

Evaluation of Pre-Peritoneal Mesh Repair in Management of Ventral Hernia

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ABSTRACT

Background: Ventral hernias are defined as a defect of the fascia in the anterior abdominal wall with or without a bulge. Clinical presentation varies from small incidental defects to giant and complicated hernias with fistulas and viscera located outside the abdominal cavity covered only by peritoneum and skin. It includes incisional hernias, paraumbilical hernias, umbilical hernia, epigastric hernias, and spigelian hernias, respectively.

Objective: The aim of the present study was to evaluate the functional outcome of pre-peritoneal mesh repair in management of ventral hernia. **Patients and methods:** This was a case control study of incisional hernia repair by pre-peritoneal mesh implantation that was carried out on 40 subjects collected consecutively at Kafr El-Sheikh General Hospital and Sayed Galal University Hospital. Diagnosis was based on clinical criteria.

Results: Regarding to symptoms, 34 cases showed swelling (85%), only 5 cases had swelling and pain (12.5%) and a case showed swelling, pain, and vomiting (2.5%). Chest infection was the most common complication seen with 3 cases (7.5%), wound infection and persistent pyrexia were seen in 2 cases for each (5%) and cellulitis, seroma and post-operative ileus were seen in only one case for each (2.5%).

Conclusion: follow up findings showed no complications except recurrence in only one case. Therefore our study affirms that pre-peritoneal mesh repair or sublay mesh is the ideal repair technique and highly recommended for ventral hernia.

Keywords: Pre-peritoneal mesh repair, Ventral hernia.

INTRODUCTION

Ventral hernia is one of the most common general surgical pathologies. An estimated 20 million patients with hernias are operated on worldwide every year, of which approximately 30% are ventral. An incisional hernia will develop in 10–15% of patients with an abdominal incision and the risk increases to up to 23% in those who develop surgical site infection. Incidence rates up to 69% have been reported in high-risk patients⁽¹⁾. Ventral hernias are defined as a defect of the fascia in the anterior abdominal wall with or without a bulge. Clinical presentation varies from small incidental defects to giant and complicated hernias with fistulas and viscera located outside the abdominal cavity covered only by peritoneum and skin (loss of domain)⁽²⁾. The symptoms range from minor cosmetic concerns to severe pain and life-threatening conditions such as bowel obstruction, incarceration, strangulation and perforation⁽³⁾.

Abdominal hernia repair is one of the most common operations in general surgery. Abdominal operations are often complicated by incisional hernias. The commonly reported incidence varies from 2 to 20%. In high risk groups with long-term follow-up, this percentage may be as high as 96%⁽⁴⁾.

Wound healing is complex and is influenced by patient genetics (ratios of certain collagen and fibroblast subtypes), patient co-morbidities affecting fibroblast-migration, biomechanical factors such as movement of the abdominal wall and pressure dynamics. Anatomical factors such as blood supply, potential spaces and technical factors relating to the repair or closure also play a role. Mesh provides a scaffold to facilitate granulation, fibroblast deposition and reorganization⁽³⁾.

Selection of the most cost-effective appropriate mesh is determined by the approach, the position of the mesh and the risks for surgical site occurrences. The surgeon needs to weigh up properties of different types of meshes. These have different advantages in terms of tissue ingrowth, encapsulation, shrinkage, pore size, anti-adhesive characteristics, risk of sepsis and explanation, in vivo disintegration, foreign body reaction, abdominal wall compliance, burst strength and cost⁽⁵⁾. The objective should be to select a mesh, which promotes healing and strengthens the repair, while reducing sepsis, thick plates of granulation and chronic pain⁽⁶⁾. Current thinking is that neither tensile strength nor mesh-weight are important determinants for good outcome, rather than adequate pore size of between 1-4 mm, coupled with a mesh of adequate burst pressure offer the most critical balance between good tissue ingrowth and protection from central mesh failure⁽³⁾.

AIM OF THE WORK

The aim of the present study was to evaluate the functional outcome of pre-peritoneal mesh repair in management of ventral hernia.

PATIENTS AND METHODS

A case control study of incisional hernia repair by pre-peritoneal mesh implantation that was carried out on 40 subjects collected consecutively at Kafr El-Sheikh General Hospital and Sayed Galal University Hospital. Diagnosis was based on clinical criteria.

Inclusion Criteria:

All patients presenting with anterior abdominal wall hernias:

- a. Umbilical hernias

- b. Epigastric hernias
- c. Paraumbilical hernias
- d. Incisional hernias.
- e. Spigelian hernias

Exclusion Criteria:

- a. Groin hernia
- b. Divarication of recti
- c. Patients < 12 years of age
- d. Patients medically not fit for surgery.

The study is a prospective clinical trial. **An approval of the study was obtained from our local Research Ethical Committee.** An informed written consent before participation of the study was collected from all patients. All data of the patients were confidential. The privacy of participants confidentially of data was guaranteed during various phases of the study. The results of this study were used as scientific material only and not be used by any legal authorities.

Any unexpected risks appeared during the course of the research was cleared to participants and the Ethical Committee on time.

Patients included in the study were subjected to the followings:

1-Full history taking and clinical examinations.

2-Pre operative preparation:

- Routine investigations were done for all patients including chest x-ray and ultrasonography of the abdomen.
- A day prior to surgery overnight fasting, enema once in night and once in morning in the day of surgery were advised.
- Patients who had hypertension, diabetes mellitus or cough were controlled preoperatively
- Patients were asked to void urine before surgery
- Decision regarding the type of anaesthesia was based on the anesthesiologist's assessment and the surgical site.
- On table skin preparation was done by painting with 5% povidone iodine aqueous solution.

3-Operative technique:

Pre-peritoneal:

- The principles of the pre-peritoneal or sublay mesh repair.
- Fibrous tissue ingrowth in the porous mesh consolidates the abdominal wall and widely disperses intra-abdominal pressure to prevent recurrence.
- Our technique involved the placement of prosthetic mesh (Polypropylene) in a pre-peritoneal plane. A prophylactic dose of antibiotic was given at induction of anesthesia.
- After incising the subcutaneous tissue, the sac is dissected and delineated. The defect is opened.
- The posterior rectus sheath along with the peritoneum is closed with 2/0 prolene suture.
- The mesh is secured with few interrupted 2/0 polypropylene sutures.

- The anterior rectus sheath is closed with continuous 1/0 polypropylene sutures.
- All the patients were given 1gm 3rd generation cephalosporin antibiotic preoperatively at the time of induction and continued till the 5th postoperative day twice daily
- The sheaths are lax and redundant due to the hernia and associated weakness.
- The advantages of placing the mesh in this plane is as follows:

- 1- This plane is highly vascular, hence, it prevents infection
- 2- Any infection occurring in the subcutaneous plane does not affect the mesh, as the mesh is retro-muscular in a deeper plane.
- 3- The prosthesis adheres to the posterior rectus sheath and renders it inextensible, permitting no further herniation.
- 4- The prosthesis unites and consolidates the anterior abdominal wall.
- 5- The prosthesis in this plane cannot be dislodged or ruptured by intraabdominal pressure, but instead is held in place by the very force that caused the hernia.
- 6- Usually a virgin plane for recurrent incisional hernia repairs.
- 7- Tension-free repair.

Post-operative:

- Oral fluids were started in the postoperative evening and normal diet resumed on day 1.
- Observation were made with regards to duration of surgery, postoperative complications like seroma formation, wound infection, duration of drain placement, post-operative stay and recurrences, if any.
- All patients were given a cefotaxime 1gm i.v. on induction. Thereafter, iv antibiotics were continued for 2 days post-operative and changed to oral cefixime 200 mg twice daily for the next 5 days. Early mobility was strongly encouraged as cultural attitudes towards surgery in the setting are prohibitors to early ambulation for several days in postoperative period.
- Patient was informed about the effects and complications of the procedure. The procedure was done under general anaesthesia, spinal or epidural anaesthesia in supine position. In all cases, old operative sear was excised, generous skin incision was used to permit adequate exposure of hernial sac and defect.
- In the postoperative period suction drain was removed once the drainage falls to 20 to 30 cc in 24 hours.
- Postoperatively, deep breathing exercises, movement of limbs in bed was advised as (Polypropylene) in a pre-peritoneal plane. A

plane is created between the posterior rectus sheath and the peritoneum for placement of the mesh.

- Early limited ambulation was done once the patient was able to bear the pain. Skin sutures removed on 10th day and in few cases after that.
- At discharge, patients were advised to avoid carrying heavy weights and advised to wear abdominal belt.

Follow Up:

- Patients were reviewed after one month, 3 months, 6 months and 12 months in all cases.
- At follow up visits, symptoms were asked for and operative site examined for any recurrence.

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 (χ^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%. 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.

RESULTS

This case control study of incisional hernia repair by pre-peritoneal mesh implantation was carried out on 40 subjects with the mean age 44.27 ± 11.74 years and female predominance (Table 1).

Table (1): Age and sex distribution

	No.	%
Gender		
Female	26	65.0
Male	14	35.0
Age (years)		
≤ 40	17	42.5
> 40	23	57.5
Min. – Max.	22.0 – 55.0	
Mean ± SD.	44.27 ± 11.74	
Median	43.0	

Regarding the type of hernia, the most common type of ventral hernia was paraumbilical hernia (45%) as shown in table (2).

Table (2): The ventral hernias with respect to number and percentage

Type of hernia	Number(N=40)	Percentage
Incisional	8	20.0
Paraumbilical	18	45.0
Umbilical	2	5.0
Epigastric	12	30.0

There were 4 cases (10%) that had irreversible hernia without obstruction and only one case (2.5%) with obstructed hernia with viable intestinal loop (Table 3).

Table (3): Complicated cases of ventral hernia

Complicated cases	Number(N=40)	Percentage
Irreversible without obstruction	4	10
Obstructed with viable intestinal loop	1	2.5

Chest infection was the most common complications seen with 3 cases (7.5%), wound infection and persistent pyrexia were seen in 2 cases for each (5%) and cellulitis, seroma and post-operative ileus were seen in only one case for each (2.5%) as shown in table (4).

Table (4): Post-operative complications

Complication	Number(N=40)	Percentage
cellulitis	1	2.5
Wound infection	2	5.0
seroma	1	2.5
Post-operative ileus	1	2.5
Persistent pyrexia	2	5.0
Chest infection	3	7.5

Concerning the laboratory findings, the mean Hb was 10.5 ± 1.8 gm/dl, the mean HCT was 33.5 ± 5.9 , the mean RBCs' count was 4.11 ± 0.81 million/cc, while the mean WBCs' count was 8.2 ± 2.02 thousand/cc and the mean platelet count was 328.9 ± 103.7 thousand/cc as shown in table (5).

Table (5): Laboratory findings of the studied cases

Variable	No.=40
Hb (gm/dl)	
Mean ± SD	10.5 ± 1.8
Range	8.8-13.3
Median	10.9
HCT	
Mean ± SD	33.5 ± 5.9
Range	22.9-41.3
Median	33.9
RBC	
Mean ± SD	4.11 ± 0.81
Range	2.49-5.5
Median	33.9
WBC	
Mean ± SD	8.2 ± 2.02
Range	5.50-12.3
Median	8.5
Platelet count	
Mean ± SD	328.9 ± 13.7

Regarding renal function tests, the mean Urea was 19.2 ± 37.4 (mg/dL) and the mean creatinine was 3.08 ± 2.8 (mg/dL) as shown in table (6).

Table (6): Renal function tests

Variable	No.= 40
Urea (mg/dL)	
Mean ± SD	19.2±3.4
Creatinine(mg/dL)	
Mean ± SD	3.08±0.8

Concerning liver function tests, the mean GPT was 23.50 ± 51.26 and the mean GOT was 30.80 ± 99.21 (Table 7).

Table (7): liver function tests

	No.=40
GPT	
Mean ± SD.	23.50 ± 1.26
GOT	
Mean ± SD.	30.80 ± 9.21

Follow up findings showed no complications except recurrence in only one case (2.5%) (Table 8).

Table (8): Follow up from month to 3 months

Follow up	Number(N=40)	Percentage
Wound sinus	0	0
recurrence	1	2.5
Bowel obstruction	0	0

DISCUSSION

Ventral hernias in the anterior abdominal wall include both spontaneous and most commonly, incisional hernias after an abdominal operation. It is estimated that 2-10% of all abdominal operations result in an incisional hernia (7).

Small hernias < 2½ cm in diameter are often successfully closed with primary tissue repairs. However, larger ones have a recurrence rate of up to 30-40% when a tissue repair alone is performed (8). Hernia recurrence is distressing to patient and embarrassing to surgeons. Nowadays tension free repair using prosthetic mesh has decreased recurrence to negligible. Despite excellent results, increased risk of infection with the placement of a foreign body and cost factor still exist. However, operating time and hospital length of stay are shortened. Primary tissue repair is associated with higher unacceptable recurrence rate, nowadays; tension free mesh repair is ideal hernia repair technique (9).

Mean age was 44.27 ± 11.74 years and female predominance (65%) was included in this study. According to literature, incisional hernia occurred more frequently in 5th and 6th decades of life and females have higher frequency than males with the ratio of 2.4: 1 (10). In the study done by **Rajsiddharth et al.** (7), ventral hernias were more common among females (70%). **Jack et al.** (11) have obtained a 64.6% of female population in the study of 342 patients, while **Godara et al.** (12) series had a female population of 42.5%. All those results are in agreement with our study.

In cases with incisional hernia, cholecystectomy was the most common associated surgery (50%) of the patients underwent incisional hernia. **Godara et al.** (12) and **Rajsiddharth et al.** (7) mentioned that gynecological surgeries were the most common associated surgery. This could be attributed to stretching and weakening of anterior abdominal wall musculo-aponeurotic layer.

In our study, regarding the associated risk factors or illness, 10 cases (25%) were hypertensive, 3 cases (7.5%) were diabetic, 2 cases (5%) were diabetic and hypertensive. **Rajsiddharth et al.** (7) stated that the most common associated risk factor (50%) was multipara, next common factor was obesity-15 patients (25%) and 8 (13.33%) patients were diabetic, 1 (1.67%) was anemic, and 1 (1.67%) was hypothyroid.

Regarding symptoms, 34 cases showed swelling (85%), 5 cases had swelling and pain (12.5%) and a case showed swelling, pain, and vomiting (2.5%). There were 4 cases (10%) had irreversible hernia without obstruction and one case (2.5%) showed obstructed hernia with viable intestinal loop. **Rajsiddharth et al.** (7) stated that all patients

presented with swelling. About seven patients had pain in the swelling or dragging type of abdominal pain. One patient with incisional hernia and one with umbilical hernia presented with signs of intestinal obstruction. **Toms *et al.*** ⁽¹³⁾ concluded that abdominal hernias can present asymptotically to life threatening emergencies. About 51 (85%) cases were without complications, 7 (11.67%) were irreducible and 2 (3.33%) were obstructed. No strangulated case was observed.

Chest infection was the most common complication seen in our study with 3 cases (7.5%), wound infection and persistent pyrexia were seen in 2 cases for each (5%) and cellulitis, seroma and post-operative ileus were seen in only one case for each (2.5%). Patients with wound infection were treated with appropriate antibiotics and regular dressing. No patient required removal of mesh because the infection was superficial and responded well to antibiotics. **Rajsiddharth *et al.*** ⁽⁷⁾ stated that the most common complication observed was seroma in 9 patients (15%). Wound infection was found in 6 cases (10%). Follow up findings showed no complications except recurrence in only one case (2.5%). They reported that no recurrence of hernia was noticed in pre-peritoneal mesh repair. **Gleysteen** ⁽¹⁴⁾ found a recurrence rate to be 20% in onlay and 4% in pre-peritoneal mesh repairs. A retrospective study in Europe done by **de Vries Reilingh *et al.*** ⁽¹⁵⁾ noticed a recurrence rate of 23% in cases that underwent onlay mesh repair and no recurrence in patients with pre-peritoneal mesh repair. **Hameed *et al.*** ⁽¹⁶⁾ stated that no recurrence in patients with pre-peritoneal mesh repair. The recurrence rate of pre-peritoneal (Sublay) mesh repair mentioned in different series varied from 2% to less than 10% ⁽¹⁷⁾.

Pre-peritoneal mesh repair is considered superior because the mesh with significant overlap placed under the muscular abdominal wall works according to Pascal's principles of hydrostatics. The intra-abdominal cavity functions as a cylinder and therefore, the pressure is distributed uniformly to all aspects of the system. Consequently, the same forces that are attempting to push the mesh through hernia defects are also holding the mesh in place against the intact abdominal wall. In this manner, the prosthetic mesh is held firmly in place by intra-abdominal pressure. The mechanical strength of the prosthetic mesh prevents protrusion of the peritoneal cavity through the hernia because the hernial sac is indistensible against the mesh. Over time, the prosthetic mesh is incorporated into the fascia and unites with the abdominal wall without an area of weakness ⁽⁷⁾.

CONCLUSION

Although pre-peritoneal or sublay mesh implantation is not a new method of repair but still lot of work is needed to be done in future. Follow up findings showed no complications except recurrence in only one case. Therefore our study affirms that pre-peritoneal or sublay mesh repair to be the ideal repair technique and highly recommended for ventral hernia.

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