair is superior to open repair in terms of less blood loss, fewer perioperative complications, and shorter hospital stay [24] [31]. We aimed in the present study to compare laparoscopic vs. open ventral hernia repair, we included 50 patients with incisional or primary ventral hernias. Half of these patients were operated upon laparoscopically using proceed mesh and the other group with open surgery using polypropylene mesh. Nowadays, laparoscopic repair of ventral hernia is being accepted by most of the surgeons and patients. Almost all ventral hernias can be repaired by laparoscopy, regardless of morbid obesity and age group [34]. In the present study, we found that age and BMI were higher in laparoscopic repair group with significant differences between two groups p-value 0.041, 0.010 respectively while sex, wall defect size were insignificant between two groups p-value 1.000, 0.656 respectively. In Eker et al study 206 patients were randomly assigned to undergo either laparoscopic (n=99) or open (n=107) incisional hernia repair. The 2 groups were similar in age, sex ratio, and mean body mass index. [11] In another study by Fabozzi et al they concluded 523 patients treated for abdominal wall hernia mean age was 66 years old (range: 6072) in open group and 68 years old (range: 63-73) in Laparoscopic group [12]. Sabuncuoğlu et al study included a total of 40 patients underwent surgery for a diagnosis of incisional hernia found that there was No differences were determined between the 2 groups in respect of age, body mass index (BMI) [38]. Another study by Earle et al for the 426 patient records after October 2001, both groups was well matched for age and American Society of Anesthesiologists (ASA) classification. There were however, a significantly higher proportion of women in the laparoscopic group (male: female 1:1.7 lap, 1:0.95 open) [10]. Study by Hussain et al on Laparoscopic ventral hernia repair involved of Thirty-two men (52.45%) and 29 women (47.54%) were included in this study. The mean age was 53.42 years (range 39–80 years) [16]. In addition to the local effects such as the laparotomy site and the size of the incision, systemic conditions such as diabetes mellitus, chronic steroid usage, old age, chronic respiratory disease, malnutrition and obesity are the risk factors for incisional hernia [37]. Regarding co morbidity Bingener et al found that diabetes was the most common co

morbidity in both groups but with insignificant between two groups p-value 0.61 [5]. This in agreement with the present study as we found that the diabetes (D.M) was the commonest co morbidity in both groups followed by hypertension (HTN) but with insignificant differences between two groups p-value1.000. In Modiya et al study found that main risk factors in both groups was diabetes mellitus 20% of the involved patients followed by smoking 14% then hypertension 12% [26]. Morbid obesity, prostatism, chronic cough, wound infection, large incision, and malnutrition are considered as risk factors for ventral hernia and incisional hernia [29]. In the present study we found that the commonest risk factor in both groups was chronic cough followed by constipation, these risk factors were insignificant between two groups p-value 0.702, 1.000 respectively. In agreement with our study In Modiya et al study 6(12%) patient had chronic cough for which medication started preoperatively. Cough was brought under control started chest physiotherapy preoperatively. Patient was posted for surgery only when patient becomes fit for surgery. Treatment for cough continued postoperatively. Patients (18%) had constipation given laxatives, stool softeners before and after surgery. 4 patients (8%) had prostatism or dysuria [26]. Regarding types of hernia in the present study we found that the commonest type was incisional hernia then umbilical hernia then paraumbilical hernia then epigastric hernia, types of hernia were insignificant between two groups with p-value 0.231. In agreement with our result Hussain A et al found that most common type of hernia was Incisional hernia following laparotomy (42%), Umbilical and paraumbilical (39.34%), Spigelian hernia and Epigastric hernia (6.55%) [16]. In Khan et al study on the comparison of open and laparoscopic ventral hernia repairs found that both group were statistically similar in terms of gender, age and types of ventral abdominal hernias [18]. In comparison between laparoscopic and open hernia repair regarding duration of operation we found that was shorter in laparoscopic repair group than open repair group with significant differences between two groups p-value <0.001. In contrary to our results, Eker *et al* found that the mean operative time in the laparoscopic group was significantly longer than in the open group (76 minutes vs 100 minutes; P =.001). In the laparoscopic group, 8 of the 94 patients (8.5%) required conversion to open repair because of technical reasons. [11] Shorter operative time for laparoscopic incisional hernia repair was reported by several studies [7, 24, 31, 30]. While other studies show no differences or longer operative times in the laparoscopic group [21, 2]. In small incisional hernia, introduction of trocars and positioning of instruments can be time-consuming. In the open technique, the hernia is often already reduced within this time. In the laparoscopic technique, the positioning and fixation of the mesh to the ventral abdominal wall can be time consuming. A major factor that might have affected the operative time in the laparoscopic group was the extensive Adhesiolysis in the midline of the abdominal wall [11]. Adhesiolysis was necessary for positioning the mesh but also for observing any other small hernia or "Swiss-cheese" defects (multiple small defects). A combination of these factors could possibly explain the significantly longer operative time in some laparoscopic cases. One hundred minutes to perform a laparoscopic ventral incisional hernia repair, however, is reasonable and conforms to data from previous studies [11].

Regarding laparotomy size in the present study we found that it was highly significant between two groups p-value <0.0001, in agreement with our result Fabozzi M et al found highly significant differences between two groups regarding laparotomy size it was 16cm in open repair and non-in laparoscopic repair [12] Analgesic requirements in the present study was higher in open repair group than laparoscopic group with significant differences between two groups p – value<0.001., regarding post-operative pain was higher in open group than laparoscopic group with highly significant differences between two groups p-value <0.0001. Several small randomized studies reported no differences in postoperative pain after laparoscopic and open incisional hernia repair [29, 24, 30, 7]. One trial reported reduced use of analgesics after laparoscopic repair [30]. Postoperative pain after incisional hernia repair often originates not from the hernia itself, but from the surrounding tissues. Mesh fixation materials, e.g., tackers or Tran's facial sutures, are believed to be responsible for postoperative pain. The advantages of laparoscopy regarding surgical wounds and wound pain could possibly be offset by mesh fixation materials such as tackers and Tran's facial sutures [45]. Antibiotic requirements in the present study was higher in open repair group than laparoscopic group with significant differences between two groups p-value <0.001. Wound infection after incisional hernia repair with mesh can be catastrophic and antibiotic prophylaxis is essential. Deep-seated infection has a serious impact on quality of life and occurs in 1–2%. The only prospective, non-randomized study reported a reduction in infection rate of 50% in those who were receiving prophylaxis [35]. In agreement with our result Porecha et al non-randomized controlled study revealed that, as compared to open repair, laparoscopic repair is associated with lesser time for surgery, reduced postoperative pain, analgesic requirement and antibiotic requirement [33]. Malik et al found that the overall incidence of complications was significantly higher in Group B with open repair compared to Group A with laparoscopic repair in the form of (Prolonged Ileus, Hematoma, Intestinal injury, Seroma, Bleeding during Adhesiolysis, Cellulitis of wound site). The recurrence rate in both groups was statistically significant (p<0.05). Recurrences in open surgery were mainly seen in patients who developed overwhelming post-operative wound infection. Most of the recurrences in laparoscopic group occurred in patients who were operated early in the series and more so with huge hernias [23]. In agreement with our study Zhang Y et al found that there was no significant difference between the two groups in the incidences of hernia recurrence and other postoperative complications, as well as in postoperative pain [47]. In contrary Fabozzi M et al study. Found that the post-operative complications rate was 14% in Open group and 5% in Laparoscopic group [12]. In Parmar et al found that there were 2 patients who developed complications in form of infection and seroma formation in open group, while in the laparoscopic group there was a single patient who developed complication in the form of ileus. However, there were no any recurrences seen in any of the groups [32]. In a Meta-analysis by Forbes et al found that there was no difference in perioperative complications, such as seroma formation, but there was a trend toward reduced hemorrhagic complications and infections requiring mesh removal in the laparoscopic group. There was also a trend toward greater risk

of bowel injury in this group. Patients who underwent laparoscopic repair, however, were at a significantly lower risk of wound infections that did not require mesh removal [14]. In the present study, we found that post-operative hospital stay was longer in open repair with significant differences between two groups P value <0.0001. In agreement with our result Modiya Y et al study mean post-operative stay was shorter for laparoscopic hernioplasty group than open hernioplasty group (2.7 vs. 4.7 days) and in our study, mean hospital stay was 3 days in laparoscopic hernioplasty than open hernioplasty was 5 days [26]. The advantages of the laparoscopic approach have been confirmed in Meta-analyses as they showed that length of hospital stay is shorter by 2– 3 days and carries lower complication rates [15, 39, 40]. In disagreement to our result Eker et al found that the median duration of hospital stay was similar in the laparoscopic and open groups (3days [inter quartile range(IQR), 2-4 days] and 3 days [IQR, 2-5 days] days, respectively; P =.50) [11]. Several studies recorded a significantly shorter mean length of hospital stay after laparoscopic repair, with mean stays no longer than 5·7 days, compared with no longer than 10 days for open surgery [7, 28, 24, 31, 1]. Regarding time of refeeding in the present study we found that it was shorter in laparoscopic group than open group with significant differences between two groups p-value <0.0001, in agreement with our result Fabozzi M et al found that time of refeeding was shorter in laparoscopic group than open group [12]. In the present study, we found that First peristalsis and first defecation were earlier in laparoscopic group than open group with significant differences between two groups p-value <0.001, 0.001 respectively, this agree with the study by Fabozzi et al as they found that first peristalsis and first defecation was earlier in laparoscopic group than open repair group [12]. In the present study, we found that permanence of drain was 2.3 days in open group and no drain in laparoscopic group p-value <0.0001 Zhang et al found that the rates of wound drainage were significantly lower in the laparoscopic group than that in the open group (laparoscopic group 2.6 %, open group 67.0 %; RR = 0.06, 95 % CI 0.03–0.09; P\ 0.00001) [47]. Fabozzi M et al agree with our result as they found that permanence of the drain was longer on open repair group than laparoscopic repair group as there was no drain in laparoscopic repair group. Regarding return to normal activities in the present study it was earlier in laparoscopic group than open group with significant differences between two groups p-value<0.0001 In Modiya Y et al study in laparoscopic surgery 23 (92%) patient returned to their work within 6th to 10th post-operative day. In open surgery 20(80%) patient returned to their work within 6th to 10th post-operative day [26]. One study described return to work. Olmi et al reported a median (range) return to work of 13 (6–15) days after laparoscopic surgery compared with 25 (16–30) days after open surgery (*P* < 0·005) [30]. Robbins et al showed that the main advantage of this minimally invasive approach is a decrease in the rate of major wound complications and early return to work. [36] In contrary to our result Parmar et al found that patients could return to normal activity in about 3.2 mean days in the open group and in 2.6 mean days in the laparoscopic group. Time taken to return to routine activity was 8.8 mean days in open group and 7.8 mean days in the laparoscopic group. This was not much statistically significant as the P value for the former was 0.3 and for the latter was 0.1 [32]. Regarding cost effectiveness in the present study we found that it was higher in laparoscopic group than open group with significant differences between two groups p-value <0.001 Two studies demonstrated the operating room supply cost, and the total hospital cost between laparoscopic and open ventral incisional hernia repair. They found that for the laparoscopic surgery groups, the instrument cost was significantly higher, and the overall cost was significantly lower [20]. This analysis has proven laparoscopy to be cost-effective [46]. When compared with non-mesh repair, when considering earlier return to work and reduced recurrences, a fact that reduces the cost by 10%–15%. [13] Other revisions, such as Cochrane's [41]. Fail to provide equally definitive results; however, they evidence the superiority of laparoscopy, although for short-term studies. These experts should shoulder the responsibility of a professionalized study before it is funded by the health system, to obtain a rationalization of resources [27, 42]. It believed that the economic cost of LVHR can be balanced by the advantages of laparoscopic surgery in this procedure. In comparison to the OVHR, the LVHR is performed with less operative time, less morbidity, shorter length of stay in the hospital and there is virtually no need for a drain. The wound infection rate will be less and we are optimistic that the future series will prove less recurrence rates for LVHR. All these points make LVHR a cost-effective procedure [16]. In other studied they showed that the laparoscopic procedure carries higher operative cost than does open repair. However, it offers better cost effectiveness as it is associated with a shorter hospital stay, reduced morbidity, significantly lower mortality, and fewer intensive care unit (ICU) admissions and 30-day readmissions, and thus it significantly reduces overall hospital costs [3, 6]. Laparoscopic incisional hernia repair has been shown to be safe and efficacious, with numerous advantages for the patient and health care providers when compared to open surgery. Increasing clinical experience and greater adoption of this approach by surgeons will improve the quality of data available to support its role as the „gold standard" treatment for this commonly encountered problem [19].

Conclusion

- Laparoscopic surgery is a successful treatment option offering significant advantages to patients compared with open ventral hernia repair.
- Laparoscopic ventral hernia repair was safe and resulted in shorter duration of stay in hospital, fewer complications, early ambulatory period and less recurrence, early return to work. Hence, it should be considered as the procedure of choice for ventral hernia repair.
- The laparoscopic approach may be more suitable for straight forward hernias, with open repair reserved for more complex hernias. Laparoscopic ventral hernia repair appears to be an acceptable surgical operation that can be offered by surgeons proficient in advanced laparoscopic techniques with access to high-technology equipment.

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