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A Comparative Study between Laparoscopic and Open Incisional Ventral Hernia Repair

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Abstract: Background: Incisional hernia is a late complication of laparotomy for which an evidence-based prophylactic approach is still lacking. Postoperatively, incisional hernias occur because of multiple factors. Preoperative co morbidities belong to these risk factors. A risk reduction related to concomitant diseases mostly does not succeed. **Objective:** to prospectively compare between open and laparoscopic incisional ventral hernia repairs regarding operative and post operative outcomes of both methods. **Patients and Methods:** This Prospective study represented a comparative analysis between open prosthetic on-lay repairs for incisional ventral hernias and laparoscopic prosthetic repair. Forty patients were included in this prospective study. They were selected from the out-patient clinic of the surgical departments of Ain Shams university hospitals for research and treatment in the period from Dec 2015 to Jun 2017. **Results:** Regarding to the types of previous hernial incisions midline incision was the commonest of both groups, there were 6 patients in group A vs 7 patients in group B with no statistical significant difference between both groups P > 0.05. As regards the mean hernial defect size it ranged from (24.75±6.00) square cm in open repair group A while laparoscopic group B it ranged from (21.45±5.93) with no significant statistical difference between both groups (P 0.707). **Conclusion:** This has been very useful in our own practice, particularly in offering advice to patients with incisional ventral hernias, in whom we tend to recommend a laparoscopic repair. Laparoscopic incisional ventral hernia repair has gained wide acceptance and should be considered the standard of care for the treatment of incisional hernias.

[Khaled Abdallah Al Fiky, Mohamed Mahfouz Mohamed Omar, Mohamed Ibrahim Hassan, Eslam Ahmed El Morsi Eweis. **A Comparative Study between Laparoscopic and Open Incisional Ventral Hernia Repair.** *Nat Sci* 2019;17(10):155-164]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 21. doi:10.7537/marsnsj171019.21.

Keywords: Incisional hernia, Laparoscopic incisional ventral hernia repair, Polypropylene mesh

1. Introduction

Ventral hernia is described as being any evisceration of the intra-abdominal or pre-peritoneal contents through a fascial defect of the abdominal wall, which may or may not result in loss of abdominal domain and/or abdominal visceral disproportion [(1)].

Ventral hernias can be primary, congenital or non-operatively acquired defects in the musculo-aponeurotic coverage of the abdomen, situated between the costal arch, pubic bone and the semilunar lines. Examples of ventral hernias are umbilical, epigastric and spigelian hernias and incisional ventral hernia [(2)].

The abdomen is walled mostly by muscles enclosed in aponeurosis, fibrous sheets, that together provide strength and flexibility as a harness for the intra-peritoneal organs. The presence of an abdominal wall hernia may also give rise to physical complaints and negatively influence the quality of life and body image [(3)].

Although the corner stone of ventral hernias diagnosis is represented by accurate clinical evaluation, imaging should be utilized to rule out abdominal co-morbidities, achieve a better definition of the hernia defect and content. Ultrasound or CT scan are recommended before a scheduled operation, especially in obese patients (BMI > 30), in the emergency setting and in those suffering for larger defects or recurrence [(4)].

The repair of an abdominal wall hernia can be extremely invasive with a long and painful period of illness and even leading in some cases to a negative outcome. Surgery can be extremely complex especially for incisional hernias due to the size of defect or sac content, extent of intra-abdominal adhesions, and length of the operation [(5)].

Pain, functional and aesthetic complaints, or strangulation are the main reasons for performing an operative repair of abdominal wall hernias. Factors like the size, content and location of the hernia defect, as well as patient comorbidity define the risks of surgery and the chances of success [(6)].

The first described repairs of the ventral hernia were open, simple suture, and primary closure. Over time, closure techniques have become more sophisticated and now include tension free mesh repair and separation of components [7].

It is now proved beyond doubt that primary repair using suture repair only techniques should not be used, as they are fallowed, on long term follow up, by unacceptably high recurrence rate, 31 % – 54 %. To overcome this high recurrence rate, a prosthetic mesh repair should be used, which decreases the recurrence rate to less than 10% [8].

Open repair of incisional ventral hernias can be very challenging with significant associated morbidity. They often complicate an otherwise uneventful abdominal operation or present as an acute incarceration and strangulation mandating immediate surgical repair. Additionally, a significant period of hospitalization is often required for recovery [9].

In 1963, Usher introduced polypropylene mesh (PPM) in the repair. It has been used in open surgery successfully without much of dilemma and is the choice of many surgeons now. However, the mesh is placed in a variety of ways. Techniques of mesh placement include on-lay, in-lay and sandwich [10].

A prosthetic mesh should always be used in open ventral hernia repair. Now, (PPM) has become the prosthetic mesh of choice in the repair of hernias. However, with the advent of laparoscopic repair where the mesh is placed intra-peritoneal, concerns regarding safety of PPM are raised. Newer meshes are introduced, claiming less complications rate [11].

Laparoscopic treatment of incisional ventral hernias is a good option as compared to open surgery, having superiority in terms of shorter hospital stay and reduced wound infection rate [12].

The principle of laparoscopic incisional hernia repair is based on Rives-Stoppa repair, first published in 1985. Original Rives-Stoppa repair involved extensive tissue dissection in a myofascial plane for placement of mesh. LeBlanc and Booth first described laparoscopic repair of incisional hernia in 1993 [13].

The characteristics of an ideal mesh for incisional ventral hernia repair should include adhesion prevention on one hand and excellent fibrous in-growth on the other hand [14].

An important difference between open and laparoscopic ventral hernia repair is the position of the mesh. In open repair the mesh is preferably placed in an on lay position with respect to the abdominal muscles and extra-peritoneally, preventing direct contact between the mesh and intra-abdominal organs. In laparoscopic repair the mesh is placed in a sub-lay position intra-peritoneal, inevitably allowing direct contact of the mesh with intra-abdominal organs [15].

Complications of laparoscopic incisional ventral hernia repair (LIVHR) were tallied from different articles that were reviewed. Seroma is the most common early complication with an incidence of 7%. Recurrence is the most common late complication with an incidence of about 5%. Postoperative pain, wound infection and trocar site cellulitis, hematoma, ileus, bowel obstruction, bowel perforation, entero-cutaneous fistula, trocar site hernia, mortality and other complications were also taken into account [16].

Aim of the Work

This study aims to prospectively compare between open and laparoscopic incisional ventral hernia repairs regarding operative and post operative outcomes of both methods.

Patients and Methods

Patients:

This study was conducted in El Demerdash and Ain- Shams university specialized Hospitals on 40 patients divided into 2 equal groups 20 patients in each; (group A- Open incisional ventral hernia repair and group B- Laparoscopic incisional ventral hernia repair), operated upon from December 2015 to June 2016 with follow up of 18 months.

Inclusion criteria:

Patients with incisional ventral hernias after 1 year of last abdominal operation that are: Male or female patient, age (18 – 60 year). Uncomplicated hernia. Patients fit for GA. Patient willing for surgery.

Exclusion criteria:

Patients who: Are generally unfit for operation (ASA III, IV or V). Patients with chronic cough, ascites, or active abdominal infection. Pregnant female patients and patients with previous history of mesh application on the anterior abdominal wall. Complicated hernia which needs emergency intervention. Patients undergoing additional procedures at the time of hernia repair, such as planned bowel resection. Contraindications of laparoscopic surgery: Pregnancy, Congestive heart failure, respiratory insufficiency. Patient with chronic liver disease child C or B with ascites not responding to medical treatment.

Methods:

All patients were subjected to the following**:**

Preoperative assessment:

Clinical Scope:

Full clinical history i.e. Personal history, Present history, Past history. Full clinical examination i.e. vital signs, body examination with Stress on the general parameters, height, weight and hence BMI calculation. Body mass index = weight in kilograms/ height in meters ^{2} ***(Bruce, 2005).*** Local examination for the hernia including site, size, number of defects, signs of previous repair, reducibility, cough impulse, tenderness, overlying skin and scars of previous

operations and hernial complications, ie irreducibility or strangulation. Investigations. Routine laboratory investigations required for preoperative assessment as CBC, INR, random blood sugar, (AST, ALT), total bilirubin albumin, kidney function tests; Abdominal ultrasound, ECG and chest X ray when required. Pulmonary function tests especially for those patients with history of pulmonary disorders.

2. Method of randomization:

Computed method was done where the patient was blindly randomized into either group (A) or group (B) preoperatively.

Intra-operative assessment:

Operations were done under general anesthesia with close monitoring. Patients are placed in a supine position, and the skin is prepared and sterilized with betadine.

Operative technique for open incisional ventral hernia repair:

Patients in the 1st group were subjected to incisional ventral hernia repair via open prosthetic on-lay repair through the following technique. The skin was incised over the hernia with removal of the old scar. The wound was deepened between the deep fascia and the aponeurosis of the external oblique muscle. The hernia sac was then identified and deep fascial flaps were raised 5 cm or more around the defect site The sac was reduced into the abdominal cavity.

Postoperative assessment:

Medication:

Adequate postoperative analgesia was necessary to improve mobility and decrease pulmonary complication. Uses of analgesics according to analgesics ladder starting with non steroidal anti inflammatory drugs (NSAIDs).

Prophylactic use of low molecular weight heparin (LMWH) was used to prevent venous thrombo-embolism, its dose is adjusted according to the body weight. Subcutaneous administration of low-molecular-weight heparin (enoxaparin) 1 mg/kg dose of given every 24 hs.

A prophylactic dose of broad spectrum antibiotic was given to the patient at skin incision and continued during the stay in hospital.

Appropriate fluid resuscitation is essential and can be managed with 200 mL/hr of intravenous fluids. (usually lactated Ringer's), with boluses given as needed to maintain urine output.

Early postoperative ambulation is strongly encouraged, with patients getting out of bed the evening of surgery and walking by postoperative day one.

A normal diet was begun on the first day post-operative once the patient had audible intestinal sounds.

Discharge: Discharge occurred when the patient was mobile and tolerating an oral diet, has adequate pain control with oral analgesics, and exhibits no signs of complication.

Follow up and assessment: All patients will had regular visits 1 week, 1month,6 month,12 months and 18 months.

All patients were subjected to comparative assessment including:

Operative time. Intra-operative complications including bowel injury, bleeding and entrapment of bowel or abdominal contents in sutures or tacks. Conversion to open repair in laparoscopic group. Post-operative hospital stay in days and hours. Post-operative pain by visual analogue scale (VAS). Return to normal activities. Post-operative complications including early complications like (surgical site infection, persistant pain, ileus, seroma, early recurrence, mechanical obstruction, hematoma formation and bowel injury) and late complications like (entero-cutaneous fistula, trocar site hernia, recurrence, late seroma, mesh bulging and mortality). Aesthetic outcome.

Table (1): Comparison between group A: open and group B: laparoscopic according to demographic data.

Demographic data	**Group A: Open** ***(n=20)***	**Group B: Laparoscopic** ***(n=20)***	**t/x2#**	**p-value**
Sex Female Male	 11 (55%) 9 (45%)	 13 (65%) 7 (35%)	0.000	1.000
Age (years) Mean±SD Range	 40.75±7.72 28-59	 40.55±11.35 22-57	0.004	0.948
BMI [wt/(ht)^2] Mean±SD Range	 29.87±5.68 22-38	 31.93±6.07 23-39	1.108	0.275

This table shows no statistically significant difference between groups according to demographic data.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

Independent-samples t-test of significance was used when comparing between two means. Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: Probability (P-value) P-value ≤0.05 was considered significant. P-value ≤0.001 was considered as highly significant. P-value >0.05 was considered insignificant.

3. Results

Table (2): Comparison between group A: open and group B: laparoscopic according to comorbid disease.

Comorbid disease	Group A: Open *(n=20)*	Group B: Laparoscopic *(n=20)*	x2	p-value
Asthmatic	2 (10%)	1 (5%)	1.026	0.311
DM	2 (10%)	2 (10%)	0.000	1.000
Chronic constipation	1 (5%)	2 (10%)	1.026	0.311

Table (3): Comparison between group A: open and group B: laparoscopic according to type of previous incision (previous operation).

Type of previous incision (previous operation)	Group A: Open *(n=20)*	Group B: Laparoscopic *(n=20)*	x2	p-value
Kocher	2 (10%)	2 (10%)	0.000	1.000
Left subcostal	2 (10%)	0 (0%)	0.526	0.468
Lower midline	3 (15%)	3 (15%)	0.000	1.000
Midline	5 (25%)	3 (15%)	0.526	0.468
Pfannansteil	4 (20%)	6 (30%)	0.526	0.468
Port site	1 (5%)	2 (10%)	1.026	0.311
Upper midline	3 (15%)	4 (20%)	1.026	0.311

This table shows no statistically significant difference between groups according to type of previous incision (previous operation).

Table (4): Comparison between group A: open and group B: laparoscopic according to defect size (cm).

Defect size square (cm)	Group A: Open *(n=20)*	Group B: Laparoscopic *(n=20)*	t-test	p-value
Mean±SD	24.75±6.00	21.45±5.93	0.143	0.707

This table shows no statistically significant difference between groups according to defect size (square cm).

Table (5): Comparison between group A: open and group B: laparoscopic according to operative time (min).

Operative time (min)	Group A: Open *(n=20)*	Group B: Laparoscopic *(n=20)*	t-test	p-value
Mean±SD	129.41±30.17	91.50±24.81	4.340	<0.001
Range	80-180	60-140		

This table shows highly statistically significant difference increase group A from Group B according to operative time (min).

Table (6): Comparison between group A: open and group B: laparoscopic according to hospital stay (day).

Hospital stay (days)	Group A: Open *(n=20)*	Group B: Laparoscopic *(n=20)*	t-test	p-value
Mean±SD	2.55±1.43	1.65±1.23	4.560	< 0.05
Range	1-8	1-6		

This table shows statistically significant difference increase group A from Group B according to hospital stay (days).

Table (7): Comparison between group A: open and group B: laparoscopic according to return to normal activities in days.

Return to normal activities in days	**Group A: Open *(n=20)***	**Group B: Laparoscopic *(n=20)***	**t-test**	**p-value**
Mean±SD	8.05±3.25	3.15±0.93	41.949	<0.001
Range	6-21	2-5		

This table shows highly statistically significant difference increase group A from Group B according to return to normal activities in day.

Table (8): Comparison between group A: open and group B: laparoscopic according to postoperative pain (VAS).

Post operative pain (VAS)	**Group A: Open *(n=20)***	**Group B: Laparoscopic *(n=20)***	**t-test**	**p-value**
Mean±SD	6.10±1.45	3.20±0.77	62.663	<0.001
Range	4-8	2-4		

This table shows highly statistically significant difference increase group A from Group B according to post-operative pain according to (VAS).

Table (9): Comparison between group A: open and group B: laparoscopic according to intra-operative complications.

Intra-operative complications	**Group A: Open *(n=20)***	**Group B: Laparoscopic *(n=20)***	**t-test**	**p-value**
Bowel Injury	0 (0%)	1 (5%)	1.026	0.311
Bleeding	0 (0.0%)	0 (0.0%)		
No	20 (100%)	19 (95%)		

This table shows no statistically significant difference between group A and Group B according to intra-operative complications.

Table (10): Comparison between group A: open and group B: laparoscopic according to postoperative complications.

Post-operative complications	**Group A: Open *(n=20)***	**Group B: Laparoscopic *(n=20)***	**t-test**	**p-value**
No	10 (50%)	15 (75%)	4.609	0.048
Yes	10 (50%)	5 (25%)		
Hematoma	1 (5%)	0 (0%)	1.026	0.311
Ileus	2 (10%)	0 (0%)	2.105	0.147
Infected mesh	1 (5%)	0 (0%)	1.026	0.311
Infected Seroma	1 (5%)	0 (0%)	1.026	0.311
Seroma	2 (10%)	5 (25%)	1.558	0.212
Wound dehiscence	1 (5%)	0 (0%)	1.026	0.311
Superficial wound infection	2 (10%)	0 (0%)	2.105	0.147
Recurrence	0 (0%)	0 (0%)	1.0	1.0

This table shows statistically significant difference between group A and Group B regarding the overall post-operative complications.

Table (11): Comparison between group A: open and group B: laparoscopic according to aesthetic outcome.

Aesthetic outcome	**Group A: Open *(n=20)***	**Group B: Laparoscopic *(n=20)***	**t-test**	**p-value**
Acceptable	14 (70%)	17 (85%)	1.290	0.256
Unacceptable	6 (30%)	3 (15%)		

As regards table (11) there was no significant difference in the aesthetic outcome 14 (70%) patients in open group were satisfied while 6 (30%) patients were unsatisfied, on the other hand in the laparoscopic group 17(85%) accepted the cosmetic outcome and 3(15%) patients had unacceptable outcome after

complete wound healing. Only one patient had a hypertrophic scar in the open repair group (A) that was managed by scar revision by plastic surgeons. P-value 0.25.

Hyper trophic scar appeared in one case of group (A) 5 % and was managed by scar revision by plastic surgeons.

This table shows no statistically significant difference between group A and Group B according to aesthetic outcome.

4. Discussion

Incisional hernia is one of the most common long term complication of abdominal incisions, with an overall incidence of 3 to 20%. Approximately 1 million hernia operations are performed each year [(17)].

Before the introduction of mesh prosthesis for repair of incisional hernia only open suture repairs were used for its cure but with an unacceptable rate of recurrence of more than 50%. With the introduction of mesh prosthesis the rate of recurrence has been brought down but surgeons worldwide had to face wound related complications thus increasing the morbidity of the procedure. Laparoscopic incisional hernia repair has been steadily accepted by surgeons as it eliminates the main complication of open mesh repair ie wound related complications and at the same time even further decreases the risk of recurrence, 16.5% open mesh repair v/s 4.0 for laparoscopic incisional hernia repair [(18)].

In his study ***Qadri*** [(19)] laparoscopic and open incisional hernia repair using polypropylene mesh - A comparative single center study suggests that these hernias are more common in females than males as 66 % in open group 57 % in the laparoscopic group. It is also observed in our study that 55% patients were females in the open repair group vs. 65% for the laparoscopic group. While in ***Qadri*** study females were 72 % in open group while 60 % for laparoscopic group.

Because hernias are far less age-dependent than other conditions are, a large proportion of the patients undergoing hernia repair are relatively young. ***In this*** study most of the patients were around 40 years old with mean 40.75±7.72 yrs for open group and 40.55±11.35 yrs in the laparoscopic group. Other studies may differ in the mean age ***Pring et al.*** [(20)] study showed 55 (48.5–72) years as mean age for open group while in laparoscopic group it was 64.5 (50.8–75.3) years.

Obesity is an important factor in the causation of incisional hernias and also complicates the treatment of these hernias [(21)]. Other studies like ***Rogmark*** [(22)] BMI had no obvious difference concerning BMI from our study contributing 29.3 in open group vs 29.3 for laparoscopic group. According to ***Itani*** [(23)] study the mean BMI in open group was 31.2 while in laparoscopic group it was 30.6. ***Qadri*** [(19)] also in his study showed no remarkable difference from other studies that open group showed mean BMI 28.5 range of (22-33) while laparoscopic group showed mean BMI of 29.1 and range of (21-37) In this study it was noted that average BMI for open group (A) was 29.87±5.68 while in laparoscopic group (B) it was 31.93±6.07. [(21)]

Co□morbidities: Diabetes mellitus, jaundice, malignancies, chronic lung diseases, prostatism, chronic constipations, as well as heavy lifting are well known risk factors for hernia development by increasing the intra□abdominal pressure, delaying healing and delaying collagen synthesis [(24)].

In this study comorbid disease occurred in 10 patients with percentage of 25 % of all patients. Asthmatic patients were 2 patients 10 % in open group and 1 patient 5% while diabetic patients were equal in both groups 2 patients (5%) in both groups. Chronic conistipation patients were 1 (5%) in open group vs 2 patients (10%) in laparoscopic group. It did not differ a lot from ***Rogmark*** [(22)]study where asthmatic patients were (7.5%) in open group vs (12.5 %) in laparoscopic group while diabetic patients were (10%) in both groups while chronic constipation patients were 20% in open group vs 10 % in laparoscopic group.

The nature of the surgical operation; operations in which there may be wound contamination (bowel resection or secondary peritonitis), surgery for malignant tumours, abdominal aortic aneurysm, stoma closure, major abdominal surgeries and operations followed by open abdomen treatment with negative pressure and delayed primary wound closure, are all risk factors for development of IH [(25)].

In this study midline incision was the most common in open group contributing to 30 % with mean defect size 24.75 square cm vs 35 % in laparoscopic group with mean defect size 21.45 square cm. ***Rogmark*** [(22)] study also had midline incision as most common incision 60 % in open group with mean defect size 25 square cm and 70 % in laparoscopic group with mean defect size 36. In ***Rogmark*** study midline incisional hernias contributed 90 % in open group with mean defect size 23.2 (and 85% in laparoscopic group with mean defect size 23.8.

One main advantage of the laparoscopic technique is the possibility of defining not only the clinically obvious fascial gap but also the beginning dehiscence of the original incision more or less adjacent to the primary defect. Limited adhesolysis means losing this advantage. Adhesions near the bowel should be lysed with scissors without any energy source to prevent thermal injury [(26)]. Bowel

injury one of major intra operative complication during adhesiolysis which is a commonest fear in laparoscopic incisional hernia repair procedure [27].

The frequency of enterotomies reported in the Cochrane review were 1.5% in the LR and 0.6% in the OR group [12]. According to ***Itani*** [23] study bowel injury was 5 % in three patients in the form of enterotomies and occurred only in the laparoscopic group. These injuries were recognized and addressed intraoperatively by converting the laparoscopic procedure to an open repair and placing a polypropylene mesh. According to ***Rogmark*** [22] in his study three bowel serosal injuries were detected during laparoscopic surgery and repaired without conversion and postoperative complications. According to ***(Eker, 2013)*** study the overall perioperative complication rate for laparoscopic repair (10%) was significantly higher than open repair (2%) (*P* =.049). The operative complications included enterotomy, serosal bowel injury, and bladder perforation. Postoperative complications occurred more often in the laparoscopic group; however, the difference in postoperative complications was not significant (35% vs 26%; *P* =.13).

As for Intra operative bleeding rates did not differ a lot from other studies. In ***Rogmark*** [22]study Omental bleeding occurred in only one case in the laparoscopic group (1.6%) while (0%) for open group. Other study [23] *and* ***(Acsencio 2008)*** showed the same results of this study with (0%) incidence.

In this study only 1 patient in group (B) during laparoscopic repair had small bowel injury with conversion to open procedure. It was 5% of laparoscopic group, 2.5% of all patients (p-value > 0.311) with no statistical significant differences between the two groups. This case patient had large incisional hernia with severe adhesions with difficult adhesolysis and unclear anatomy. The operation was converted to open procedure. Adhesolysis was carefully done with good intestinal exploration anti mesenteric tear was noticed at small intestine primary repair was done using vicryl 2/0 in 2 layers, with good peritoneal wash. Patient stayed 5 days post operatively, follow up revealed that there were no further complications after discharge. There was no major intraoperative complications in the open group.

Regarding to post-operative complications and recurrence results in ***Itani*** [23] study, wound hematoma occurred in 4 patients of both groups (5.6 %) of all patients. Two at each group with conservative management. ***(Eker, 2013)*** showed a (10%) of post-operative wound hematoma without the need for intervention. In this study, post operative **haematoma** occurred in one patient in group (A) after open repair 5% in open group (A) 2,5 % of total patients. (P = 0,48) with significant difference between both groups that laparoscopic group had less over all complications. Haematoma was discovered in 1 patient of the open group on the 4th day post-operative and treated conservatively with u/s follow up and 7 days of oral antibiotics then started to decrease in size and then disappeared within one month.

Recurrence rate after 16 months follow up showed no incidence in this study. In ***Qadri*** [19] study the recurrence rate in was 2.5% in laparoscopic group and 2.5% in open group. ***Itani*** [23] study showed that overall recurrence rate up to 2 years for the laparoscopic repair group was (12.5%) with no difference from that for the open repair group (6 of 73 patients [8.2%] ***Rogmark*** [22] showed in his study that the recurrence rates were 0% in both operations ***Pring*** [20] in his study showed equal recurrence rates of 1 % for both groups.

According to ***(Eker, 2008)*** Postoperative complications occurred more often in the laparoscopic group; however, the difference in postoperative complications was not significant (35% vs 26%; *P* =.13). Seroma occurred in 4 % patients in the open group and 7 % patients in laparoscopic group.

In ***(Asencio, 200)*** study local complication rate was superior in the LG (33.3% versus 5.2%) (p\0.001). Except for a colonic fistula in the patient with bowel perforation, and a port-site hematoma, the other local complications were seromas of the unresected hernial sac, the majority of which did not require aspiration. ***Pring et al.*** [20] study showed seroma rate of 17% in the laparoscopic group and 33% in the open group, after 6 weeks of follow up however, there were two seromas in the laparoscopic group (6.7%) and none in the open repairs. In this study Seroma developed post operatively in 7 cases (17,5%) of all cases. Two cases were in group (A) 10 % in comparison to 5 cases in group (B) 25% of laparoscopic group p - value > 0.05. Seroma significantly developed more in laparoscopic group. Only one patient in open group (A) had infected seroma and needed drainage of the seroma and received oral antibiotic and daily dressing for 7 days and seroma resolved after 2 weeks. All other seromas were self-limed and treated conservatively then disappeared within 2 months.

According to ***Pring et al.*** [20] two patients required removal of the mesh. One was following repair on day 5 because of a Staphylococcus aureus mesh infection. The other patient developed a wound abscess that cultured skin organisms, the mesh was removed on day 25. Both these patients underwent primary suture repair of the hernia at the time of mesh removal. Mesh infection occured in this study, it happened in 1 case (5%) in open repair group (A) while no mesh infection was detected in the laparoscopic group B (0%).

This complication was discovered 8 days postoperatively. Presenting with small sinus discharging sero-purulent material in increasing amount.

The patient was admitted to the hospital starting with IV antibiotics and aggressive dressing with no response. The problem necessitated debridement under general anesthesia with removal of the mesh and wound closure with completely aseptic technique. This patient stayed for long time (about 20 days) in hospital for antibiotics according to culture and sensitivity test with twice daily dressing.

The wound-related complications include wound hematoma, infection, dehiscence, necrosis, chronic sinus, seroma, and long-term chronic pain. According to ***(Asencio, 2008)*** study, the incidence of wound-related complications from open mesh repair ranges from 3.5% to 18%, whereas for laparoscopic repair the reported overall incidence is 2%. ***Pring et al.*** [20] study showed incidence of (3.3%) in laparoscopic group Vs (16.7%) in open group patients concerning wound related complication and infection. ***(Eker, 2013)*** in his study shows wound infection in 3.3 % of laparoscopic group vs 16.7 % in open group.

In this study superficial wound infection occurred in 2 patients in group (A) 10 %. P value > 0.05 with no significant statistical differences between both groups.

All cases treated conservatively by dressing and debridement of infected areas under local anesthesia with complete recovery after 30 days.

The high complication rate associated with open repair seems to be due to extensive lateral dissection and subcutaneous drainage placement, which increase infection rate. Infection is one of the major risks in the development of recurrent incisional hernias. Laparoscopic IH repair is thought to be a better approach because it does not require extensive dissection of subcutaneous tissue and postoperative drainage [23].

According to ***(Park, 1998)*** study and during follow-up, hernia recurrence developed in 6 patients in the laparoscopic repair group 10 % and in 17 patients in the open repair group 34 %. In this study hernia recurrence showed statistically non-significant differences between both groups as it did not occur in either groups.

Most of our patients in laparoscopic group were subjectively more comfortable in the postoperative period and were ambulant on 1st postoperative day. The mean hospital stay was significantly shorter in laparoscopic incisional hernia repair group (1.65±1.23) days as compared to open repair group (2.55±1.43) days. ***Qadri*** [19] stated in his study that the mean hospital stay in days was 4.33(2-7) for open repair while for laparoscopic repair it was 1.53 (1-6) days. ***Rogmark*** [22] in his study showed that there was no significant difference between both group in mean postoperative hospital stay, 2 (1–3) days for open group and 2 (1.5–3) for laparoscopic group. ***Eker*** [28] study stated that the median duration of hospital stay was similar in the laparoscopic and open groups (3 days) in both groups. ***Pring et al.*** [20] study also showed no significant difference in the term of Median length of hospital stay in days which was 1 (1–2) days for laparoscopic group and 1 (1–1.8) days for open group.

De-Maria [29] and ***Raftopoulos*** [30] in their series found that patients had less pain following laparoscopic repair compared to open repair group. ***Qadri*** [19] study showed (mean VAS 3.6 for laparoscopic group and 4.0 for open group). ***Pring et al.*** [20] study showed median pain score at 24 h of 6 (5–8) for laparoscopic group and 6.5 (5–8) in open group. According to ***Bathalapalli*** [31] study, visual analogue scale grade (0-5) was median grade 4 in open group as compared to median grade 3 in laparoscopic group. However in this study according to visual analogue scale (VAS), laparoscopic group patients had less pain than open repair group as follows (3.20±0.77) in laparoscopic group VS (6.10±1.45) in the open group.

Time needed to return to normal activities showed variations in many studies. ***Pring et al.*** [20] showed that the time to return to normal activities in weeks was 4 (3–4.3) weeks for laparoscopic group and 4 (2.3–6) weeks for open group. ***Itani*** [23] study shows no differences in the times to resume normal activities (daily, work, re-creational, social, and sexual activities) were observed between the 2 groups. The median time to resume daily activities was 8 days for both groups. The time to resume work activities for the laparoscopic group was shorter (median, 23.0 days; interquartile range, 30 days) compared with that for the open repair group (28.5 days; 44 days). In this study there was a significant difference between both group regarding full recovery and return to normal daily activities. Open group needed 8.05±3.25 with range 6-21 weeks and laparoscopic group needed 3.15±0.93 with range 2-5 weeks to resume normal work activities.

Occurrence of incisional hernia has a significant impact on health-related quality of life and body image, and most patients require life style modifications and seek surgical repair because of pain, physical discomfort, and cosmetic reasons [32].

Bathalapalli [31] study shows that 15 patients who underwent laparoscopic repair felt they had good cosmetic result while only one patient in open group felt good. 10 patients in open group felt that they had bothering scar as compared to one patient in laparoscopic group. However in this study there was

no significant difference in the aesthetic outcome 14 patients in open group were satisfied while 6 patients were unsatisfied, on the other hand in the laparoscopic group 17 accepted the cosmetic outcome and 3 patients had unacceptable outcome after complete wound healing. Only one patient had a hypertrophic scar in the open repair group (A) that was managed by scar revision by plastic surgeons.

Conclusion

Laparoscopic incisional hernia repair offers lower postoperative morbidity, reduced operative time, early oral feeds and ambulation, reduced hospital stay and advantages in terms of blood loss, avoidance of drains, better cosmesis, reduced recurrence and ability to do the procedure in obese patients and multiply scarred abdomen. The approach carries a higher risk of bowel injury during surgery, but it has a significantly lower risk of SSI. Laparoscopic repair offers a quality of life and patient satisfaction comparable to or better than that of open repair, and the recurrence rate is equivalent. Even for the repair of large hernias, laparoscopic incisional hernia can help to reduce the abdominal wall complications associated with the open technique. For all these reasons, laparoscopic incisional ventral hernia repair is used with increasing frequency in everyday surgical practice. This has been very useful in our own practice, particularly in offering advice to patients with incisional ventral hernias, in whom we tend to recommend a laparoscopic repair. Laparoscopic incisional ventral hernia repair has gained wide acceptance and should be considered the standard of care for the treatment of incisional hernias.

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9/8/2019