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Laparoscopic Para-Umbilical Hernial Repair versus Conventional Surgical Management

MOHSEN H. ABD EL-KADER, M.Sc.; MAHMOUD Th. AYOUP, M.D.; MOHAMED B.M. KOTB, M.D.; ABD EL-RADI A. FARGALY, M.D. and MOSTAFA Th. AHMED, M.D.

The Department of General Surgery, Faculty of Medicine, Assiut University

Abstract

Background: Para-umbilical hernia repair has shown a progressive development. It was initially performed by the open technique. With the introduction of new mesh types, laparoscopic para-umbilical hernia repair is gaining increasing acceptance.

Patients and Methods: The study included 45 patients with para-umbilical hernia with defect size 3cm or less. 15 of these patients were operated upon laparoscopically (group 1) using composite mesh, and the other group (group 2) with open surgery using polypropylene mesh.

Results: Group 1 showed less post-operative complications and short hospital stay in comparison to the open (group 2). It also showed no recurrences in comparison to 6.7% for the group 2 but group 1 is accompanied with long operative time and high cost.

Conclusion: Our results suggest that laparoscopic para-umbilical hernia repair is safe, effective and technically feasible operation with reduced morbidity, earlier recovery and shorter hospital stay and less recurrence rate than the open group.

Key Words: *Para-umbilical hernia – Laparoscopic.*

Introduction

SINCE the first report by Leblanc and Booth **[1]** in 1993 laparoscopic ventral hernia repair has gained increased popularity among surgeons as well as patients over the conventional repair done through laparotomy with or without mesh. Among the benefits of the laparoscopic approach when compared to open mesh repair are the reduced postoperative pain, overall complication rate and hospital stay **[2]**.

The use of mesh in open repair has become the rule since the superiority of the abdominal wall prosthetic reinforcement was demonstrated **[3]**. However, this means the use of long incisions, large subcutaneous flaps and prolonged drainage. While the advantages of laparoscopy over the open repair are still unclear, the risk of recurrence seems to be equivalent with rates of 9% or less for the most recent publications **[4]** when compared to large series of open repair with mesh **[5]**.

However, so far there is no general agreement on whether the laparoscopic treatment should be used in very small or very large ventral hernias or a primary method for repair. The use of composite mesh has as allowed a secure intraperitoneal placement of the mesh in contact with the visceral content.

Over the years, the laparoscopic approach for ventral hernia repair has demonstrated its feasibility and reliability with a low rate of conversion to open and the ability to treat even the largest abdominal wall defects. Intraperitoneal mesh placement has been made possible with the use of composite mesh, avoiding the risk of bowel fistula and with a reduction in adhesion formation **[6]**.

The two advantages of the laparoscopic approach are clearly the reduced risk of postoperative complications and the shorter hospital stay in comparison to the more traditional open approach **[11,15]**.

Correspondence to: Dr. Mohsen H. Abd El-Kader,
E-Mail: dr_mohsenhassan3088@yahoo.com

Abbreviations:

ASA : American Society of Anaesthesia.
BMI : Body Mass Index.
PDS : Poly-Dioxanone Suture.
PUH : Para-Umbilical Hernia.

However the potential risk of bowel injury during the hernia dissection should be considered as a specific of this procedure.

The pitfall for intraperitoneal placement of composite mesh gives as good results as the open approach with onlay or sublay polypropylene or polyester mesh. Improvements in mesh fixation techniques could reduce the risk of post-operative pain and make the laparoscopic approach with intraperitoneal composite mesh an even more credible alternative to ventral hernia open repair [7].

Patients and Methods

Study design:

The study was a single-center, quasi experimental clinical trial study.

Study setting:

The study was carried out at Assiut University Hospital. The hospital is a main Teaching Hospital for Assiut University, Faculty of Medicine. Adult patients with para-umbilical hernias are seen in the general surgery outpatient clinic. The general out-patients clinic is run by a general surgery professor who is assisted by assistant lecturer, senior residents, intern doctors, nursing officers. The study was conducted between January 2016 and February 2017.

The study included 45 patients with para-umbilical hernia with defect size 3 cm or less. 15 of these patients were operated upon laparoscopically using composite mesh (DYNA mesh IPOM), and the other group with open surgery using polypropylene mesh.

Population:

Target population:

All adult patients with para umbilical hernias who seek treatment at the General Surgery Department (unit BI). Assiut University Hospital during the study period.

Study population:

All adult patients who presented in the outpatient clinic with a primary, reducible para umbilical hernia and consented to participate in the study.

Selection criteria:

Inclusion:

Participants:

- Male or female adults.
- Patients with a primary, uncomplicated para umbilical hernia.
- Patients who are fit for anaesthesia (ASA score 1 & 2).
- Patients who provide a written informed consent.
- Patient who agree to provide short term outcome data and agree to provide contact information.

Exclusion:

- Male and female children.
- Patients who are unfit for anesthesia (ASA score more than 2).
- Patients with large hernia with defect more than 3cm.
- Patients requiring any other concomitant surgical procedures.
- Patients who have been undergone previous abdominal surgical procedures interfering with the repair technique e.g. recurrent para umbilical hernia.

Interventions:

Preparation:

All patients were subjected to the following:

Full clinical assessment in the form of full history and physical examination including clinical assessment of the size of the defect.

Routine preoperative laboratory investigations, including full blood count liver function tests, kidney function tests and ECG.

All patients were hospitalized the day before surgery, all patients were kept fasting 8 hours before surgery.

Informed consent was taken from all patients.

Antibiotic prophylaxis was given with induction of anesthesia as a single intravenous dose in the form of ultracillin (sulbactam/ampicillin) 1500mg-SEDICO Company. Then another dose after 12 hours.

The operation was conducted under general anaesthesia.

Nasogastric tube, and Foleys catheter were inserted after intubation and were removed at the end of the laparoscopic procedure.

All the patients were assessed for the following:

- Duration of the procedure (to compare the operative time needed for each case of both groups).
- Length of hospital stay.
- Post-operative pain score.

- Resumption of oral diet.
- Return to normal activity.
- *Early and late complications:*

1- Seroma and hematoma.

2- Wound infection.

3- Infected mesh.

4- Bowel injury.

5- Early recurrence.

In the laparoscopic group (group 1) of the 15 patients 9 were females and 6 were males. The age ranged from 22 to 50 years. In open surgery (group 2) of the 30 patients 19 were females and 11 were males. The age ranged from 22 to 65 years.

Repair techniques:

Technique of laparoscopic repair of para-umbilical Hernia:

- The patient is placed in the supine position on the surgical table. The arms extended and the legs extended and adducted.
- General anaesthesia is used for all patients in group 1.
- Bladder and gastric decompression was employed in all cases.
- Monitor is placed on the right side of the patient with the surgeon and the assistant on the left side of the patient.
- Skin preparation by 10% bovidine iodine.
- A pneumoperitoneum (with $CO_{2\ gas)}$ is achieved with a Veress needle insertion. The preferred site for initial access is the Palmer's point, (a point 3cm below the left costal margin in the midclavicular line). This point is least likely to encounter intra-abdominal adhesions.
- The main trocar was inserted using 10mm port, being placed on the left side as far away from the defect as possible to be limited laterally by the anterior axillary line and at the level of the umbilicus. Direct view laparoscopic (30 degree) is inserted to facilitate the introduction of the other trocars.
- Laparoscopic exploration of the abdomen and searching for any other hernial defects is done.
- Another two working trocars are inserted using 5mm ports. Their site is on the left side at the mid clavicular line, one just below the left costal margin and the other in the left iliac fossa.
- A fourth optional 5mm port can be created on the right side at the level of the umbilicus in the anterior axillary line to assist mesh unfolding and fixation.
- Laparoscopic exploration of the abdomen is done.
- Reduction of the hernia content is done, both blunt and sharp dissection are required, and counter pressure on the outside of abdominal wall is often very helpful. Once this is done, the next step is to determine the borders of the hernia defect.
- After the viscera are reduced, identification of the border of the defect is done by placing needles through the abdominal wall and confirming the position of the hernia defect.
- Once the hernia defect has been defined the proper size of the mesh is determined which depends on the size of the defect. The mesh size should cover the defect with 3 to 5cm overlapping.
- Four sutures of 2-0 PDS or Vicryl sutures are tied to the four corners of the mesh.
- The mesh is then rolled and introduced to the abdominal cavity through the 10mm port and then unfolded.
- Fixation of the mesh to the abdominal wall is performed by introduction of suture passing instrument and pairs of corresponding sutures are individually pulled trans abdominally and tied together through 2mm skin incisions and buried in the subcutaneous tissue.
- We did support fixation of the composite mesh via 5mm tacks, one cm apart with double crowning technique.
- Pneumoperitoneum is released and port sites are closed.
- No drains were inserted.
- Closure of the fascial defect at the 10mm port site was done via vicryl 0, and skin incision via 4 o vicryl subcuticular closure.
- Both nasogastric tube and Foleys catheter were removed before extubation.
- Patients start oral feeding after complete recovery from anaesthesia.

Technique of open repair with Mesh:

The established technique of surgical treatment of para umbilical hernia is the onlay mesh fixation.

The following technique of on lay implantation was done:

- The patient is placed in the supine position on the surgical table. The arms extended and the legs extended and adducted.
- General anaesthesia is used for all patients in group 2.
- Skin preparation by 10% bovidine iodine.
- Transverse skin incision above the hernia bulge is done.
- Dissection of the sac from the surrounding sub cutaneous tissue till the neck of the sac.
- Opening of the hernial sac.
- Dissection of adherent intestine and intra-abdominal reduction of any contents.
- Inspection of the margins of the defect to look for any adhesions.
- Closure of the hernia gap transversely by fascia approximation with continuous polypropylene suture (Prolene no. 1).
- On-lay positioning of the polypropylene mesh (Prolene). The area of overlapping is 5cm in all directions. The mesh is fixed to the aponeurosis without tension, with non-absorbable suture (Prolene no 1) the technique of fixation is all around the four edges of the implant by interrupted stitches.
- Use of suction drain, careful subcutaneous closure and skin closure.

Post-operative follow-up:

Patient with para umbilical hernias who met the eligibility criteria for either open or laparoscopic surgical repair were enrolled into this study, from January 2016 to February 2017, following surgery, patients were followed-up for the previously mentioned items, firstly during the hospital stay and then one week following discharge from the hospital, at 4 weeks, at 6 weeks, then at 9 months, and later at the end of first post-operative year.

Method of calculation of the cost:

We calculated the total cost of the technique either laparoscopic or open by collecting the costs of the following items for every technique:

1- The mesh price which is 3500L.E for the Dyna mesh and 200L.E for the Polypropylene mesh.
2- Method of fixation of the mesh which is 2050L.E (tackers & sutures) in the laparoscopic group and 100L.E (sutures) in the open group.
3- Operation theatre charges which is 300L.E for either technique.
4- Hospital stay (150L.E per day).
5- Medicines administered in the ward which are 100L.E for laparoscopic group and 400L.E for the open group.
6- Cost of anaesthetics is 350L.E for the laparoscopic group and 350L.E for the open group.
7- Fees of the surgeon and anaesthetist are not calculated.

Results

Personal and clinical data:

Table (1): Personal and clinical data of the studied groups.

	Laparoscopy group (n=15)	Open group (n=30)	*p*-value
Age (years):			
Mean ± SD	37.70±9.70	43.23±12.41	0.240
Range	22.0-50.0	22.0-65.0	
Sex:			
Male	6 (40.0%)	11 (36.7%)	0.828
Female	9 (60.0%)	19 (63.3%)	
BMI (Kg/m^2):			
Mean ± SD	27.00±2.49	27.10±2.16	0.950
Range	23.0-30.0	22.0-30.0	
Size of defect (cm):			
Mean ± SD	2.20±0.79	2.13±0.78	0.815
Range	1.0-3.0	1.0-3.0	
Operative time (hours):			
Mean ± SD	2.00±0.50	1.49±0.23	0.001*
Range	1.5-3.0	1.3-2.0	

The mean age for the study groups is 37.70± 9.70 for the laparoscopic group and 43.23±12.41 for the open group.

Male to female ratio is 4:6 for the laparoscopic group and 3.6:6.3 for the open group.

The BMI is almost equal in both groups.

The mean size of the defect is 2.2 for the laparoscopic group and 2.1 for the open group.

The operative time is longer for the laparoscopic group in comparison to the open group and the differences are highly statistically significant (p=0.001).

Summary of outcomes:

Post-operative pain:

Table (2): Pain score VAS (Visual Analogue Scale).

VAS scale	Laparoscopy group (n=15)	Open group (n=30)	*p*-value
First day:			
Mean ± SD	3.10±0.57	5.10±0.61	0.000*
Range	2.0-4.0	4.0-6.0	
Second day:			
Mean ± SD	2.10±0.57	3.33±0.48	0.000*
Range	1.0-3.0	3.0-4.0	
Seventh day:			
Mean ± SD	0.80 0.42	1.07±0.58	0.188
Range	0.0-1.0	0.0-2.0	

The mean pain scores are higher between the open group than the laparoscopic group at the three time points and the differences are statistically significant at the first and second day monitoring (p=0.000), but not significant at the seventh day (p=0.188).

Hospital stay:

Table (3): Hospital stay.

	Laparoscopy group (n=15)	Open group (n=30)	*p*-value
Hospital stay (days):			
Mean ± SD	2.50±0.71	7.93±1.31	0.000*
Range	2.0-4.0	6.0-12.0	

The mean hospital stay for the laparoscopic group is 2.50±0.71 that range from 2 to 4 days and 7.93±1.31 for the open group with a range of 6 to 12 days. The differences are highly statistically significant (p=0.000).

Post-operative complications:

Table (4): Post-operative complications.

Post-operative complications	Laparoscopy group (n=15)		Open group (n=30)		*p*-value
	No.	%	No.	%	
Seroma	2	13.3	5	16.7	B0.771
Superficial wound infection	1	6.7	4	13.0	0.385
Recurrence	0	0.0	2	6.7	0.545
No complication	12	80	20	66.6	0.423

While post-operative complications which are seroma, superficial wound infection and recurrence occur with high rate among the open group, however there are no statistical difference between the two intervention arms.

Seroma occurred in 2 cases of 15 (13.3%) in the laparoscopic group and in 5 cases of 30 (16.7%) in the open group.

Superficial wound infection occur in one case (6.7%) in the laparoscopic group but in the open group there are 4 cases (13%) that developed superficial wound infection as a post-operative complication.

No recurrent cases in the laparoscopic group during the period of the study.

Two cases of 30 developed recurrence in the open group with 6.7% rate.

The first case recurred 4 months post-operativ ly, the second case recured at the end of the first year post-operativly.

Cost:

Table (6): Cost (L.E).

	Laparoscopy group (n=15)	Open group (n=30)	*p*-value
Cost (LE):			
Mean ± SD	6455.0±117.0	1590.0±196.7	0.000*
Range	6345-6660	1300-2200	

The cost ranged from 6345 to 6660L.E in the laparoscopic group and 1300 to 2200L.E in the open group.

The statistical difference was highly significant. (p=0.000).

The high cost in the laparoscopic group is due to expensive materials (mesh & tacker) needed for this technique.

Discussion

There is an increasing evidence that laparoscopic approach for PUH is superior to open mesh repair in terms of operative and post-operative complications, pain and overall morbidity and mortality [8,9]. The study was conducted to compare the laparoscopic PUH repair with open techniques of repair in terms of operative time, total hospital stay, post-operative pain, post-operative complications, and cost.

Demographic and clinical characteristics in this study:

The mean age for the study groups is 37.70±9.70 for the laparoscopic group and 43.23±12.41 for the open group. Male to female ratio is 4 to 6 for the laparoscopic group and 3.6 to 6.3 for the open group. The BMI is almost equal in both groups. The included size of the hernia defect is not more than 3cm diameter with a mean of 2.2 for the laparoscopic group and 2.1 for the open

group. The distribution of the personal and clinical data is similar in the two intervention arms and the differences are not statistically significant ($p>0.05$). This implies that any influence of these variables on the key outcomes of surgery was similarly distributed in the two study arms.

Analysis of the operative time:

Total duration of surgery in the laparoscopic repair was significantly longer compared to the open technique in this series.

Most of the time is consumed in handling the mesh intra-peritoneally, but with experience this difficulty can be overcomed. Park et al., **[10]** and Holzman et al., **[15]** reported a similar difference between their groups. Zanghi et al., **[14]** reported a similar difference with mean operative time of 140min and 120min in the laparoscopic group and the open group respectively. The time for laparoscopic repair decreases with the progress in the learning curve.

Assessment of pain:

Pain was scored on the visual analogue scale of 0 to 10. The pain experienced by the participants in the two study arms was higher between the open group at the three time points (1 st day, 2 nd day and 7th day). The mean pain score was highest on the first post-operative day in both arms. The overall trend showed lower scores among the laparoscopic group which is statistically significant ($p<0.05$) for the first and second post-operative days and insignificant ($p>0.05$) for the seventh post-operative day. In comparison with other studies, the same findings were reported in a study by Zanghi et al., **[14]**.

Hospital stay:

In the current study the mean hospital stay in group 1 was reduced to 2 days, while it was 8 days in the group 2. The majority of studies **[10-12]** have documented a decrease in overall hospital stay that can be attributed to decreased post-operative pain, absence of surgical drains, less wound complications and more rapid return of oral intake a more rapid return of ambulatory activity.

Analysis of the post-operative complications:

The overall rate of complications was higher in open surgical repair compared to laparoscopic repair. Incidence of seroma formation was 2 (13.3%) for the laparoscopic group and 5 (16.7%) for the open group. The current study reports post-operative superficial wound infection in 1 (6.7%) patients operated by laparoscopic technique. This is significantly lower in comparison with open surgical technique where wound infection occurred in 4 (13%) patients. Beldi et al., **[17]** confirms this observation and claimed a substantial reduction in the wound infection in laparoscopic para-umbilical hernia repair. Longer incisions and tissue handling in open repair are the main reasons for an increased incidence of wound infection. Wound infection contributes significantly to the morbidity associated with open surgical repair of ventral hernias. The higher complication rate in open surgery were mainly contributed by superficial wound infection (13%) and seroma (16.7%). Both of these complications were significantly lower in the laparoscopic group. This finding is in line with the observation of an earlier studies **[11,13,15,16]**.

Recurrence:

Patients of both groups were followed up till the end of the period of the study. The recurrence rate in laparoscopic repair of PUH was 0%, while in open technique it was 2 (6.7%). The first case recur 4 months post-operative, the second case recur at the end of the first year post-operative. Carbajo et al., **[11]** reported recurrence rate of 0% for laparoscopy and 7% for the open mesh repair. Holzman et al., **[15]** reported recurrence rate of 10% for laparoscopy and 13% for the open mesh repair.

Cost outcomes:

There are encouraging results being reported in comparative studies regarding the cost analysis of laparoscopic versus open repair of ventral hernias. In a recent series, laparoscopic umbilical hernia repair using a dual-layer polypropylene mesh and transfascial sutures significantly reduced surgical site infections, length of hospital stay, and costs as compared to open mesh repair **[17]**. However, types of mesh used and fixation device can make major differences in cost calculations. We can use trans-abdominal suture for fixation of mesh instead of the tackers to reduce the cost of procedure.

Conflicts of interest:

No conflict of interest has been declared.

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دراسة مقارنة بين إصلاح الفتق الجار سرى عن طريق منظار البطن الجراحى والتدخل الجراحى التقليدى

مقدمة: شهدت جراحة إصلاح الفتق الجار سرى تطورا كبيرا فى الآونة الآخيرة حيث آنها كانت تجرى عن طريق الشق الجراحى التقليدى ولكن مع دخول الآنواع الجديدة للشبك الجراحى تطورت طريقة منظار البطن الجراحى فى إصلاح الفتق الجار سرى ولاقت قبولا كبيرا.

المرضى والطرق: تضمنت الدراسة ٤٥ مريض بالفتق الجار سرى بشرط آن يكون حجم الفتق آقل من آو يساوى ٣سم. تم تقسيم المرضى إلى مجموعتين، المجموعة الآولى وهى المجموعة قيد الدراسة وهى عبارة عن ١٥ مريض تم إجراء الجراحة لهم عن طريق منظار البطن الجراحى بإستخدام شبكة معينة لا تسبب إلتصاقات مع الآمعاء والمجموعة الثانية وهى مجموعة التحكم وتضم ٣٠ مريض تم إجراء الجراحة لهم عن طريق الشق الجراحى التقليدى بإستخدام الشبكة الجراحية (البولى بروبيلين).

النتائج: تشير نتائج الدراسة إلى آن المجموعة الآولى كانت مصحوبة بنسبة مضاعفات بعد العملية وفترة بقاء المرضى فى المستشفى آقل من المجموعة الثانية، كذلك لم تكن هناك نسبة إرتجاع للفتق الجار سرى بعد العملية فى المجموعة الآولى مقارنة بنسبة إرتجاع للفتق ٦.٧٪ فى المجموعة الثانية. لكن المجموعة الآولى كانت مصحوبة بنسبة آكبر منها فى المجموعة الثانية وذلك فى عاملين هما التكلفة المالية ومدة إجراء الجراحة.

الإستنتاج: نستنتج من الدراسة آن طريقة إصلاح الفتق الجار سرى عن طريق منظار البطن الجراحى هى طريقة آمنة وفعالة وسهلة الإجراء وتؤدى إلى تقليل نسبة المضاعفات بعد العملية ونسبة إرتجاع الفتق بعد العملية كما آنها تقلل فترة بقاء المريض فى المستشفى وتتميز بالتعافى المبكر بعد العملية.