Ventral hernias repair using combined open component separation technique with onlay polypropylene mesh

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Background
Ventral hernia repair with large defect represents a surgical challenge, as a classical repair has increased risk of compartmental syndrome and is associated with high rate of recurrence. The main indications of combined components separation technique with onlay polypropylene mesh are to avoid under-tension repair and thus avoid risk of complications.
Aim
To evaluate combined open component separation technique with onlay polypropylene mesh in repair of ventral hernia with large defect.
Patients and methods
This prospective study was carried out at the Gastrointestinal and Laparoscopic Surgery Unit, General Surgery Department, Tanta University, between December 2017 to May 2019 and included 40 patients who presented with ventral hernia with large defect.
Results
The study population included 35 females and five males, with a mean age of 42.54 ±6.27 years. The mean preoperative BMI was 35.65±2.63 kg/m^2. The mean operative time was 174.24±28.34 min, and the mean postoperative hospital stay was 4.12±2.1 days. Postoperative complications were encountered in 14 (35%) patients. No recurrence occurred with a mean follow-up of 24 months.
Conclusion
Combined open component separation technique with onlay polypropylene mesh reinforcement achieved strong, tensionless, and functional fascial closure in ventral hernias with large defect.

Keywords:
components separation, polypropylene mesh, ventral hernia

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Introduction

The ideal hernia repair should be tension free and provide dynamic muscle support. Incisional and recurrent hernia is usually attributed to certain patient comorbidities, defect size, and surgical repair procedure [1].

In 1990, Ramirez *et al.* [2] repopularized the 'component separation technique' innovated by Young [3] to bridge the fascial gap without the use of mesh. Anterior component separation technique involves external oblique aponeurosis release incisions to allow for medial advancement of the myofascial composite achieving fascial closure without undue tension.

Posterior component separation provides equivalent myofascial advancement with significantly low surgical site infections, low hernia recurrence, and improvement in rectus muscle function when compared with anterior component separation [4].

Mesh reinforcement of component separation appears to decrease hernia recurrence to 5% [5].

Patients and methods

This prospective study was carried out at the Gastrointestinal and Laparoscopic Surgery Unit, General Surgery Department, Tanta University, between December 2017 and May 2019, including 40 patients presented with ventral hernia with large defect. The study was approved by the Research Ethics Committee, Quality Assurance Unit, Faculty of Medicine, Tanta University.

Preoperative assessment and preparation

Data from all operated patients were routinely collected prospectively in a database. The hospital files of included patients have been reviewed, and the following data were collected: anthropometric measurements in the form of weight, height, and BMI; laboratory investigations;

imaging investigations; and evaluation of the associated comorbidities.

Operative technique

All operations were done under general anesthesia. The peak airway pressure was measured before skin incision to be compared with that measured during and after fascial closure. The incision was planned according to the site of hernia, presence of previous surgical scars, and whether apronectomy was planned or not. Dissection of the hernial sac was done then opened with reduction of the contents. Width of the defect was measured. Then, dissection was continued to ~2–5 cm lateral to the linea semilunaris on both sides, superiorly to the costal margins and inferiorly to the symphysis pubis. The anterior component separation was performed by a vertical incision 1 cm lateral and parallel to the linea semilunaris extending on one side or both sides as needed from the costal margin down to the inguinal region, to develop plane between the external oblique fascia and the internal oblique fascia (Figs 1 and 2). If there was any tension, posterior component separation was done by dissection of the rectus muscle off the posterior rectus sheath, which incised longitudinally 2 cm lateral to medial border of rectus abdominis muscle on one side or both sides as needed before closure of the defect. Continuous closure of linea alba was performed using prolene 1, which will induce gapping of the external oblique aponeurosis incision on one or both sides, providing tensionless midline closure. Then, a large polypropylene mesh was placed onlay, extending from the costal margins above to the symphysis pubis below and laterally for at least about 5 cm beyond the lateral edge of the external oblique aponeurosis covering the developed gaps and the midline fascial closure. The mesh was fixed by continuous sutures with the lateral edge of the external oblique aponeurosis and was positioned overlying the external oblique aponeurosis (Fig. 3) and beyond the lateral edge of external oblique aponeurosis for 5 cm. Although to minimize extensive flap mobilization, the mesh was positioned underneath the external oblique aponeurosis (Fig. 4). Tube drains were inserted in both sides.

Operative data included operative time, any operative complications, or other surgical procedures performed.

Postoperative data included postoperative course, length of hospital stay, any complications, readmission or intervention, and recurrence.

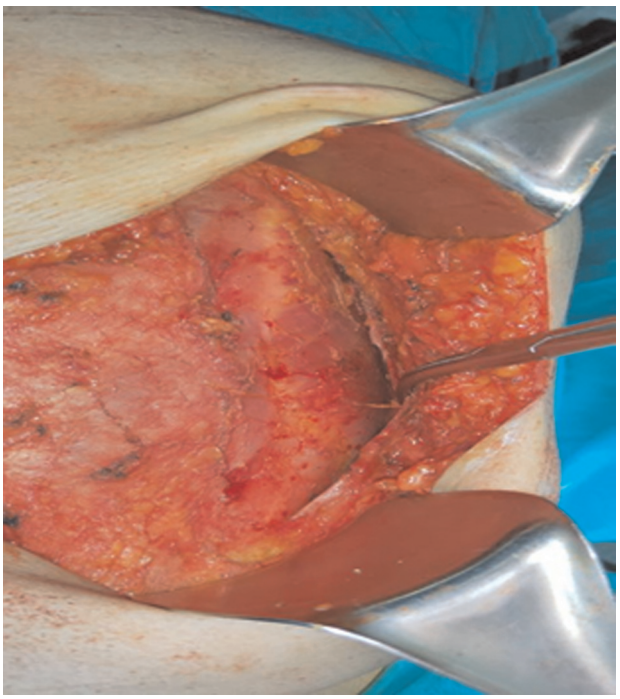
Statistical analysis

The results were collected, tabulated, and statistically analyzed using the SPSS statistical package, version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were prepared. Categorical data were expressed as number and frequency (percent). Metric data were expressed as range, mean, and SD.

Figure 1

Plane between the external oblique and the internal oblique.

Figure 2

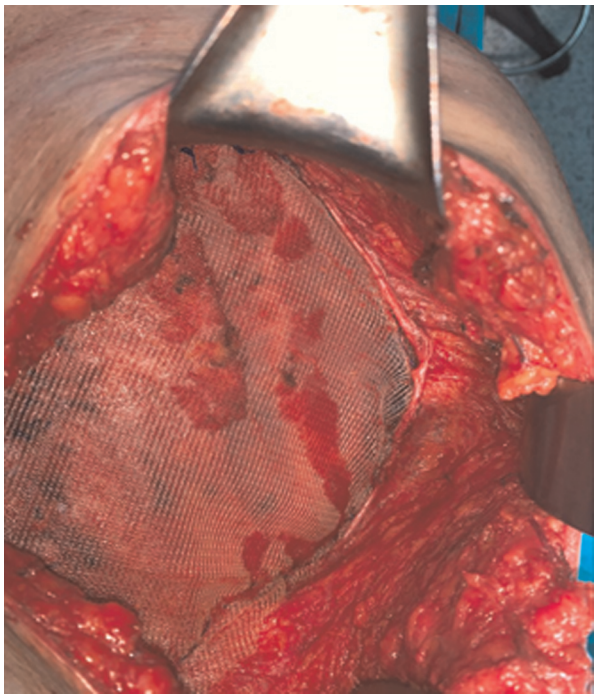


Plane between the external oblique and the internal oblique.

Figure 3

Mesh was overlying external oblique aponeurosis.

Figure 4



Mesh was underneath external oblique aponeurosis.

Written informed consent was obtained from the patients.

Results

The study population included 35 females and five males, with a mean age of 42.54±6.27 years. The mean preoperative BMI was 35.65±2.63 kg/m^2. In this study, 30 (75%) patients were obese, 10 (25%) patients were type 2 diabetes mellitus (DM), nine (22.5%) patients experienced chronic chest disease, five (12.5%) patients were smoker, and multiparity was found in 25 (62.5%) patients. A total of 22 (55%) patients had incisional hernias, 10 (25%) had recurrent ventral hernias, and eight (20%) had de novo ventral hernias (Table 1).

Table 1 Preoperative results

Preoperative results	*N*=40 [*n* (%)]
Sex	
Female	35 (87.5)
Male	5 (12.5)
Age	
Minimum–maximum	36–50
Mean	42.54±6.27
BMI	
Minimum–maximum	28–38
Mean	35.65±2.63
Associated risk factors	
Obesity	30 (75)
Multiparity	25 (62.5)
Type 2 DM	10 (25)
Chronic chest disease	9 (22.5)
Smoking	5 (12.5)
Types of hernia	
Incisional hernia	22 (55)
Recurrent ventral hernia	10 (25)
De novo ventral hernia	8 (20)

More than one risk factor was found in the same patient. DM, diabetes mellitus.

Operative records

The mean operative time was 174.24±28.34 min. Unilateral anterior component separation technique was performed in seven (17.5%) patients with defect width 5–7 cm, bilateral anterior component separation technique was performed in 25 (62.5%) patients with defect width 8–10 cm, bilateral anterior and unilateral posterior component separation technique was performed in three (7.5%) patients with defect width 11–13 cm, and bilateral anterior and bilateral posterior component separation technique was performed in five (12.5%) patients with defect width 14–16 cm to obtain tensionless midline fascial closure. The mesh was positioned overlying the external oblique aponeurosis in 28 (70%) cases, whereas it was positioned underneath and beyond the lateral edge of external oblique aponeurosis in 12 (30%) cases to minimize extensive flap mobilization (Table 2). Associated surgical procedures showed 20 (50%) patients underwent apronectomy and four (10%) patients underwent laparoscopic cholecystectomy owing to chronic calcular cholecystitis; these patients

Table 2 Types of component separation technique according to width of the defect and mesh position

Width of the defect	*N*=40 [*n* (%)]	Types of component separation technique
5–7 cm	7 (17.5)	Unilateral anterior components separation
8–10 cm	25 (62.5)	Bilateral anterior components separation
11–13 cm	3 (7.5)	Bilateral anterior and unilateral posterior components separation
14–16 cm	5 (12.5)	Bilateral anterior and bilateral posterior components separation
Mesh position		
Overlying external oblique aponeurosis	28 (70)	
Underneath external oblique aponeurosis	12 (30)	

experienced lower midline incisional hernia, in whom laparoscopic cholecystectomy could be safely approached, and were done before hernia repair.

Postoperative results

The mean postoperative hospital stay was 4.12±2.1 days. Postoperative complications occurred in 14 (35%) patients; six (15%) patients developed seroma after drain removal, which was managed by ultrasound (US)-guided aspiration under complete aseptic condition. On follow-up, two patients required frequent aspiration, and one of them required US-guided drain insertion and removed thereafter. Overall, four (10%) patients developed small subcutaneous hematoma, which was managed conservatively, and covered with antibiotics till complete absorption of the hematoma, which was confirmed by serial follow-up US; three (7.5%) patients had superficial wound infection, and all of them were managed conservatively with daily dressing and antibiotics according to culture and sensitivity test; and one (2.5%) patient developed wound dehiscence, who was managed conservatively with daily dressing (Table 3).

The follow-up period ranged from 14 to 32 months, with a mean of 24 months, and no hernia recurrence was reported during this period.

Table 3 Postoperative complications

	N=40 [*n* (%)]
Postoperative complications	14 (35)
Seroma	6 (15)
Hematoma	4 (10)
Wound infection	3 (7.5)
Wound dehiscence	1 (2.5)

Discussion

The aim of the study was to evaluate combined open component separation technique with onlay polypropylene mesh in repair of ventral hernia with large defect. This study included 40 patients who accepted to participate and signed an informed consent.

A total of 22 (55%) of our patients had incisional hernias and 10 (25%) had recurrent ventral hernias, which was caused by different risk factors such as multiparity, obesity, DM, and smoking.

Regarding sex distribution in our study, females constituted the majority of our patients, representing 35/40 (87.5%). This sex incidence is matched with that reported by Daware *et al.* [6]. This explained that multiparity, present in ~25 (62.5%) cases in our study, is a risk factor in women for causing hernia.

Regarding obesity, which is one of the major hernia risk factors, in our study, 30 (75%) patients are obese, with a mean BMI of 35.65±2.63 kg/m^2, which is matched with that reported by Lowe *et al.* [7], with a mean BMI of 33.2 kg/m^2.

In our study, 10 (25%) patients had type 2 DM, which increased the risk of infection and recurrence [8].

In our study, five (12.5%) patients were smokers. As smoking is a significant risk factor for incisional hernia, smokers had a higher risk of incisional hernia independent of other risk factors [9].

The operative time is variable between different studies owing to different technique and associated different procedures. In our study, the mean operative time was 174.24±28.34 min, which matched with that reported by Torregrosa *et al.* [10], with average time of 197±7 min.

In our study, we performed unilateral anterior component separation technique in seven (17.5%) patients, with defect width of 5–7 cm; bilateral anterior component separation technique was performed in 25 (62.5%) patients, with defect width of 8–10 cm; bilateral anterior and unilateral posterior component separation technique was performed in three (7.5%) patients with defect width of 11–13 cm; and bilateral anterior and bilateral posterior component separation technique was performed in five (12.5%)

patients, with defect width of 14–16 cm, to obtain tensionless midline fascial closure and avoidance of compartmental syndrome. However, the external oblique aponeurosis release incision will unload (loss of insertion) the external oblique muscle, resulting in myopathic changes. Moreover, the donor sites are prone to bilateral bulging or even herniation [3,11,12].

Slater *et al*. [11] reported very high hernia recurrence after component separation technique without mesh. However, mesh reinforcement modification shows lower hernia recurrence as detected by Buenafe and Lee-Ong [13].

So, in our study, we use large onlay heavyweight polypropylene mesh which was fixed by continuous sutures with the lateral edge of the external oblique aponeurosis to cover the hernia defect and the donor sites and recreate a functional abdominal wall with reloading the external oblique muscles preventing the myopathic changes, as reported by Singh *et al*. [14].

In our study, the mesh was positioned overlying the external oblique aponeurosis in 28 (70%) cases, whereas it was positioned underneath and beyond the lateral edge of external oblique aponeurosis in 12 (30%) cases to minimize extensive flap mobilization.

In our study, the mean postoperative hospital stay was 4.12±2.1 days, which agrees with that reported by Gnaneswaran *et al*. [15] (4 days).

Postoperative complications occurred in 14 (35%) patients; six (15%) patients developed seroma after drain removal, which was managed by US-guided aspiration under complete aseptic condition. On follow-up, two patients required frequent aspiration, and one of them require US-guided drain insertion and was removed thereafter. Overall, four (10%) patients developed small subcutaneous hematoma, which was managed conservatively and covered with antibiotics till complete absorption of the hematoma, which was confirmed by serial follow-up US. Moreover, three (7.5%) patients had superficial wound infection, and all of them were managed conservatively with daily dressing and antibiotics according to culture and sensitivity test. One (2.5%) patient developed wound dehiscence and was managed conservatively with daily dressing.

No major complications occurred in our study such as compartmental syndrome, which occurred in other studies: two cases in Torregrosa *et al*. [10], two cases in Singh *et al*. [14], and one case in Morris and LeBlanc [16], which is explained by measuring the peak airway pressure before skin incision and to be compared with that measured during and after fascial closure.

There is no mortality in our study. However, it occurred in one of two cases of compartmental syndrome 5 days postoperatively owing to multiorgan failure in Torregrosa *et al*. [10].

The follow-up period ranged from 14 to 32 months, with a mean of 24 months, and no hernia recurrence was reported during this period, which matched with that reported by different studies such as Gnaneswaran *et al*. [15], Adekunle *et al*. [17], and Nasajpour *et al*. [18].

Recurrence occurred in different studies, as Robin-Lersundi *et al*. [19] reported 4.3% presented incisional hernia recurrence; Torregrosa *et al*. [10] reported 8.2% hernia recurrence; Hicks *et al*. [20] had 13.3% hernia recurrence; and Singh *et al*. [14] reported recurrence rate of 7.9%. This may be owing to wound complications, which were reported in Slater *et al*. [11], who found that there was a nearly three times increased risk of recurrent hernia development in patients with wound complications.

The use of component separation techniques in the repair of large ventral hernias results in an increased risk of wound complications but does not increase the hernia recurrence rate [21].

There are some disadvantages for component separation technique. First, the skin and subcutaneous tissue must be mobilized over a large distance, which creates a large wound surface predisposing to significant hematoma and seroma formation and infection. Moreover, this extensive mobilization endangers the blood supply of the flaps, which can lead to skin necrosis in the suture line [22].

So, surgeons have performed endoscopically assisted transection of the external oblique aponeurosis. This saves the circulation via the intercostal arteries, diminishes the wound surface, and improves the cosmetic result [23]. Endoscopic component separation technique allows for similar abdominal advancement while minimizing wound complications [24].

Conclusion

Combined open component separation technique with onlay polypropylene mesh reinforcement achieves strong, tensionless, and functional fascial closure in ventral hernias with large defect.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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