Sublay mesh repair versus primary anatomical repair of strangulated ventral hernia: a prospective randomized controlled trial

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Background
Despite the high recurrence rate, the primary anatomical repair is considered the first line of treatment for strangulated ventral hernias (VH) to avoid high infection risk following the use of a nonabsorbable mesh in a potentially contaminated field.
Objective
To assess the use of sublay mesh repair in strangulated VH regarding postoperative wound complications and recurrence.
Patients and methods
This study was conducted on 90 patients aged more than 18 years old who presented with a strangulated VH at Mansoura University Hospitals during the period between September 2019 and September 2020. All included patients were randomized into two groups for doing hernia repair using sublay mesh repair or primary anatomical repair.
Results
Our results showed no statistically significant difference between both studied groups in terms of postoperative complications, pain, periods of hospital stay, and return to normal activity ($P>0.5$). Drain was removed after a relatively longer period in sublay mesh group and that difference was statistically significant. During the 6-month follow-up period, the recurrence rate was significantly higher in the primary anatomical group (six cases) than in the sublay mesh group (one case) ($P=0.04$).
Conclusion
We concluded that the sublay space does not carry an additional risk of complications but was found to have a beneficial effect of reducing recurrence in these patients.

Keywords:
repair, strangulated ventral hernia, sublay mesh

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Introduction

A ventral hernia (VH) is a projection through the anterior abdominal wall except for the inguinofemoral area [1].

VH may be associated with significant morbidity and in rare cases mortality due to incarceration of bowel or abdominal contents such as fat or omentum [2].

Despite increasing rates of diagnosis and repair, VH remains one of the leading causes of small bowel obstructions [3].

A strangulated hernia is one in which the blood supply to the contents of the hernia becomes compromised which can progress to gangrene of the affected part with a high incidence of contamination [4].

Approximately 10% of ventral hernia repairs are emergently performed [5]. Most surgeons depend on primary suture repair for the management of strangulated VH as the use of a foreign body (a nonabsorbable mesh) should be avoided for fear of infection in a potentially contaminated field [6]. Open suture repairs in those critical patients have a high incidence of recurrence, ranging from 25 to 52% [7].

Mesh repair is the standard management in elective VH repair. It has many approaches according to the site of mesh placement (onlay, intraperitoneal, inlay, and sublay either retro-rectus between rectus muscle and posterior rectus fascia or preperitoneal within preperitoneal space below posterior rectus fascia) [8].

The sublay positioning of a synthetic mesh has many benefits: avoiding hazards of intraperitoneal mesh on the bowel, away from possible subcutaneous tissue infection, and escape the wide subcutaneous dissections to raise the flaps, which lead to a lower incidence of seroma formation and infection [9].

Many studies compared primary repair and onlay mesh repair in complicated VH, which showed that with the onlay mesh repair, skin flaps must be created, which increases the risk of wound complications and mesh infection [10–12].

To the best of our knowledge, no published study assessed the use of sublay mesh repair in strangulated VH. Accordingly, our study was conducted to assess the use of sublay mesh repair in strangulated VH regarding postoperative wound complications and recurrence.

Patients and methods

This study was conducted on 90 patients aged more than or equal to 18 years old who presented with a strangulated VH (paraumbilical, epigastric, and incisional) at Mansoura University Hospitals during the period between September 2019 and September 2020. Patients with tense ascites, uncontrollable coagulopathy, or unfit patient for locoregional (spinal) and general anesthesia were ruled out from the study. Moreover, we excluded pregnant women and immunocompromised patients.

For treating the strangulated hernia, patients underwent surgical repair using the primary anatomical repair or sublay mesh repair. The two surgical techniques were explained to candidate patients, and written informed consent was taken from the included patients. All included patients were randomized between the two techniques using numbers created by the WHO site for randomization. These numbers were sealed inside envelopes and were opened by a nurse not involved in the study in the operative room.

Ethical approval for the study was obtained from the institutional review board of Mansoura Faculty of medicine (MS.19.10.846). The study was registered on www.researchregistry.com under the unique identifying number.

Preoperative assessment

Detailed history was taken from all patients. General and local clinical examination, laboratory investigations, and radiological investigations, including pelvi-abdominal ultrasonography, and radiograph, were carried out to assess the strangulated hernia and detect possible complications.

Surgical technique

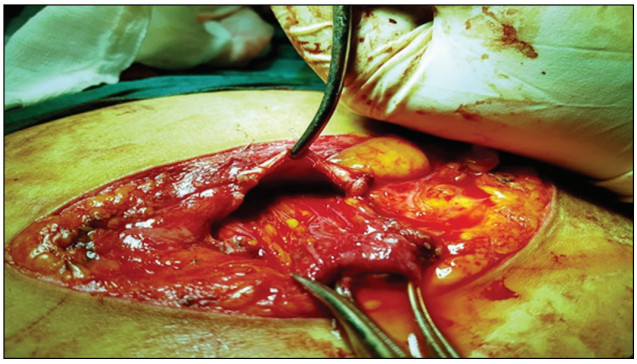
All included patients were given prophylactic antibiotics (ampicillin+sulbactam combination 1.5 g vial half an hour preoperative), intravenous fluid resuscitation, and elastic stocking. Ryle tube was inserted in patients with signs of intestinal obstruction (repeated vomiting±constipation). Patients were placed in a supine position with skin preparation from the nipples to the upper thighs, and general or locoregional anesthesia was performed for both techniques as decided by the anesthesia team. Both techniques were performed by a team of one of the staff lecturers and an assistant lecturer. After skin incision, dissection of the hernia sac down to its neck was done and opening of the sac was done to visualize the content after protecting the operative field from contamination with towels soaked in povidone-iodine solution, taking care to avoid/minimize spillage of intestinal contents. Strangulated omentum was resected. Strangulated loops were managed by widening of the defect to deliver the two constriction rings and application of hot fomentations and 100% oxygen for suspicious loops. If suspicious loops become viable, they were reduced intraperitoneally. If there was an evident infarction of the wall, it was resected. Gangrenous loops were resected from the start. After resection of nonviable loops, intestinal anastomosis was carried out (Fig. 1).

After the management of strangulated contents, the hernial sac was resected at its neck, irrigation of the operative field with 0.9% normal saline and povidone-iodine solution was done and then repair was done using new pairs of surgical gloves. Hernia defect was repaired using either primary suture repair or sublay mesh. For insertion of sublay mesh, retro-rectus space was created by both sharp and blunt dissection (Fig. 2) and then the defects between two posterior rectus sheath leaflets were closed by 2/0 vicryl sutures (Fig. 3) and then polypropylene mesh was inserted in the retro-rectus space covering 5 cm beyond the margins

Figure 1

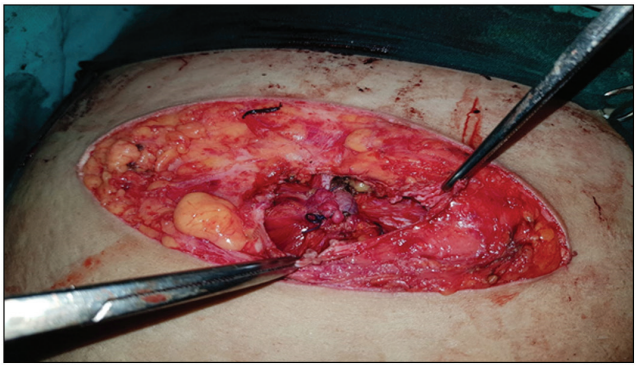
Identification of strangulated loop with its two constriction rings.

Figure 2



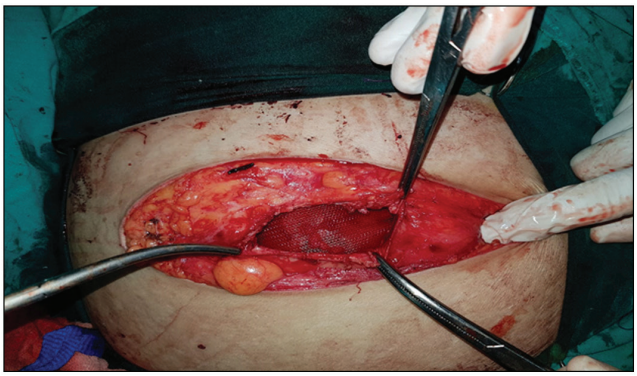
Creation of preperitoneal space.

Figure 3



Excision of hernia sac with closure of peritoneal defect.

Figure 4



Preperitoneal sublay mesh in place.

of the original defect (Fig. 4). Mesh was fixed with 0 polypropylene sutures and then closure of the defect of the anterior rectus sheath was done. Finally, the subcutaneous drain was inserted with the closure of the skin.

Postoperative care

Early ambulation was encouraged in all patients, and postoperative antibiotics were given for 5 days. Patients were discharged once they were hemodynamically stable and with adequate oral intake.

Follow-up

Follow-up was conducted at 1-week, 2-week, 1-month, and 6-month intervals at the general surgery outpatient clinic 'OPC,' and the patients were monitored for signs of postoperative wound complications (seroma, hematoma, and infection). Drain was removed once its discharge became 10–20 ml/day. Stitches were removed after 10 days.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. (IBM Corp., Armonk, New York, USA). Qualitative data were described using numbers and percentages. Quantitative data were described using median (minimum and maximum) for nonparametric data, and mean and SD for parametric data after testing normality using the Kolmogorov–Smirnov test. Significance of the obtained results was judged at the 0.05 level. For qualitative data analysis, the χ^2 test was used for the comparison of two or more groups, and Fisher exact test was applied as correction for the χ^2 test when more than 25% of cells have a count less than 5 in 2×2 tables. For quantitative data analysis between groups, the Mann–Whitney *U* test was used to compare two independent groups. Student *t* test was used to compare between the two groups.

Results

Preoperative data

Table 1 shows the distribution of sociodemographic characteristics and type of hernia among included patients. There was no statistically significant difference between the two groups regarding age, sex, and type of hernia ($P>0.5$).

Operative data

The operative time of the sublay mesh repair was significantly longer than that of the primary anatomical repair ($P=0.001$) (Table 2). The defect size between the two studied groups showed no statistically significant difference ($P=0.588$) (Table 2). In dealing with hernia contents, we found that 33.3% of cases in the sublay mesh repair group and 35.6% in the primary anatomical repair group needed resection anastomosis. The most organ resected was the omentum (70.9%) followed by the small bowel (22.6%) and colon (6.5%) (Table 2).

Postoperative data

Figure 5 illustrates postoperative complications in both groups. There was no significant difference between the primary anatomical repair and the sublay mesh regarding complications ($P>0.5$).

Our results showed no statistically significant difference between both studied groups in terms of postoperative

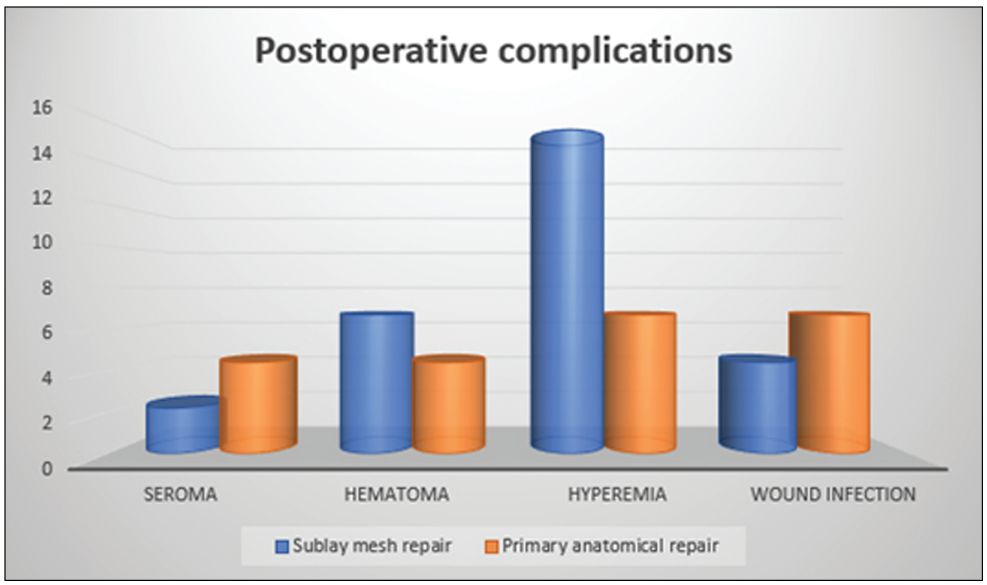
Table 1 Distribution of preoperative data (sociodemographic characteristics and type of hernia) among included patients

	Operation		*P*
	Sublay mesh repair (*N*=45)	Primary anatomical repair (*N*=45)	
Age			
Mean±SD	60.25±9.86	60.25±9.86	0.556
Sex	*n* (%)	*n* (%)	
Male	20 (44.4)	18 (40.0)	0.669
Female	25 (55.6)	27 (60.0)	
Type	*n* (%)	*n* (%)	
Epigastric	9 (20)	15 (33.3)	0.15
Paraumbilical	16 (35.6)	18 (40)	0.66
Incisional	20 (44.4)	12 (26.7)	0.08

Table 2 Distribution of operative data (operative time, defect size, and incidence of organ resection) among studied groups

	Operation		*P*
	Sublay mesh repair (*N*=45)	Primary anatomical repair (*N*=45)	
Operative time			
Mean±SD	60.44±8.53	55.28±5.68	0.001
Defect size			
Mean±SD	3.55±1.3	3.35±2.1	0.588
Incidence of organ resection	*n* (%)	*n* (%)	*P*
Nonresection	29 (64.4)	30 (66.7)	0.82
Resection	16 (35.6)	15 (33.3)	0.82
Omentum	12 (75.0)	10 (66.6)	0.609
Small bowel	2 (18.8)	5 (26.7)	0.598
Colon	1 (6.2)	1 (6.7)	1.0

Figure 5



Postoperative complications.

pain, periods of hospital stay, and return to normal activity (*P*>0.5). Drain was removed after a relatively longer period in sublay mesh group and that difference was statistically significant (Table 3).

During the 6-month follow-up period, the recurrence rate was significantly higher in the primary anatomical group (six cases) than in the sublay mesh group (one case) (*P*=0.04) (Table 3).

Discussion

Strangulated abdominal wall hernias are major surgical problems faced by general surgeons all over the world [13].

Table 3 Distribution of postoperative data (recurrence, postoperative pain, periods of hospital stay, time to return to normal activity, and drain duration)

	Operation		*t*	*P*
	Sublay mesh repair (*N*=45)	Primary anatomical repair (*N*=45)		
Postoperative pain (VAS score)				
Mean±SD	3.0±0.32	2.89±1.2		0.55
Hospital stays				
Mean±SD	7.45±0.98	6.58±2.1		0.258
Time to return to normal activity				
Mean±SD	9.25±2.54	8.90±3.32	0.421	0.06
Drain duration				
Mean±SD	4.12±0.15	3.4±±0.25	16.57	0.001
Recurrence	*n* (%)	*n* (%)		
	1 (2.2)	6 (13.3)		0.04

VAS, visual analog scale.

Primary anatomical repair had the upper hand in the management of strangulated VH because of the fear of infection following the use of a foreign body (a nonabsorbable mesh) in a potentially contaminated field despite the high incidence of recurrence reaching up to 52% [14,15]. In this work, we tried to assess the sublay mesh repair as an alternative to primary anatomical repair in the management of strangulated VH.

To achieve this aim, 90 patients were included in our study and divided into two groups: group I, which included 45 patients (20 males and 25 females) with strangulated VH that were repaired with sublay mesh, and group II, which included 45 patients (18 males and 27 females) with strangulated VH that were repaired with the primary anatomical repair.

The number of female patients in our study was 52 (57.8%) patients, which is slightly higher than male patients, which were 38 (42.2%) patients. This goes with the studies of Abd El-Kader and Ali [9] with 31 (51.7%) female patients and 29 (48.3%) male patients, and Xourafas *et al.* [16] with 98 (55.4%) female patients and 78 (44.6%) male patients, and Abdel-Baki *et al*. [17] with 41 (97.6%) female patients and one (2.4%) male patient. However, it differs from the studies of Bondre *et al*. [18] with 365 (48%) female patients and 396 (52%) male patients, Topcu *et al.* [19] with 81 (52.9%) female patients and 72 (47.1%) male patients and Dissanayake *et al*. [20] with 42 (48.8%) female patients and 44 (51.2%) male patients, in which the number of male patients exceeds that of female patients.

Abd Ellatif *et al*. [21] operated on 63 cases of strangulated VH, whereas Venara *et al*. [19] operated on 37 cases of incarcerated umbilical hernia. In our study, we operated on 90 cases of strangulated VH, where half of them were repaired with sublay mesh and the other half were repaired with primary anatomical repairs. A total of 34 cases of our study were paraumbilical, whereas 32 cases were incisional and the others were epigastric hernias.

Regarding the operative time, in our study, the operative time of the sublay mesh repair was significantly longer than that of the primary anatomical repair. This goes with the studies of Abd Ellatif *et al.* [21], Abdel-Baki *et al.* [17], and Abd El-Kader and Ali [9] but without statistically significant difference.

In our study, hernia defect size ranged from 2 to 5 cm in both groups without statistically significant difference. This meets most of the literature reviews as in the studies of Dissanayake *et al.* [20], Ozbagriacik *et al.* [13], Xourafas *et al*. [16], and Abdel-Baki *et al.* [17].

Of 90 cases in our study, resection of nonviable hernia contents was done in about 31 cases, whereas the hernia contents in other cases were viable and reduction of the contents was done. Almost all of the literature has reviewed that the resection groups were less than the nonresection groups like Abd El-Kader and Ali [9], Ozbagriacik *et al*. [13], Venara *et al*. [19], Topcu *et al.* [19], and Abd Ellatif *et al*. [21].

Regarding our study, we found that the omentum was the most resected organ (22 cases) followed by the small intestine (seven cases) and lastly colon (two cases). These findings go with the studies of Ozbagriacik *et al.* [13], Topcu *et al.* [19], and Abdel-Baki *et al*. [17] However, Nieuwenhuizen *et al*. [22], Abd El-Kader and Ali [9], and Abd Ellatif *et al*. [21] reviewed that all resected organs were only bowel.

In our study, there was no statistically significant difference between the two groups regarding short-term postoperative complications. The incidence of seroma in the sublay mesh group was only one case versus two cases in the primary anatomical group. All

cases of seroma were conservatively treated either with compression or needle aspiration.

Wound infection was encountered in two cases in the sublay mesh group and three cases in the primary anatomical group. No mesh had to be removed, and all infected cases were successfully treatable using conservative measures (proper antibiotics and/or local wound dressing). This goes with the studies of Dissanayake *et al.* [20], Haskins *et al.* [23], Bessa and Abdel-Razek [24], and Abd Ellatif *et al.* [21], which reviewed that mesh repair in strangulated VH is safe. In contrast, Nieuwenhuizen *et al.* [22], Abd El-Kader and Ali [9], and Ozbagriacik *et al* [13] reviewed that surgical site infections among the mesh repair group were higher than anatomical repair group, and this can be explained by positioning the mesh over the anterior rectus sheath (onlay mesh repair). However, it is not considered a contraindication for mesh implantation in a strangulated VH.

Recurrence rate is still the main concern when repairing any VH and especially in a strangulated VH. In our study, we faced only one case of recurrence after the sublay mesh repair and six cases after the primary anatomical repair. This goes with the studies of Dissanayake *et al.* [20], Abd El-Kader and Ali [9], Topcu *et al.* [19], Bessa and Abdel-Razek [24], Abdel-Baki *et al.* [17], and Abd Ellatif *et al.* [21]. They all stated that mesh repair significantly reduced hernia recurrence and improved patient outcome.

Postoperative pain in our study was assessed using visual analog scale score, which shows no statistically significant difference between both groups. To our knowledge, no other studies reviewed strangulated VH and assessed postoperative pain using this score.

In the sublay mesh group, the hospital stay ranged from 6 to 8 days, with a mean of 7.45 ± 0.98 days, whereas in the primary anatomical group, it ranged from 4 to 8 days with a mean of 6.58 ± 2.1 days. This meets the studies of Abd El-Kader and Ali [9] with slightly more prolonged hospital stay up to 23 days in some patients. Moreover, Abd Ellatif *et al.* [21] reviewed more hospital stay among the mesh repair group. However, Ozbagriacik *et al.* [13] reviewed more hospital stay among the primary repair group. Hospital stays affected the return to normal activity in our study, which occur after 9.25 days in the sublay mesh group and 8.90 days in the primary anatomical group.

Subcutaneous drain was removed once its discharge became 10–20 ml/day with a mean of 4.12 ± 0.15 days among the sublay mesh group and a mean of 3.4 ± 0.25 days among the primary anatomical group.

Conclusion

Strangulated VH are common surgical problems with increased morbidity and mortality in the patients. Most surgeons advocate a primary repair strategy for the management of these hernias because of the theoretical risk of complications following onlay mesh repair for these hernias. We found that positioning the mesh in the sublay space does not carry an additional risk of complications but was found to have a beneficial effect of reducing recurrence in these patients. Longer follow-up periods and larger multicentric studies are needed to confirm these findings.

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Conflicts of interest

There are no conflicts of interest.

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