Double-mesh technique abdominal wall reconstruction for severe rectus diastasis and ventral hernia repairs (two for two)

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Introduction
Standard rectus plication techniques may not suffice for severe cases of rectus diastasis, especially with ventral hernia. In our study, prosthetic subfascial sublay mesh and onlay mesh may facilitate the repair of severe rectus diastases, especially with concomitant ventral hernias. There is little agreement about the most appropriate technique to repair these defects, in spite of the fact in the prevalence of ventral hernias we are often faced with reinforcement with prosthetic meshes. In the component separation technique, we found high unaccepted recurrence rate. In an attempt to reduce recurrences, we attempt to use sublay mesh and onlay mesh to inforce the defect and prevent or to decrease the recurrence. Our objective was to determine prosthetic mesh practice patterns of onlay and sublay reconstructive methods regarding indications.

Patients and methods
A total of 32 consecutive patients who underwent abdominal wall reconstruction by means of component separations associated with polypropylene mesh were included. A technique of placing mesh in a sublay manner, deep to the rectus muscles without anterior dissection of rectus abdominis from anterior sheath to avoid damage of its blood supply and damage deep umbilical perforators during dissection ended by onlay mesh on anterior rectus sheath, was applied. The complications were recorded and follow-up data were obtained after double-mesh technique.

Aim
To use prosthetic polypropylene mesh sublay (above or anterior to the posterior rectus sheath) with another onlay mesh (above the anterior rectus sheath) for rectus diastasis with or without ventral hernia.

Results
From May 2016 to January 2018, we had 16 patients who underwent cosmetic abdominal repair either for a ventral hernia repair with mesh or a rectus diastasis repair with mesh. Three patients had (isolated) rectus diastasis alone. The mean age of the patients was 55 years, with a range of 35–75 years of age. Overall, 92% of the patients were female. The mean;Deg;BM;Deg;I of the patients was 32 kg/m^2 (range: 25–40 kg/m^2). There were no surgical-site infections but three surgical-site occurrences – seromas, which were treated with drainage in the office. After an average of 365 days of follow-up, none of the patients had recurrence of a bulge or a hernia.

Conclusion
This study used a double-mesh reinforcement procedure, with a low rate of recurrence and occurrences. Moreover, the repair of a large, complex hernia by double-mesh repair technique augmented with polypropylene onlay mesh and sublay results in lower recurrence rates compared with historical reports of component separation technique alone.

Keywords:
onlay, prosetic polypropylene mesh, sublay, ventral hernia

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Introduction

Abdominal wall defects caused by trauma, tumor resection, recurrent, incisional hernias, or long-term increasing of intra-abdominal pressure causing ventral hernia or rectus diastasis are a commonly encountered and challenging problem for surgeons [1,2]. Patients with divarication of rectus abdominis muscle (DRAM) can experience similar complaints as patients with ventral hernias, such as lower back pain and functional and cosmetic impairment, although DRAM is not complicated by any threat of strangulation [3–5]. DRAM repair is challenging for most general surgeons as guidelines on indication

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and methods for repair do not exist [4,6]. The similarity to primary ventral hernias causes frequent misclassification of the disease, and potential mistreatment of DRAM. In recent years, the overall complexity of evidence concerning DRAM treatment has increased. This is owing to the development and implementation of several new reconstructive techniques, combined with heterogeneous outcome measurements, heterogeneous definitions for DRAM, and the lack of high-quality data [4,7].

Despite the fact of high prevalence of this problem, there is little agreement about the most appropriate technique or prosthetic to repair these defects. Furthermore, operative repair of abdominal wall defects can be compromised by their size and the contamination source. Unlikely any single technique is not adequate for patients with large ventral hernia and rectus diastasis. Additionally, the absence of a clear classification system to standardize all reports makes carrying out comparative analysis not easy [3,4,8].

There was less consensus data for ideal prosthetic for high-risk patients (obese, diabetics, chronic obstructive pulmonary disease, and smokers) without the presence of contamination.

We have developed familiarity with using of prosthetic mesh for the repair of moderate to large ventral hernias. We hypothesized that prosthetic mesh can support severe female and male pattern rectus diastasis, and moderate to large ventral hernias, and could be safely and effectively combined with abdominoplasty during the same procedure [3,8].

Pathophysiology

Rectus divarication (rectus diastasis)

The condition of rectus diastasis is familiar but without standard general definition [9]. Rectus diastasis, is not a true hernia, causes biomechanical alterations of the abdominal wall, leading to patient discomfort. Increased intra-abdominal pressure leads to tissue expansion of the abdominal wall, particularly at the linea alba [10]. Certain conditions (such as aging, ascites genetic predisposition, smoking, and chronic obstructive pulmonary disease) increase the risk of developing rectus muscle diastasis, and most women develop rectus muscle diastasis after pregnancy, particularly multiple gestations with large infants. Female pattern rectus diastasis is centered at the level of the umbilicus, but can ascend up to the xiphoid and down to the symphysis pubis. In contrast, the male pattern rectus diastasis [5,7] more frequently develops as a sequela of increased intra-abdominal fat volume, occurs primarily in the supraumbilical region, and occurs in the fifth to sixth decades of life [7]. In addition, lateral insertion of the rectus muscles along the costal margin can share the development of rectus diastasis and recurrence after plication procedure [11].

With increasing of the abdominal circumference from the stretching of the linea alba, the intraabdominal pressure decreases, and a new steady state happens. Some elastic recoil of the exhausted tissues is possible (Figs 1–4).

Ventral abdominal hernia

The lateral displacement of the rectus muscles, local discomfort, decreased intraabdominal pressure, increased muscle fatigue, and back pain all associate with large ventral hernias. A major difference between rectus muscle diastasis and a ventral hernia is the scar tissue (rather than the linea alba) created at the time of a previous laparotomy incision that pulls away from the midline [5,8]. When the scar stretches, the peritoneal surface is no longer smooth and help an omega shape, permitting the bowel to be entering the hernia sac.

Figure 1

Male patient with divarication of recti without umbilical hernia.

Figure 2

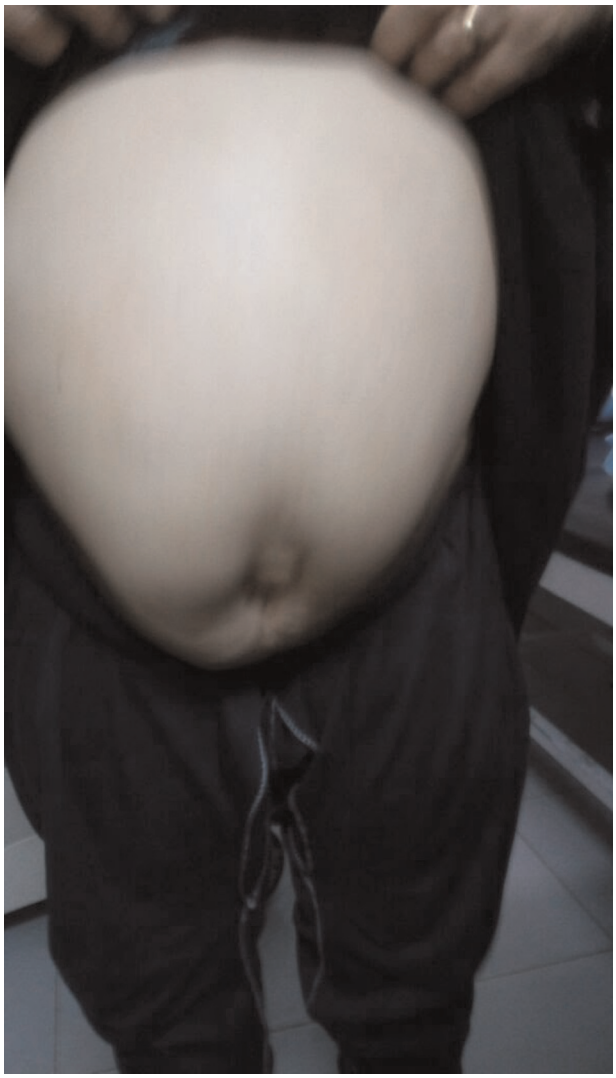
Another male patient with divarication of recti and umbilical hernia.

Figure 3

Female patient with divarication of recti without umbilical hernia.

Therefore, there is a risk of complication such as incarceration and strangulation with ventral hernias [11,12].

Figure 4

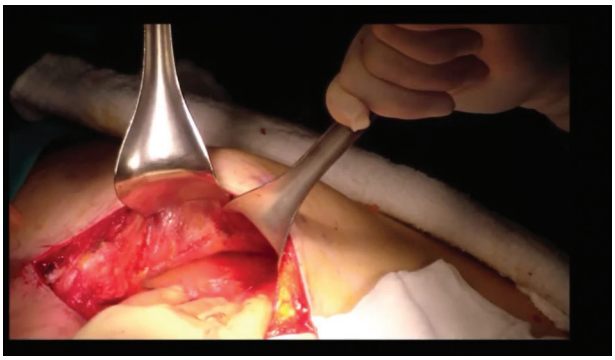


Another female patient with rectus diastasis with umbilical hernia.

Patients and methods

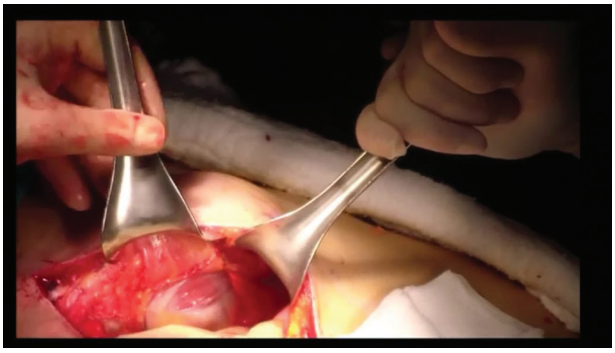
All 32 patients underwent abdominal wall double-mesh technique surgery from May 2016 to January 2018. Three patients had (isolated) rectus diastasis alone. The mean age of the patients was 55 years, with a range of 35–75 years of age. Overall, 29 (92%) patients were female and three males. The mean BMI of the patients was 32 kg/m^2 (range: 25–40 kg/m^2). Sixteen patients underwent abdominoplasty combined with either rectus diastasis repair with mesh or a prosthetic ventral hernia repair. As most ventral hernia repairs will remove some element of skin and subcutaneous tissue, only those patients for whom there was an additional out-of-pocket payment for skin contouring were included. The rectus diastasis repairs were entirely out-of-pocket expenses. All patients were analyzed for patient characteristics, operative features, and postoperative course, including surgical-site infections and surgical-site

Figure 5



Female patient with rectus diastasis with incision of medial border of anterior rectus sheath.

Figure 6



Posterior rectus sheath before dissection of the posterior rectus sheath.

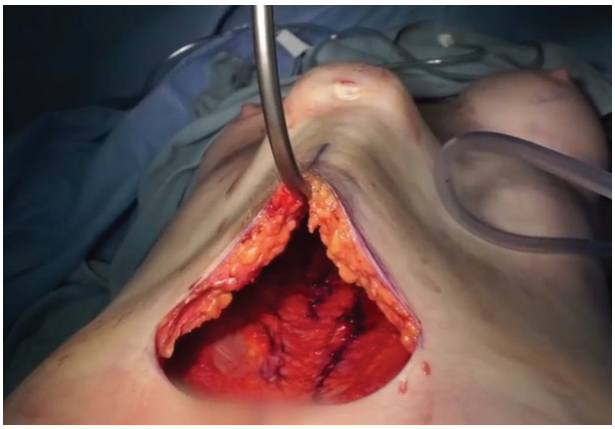
occurrences. Follow-up is defined as the last clinic visit or round.

Surgical technique

Divarication of recti

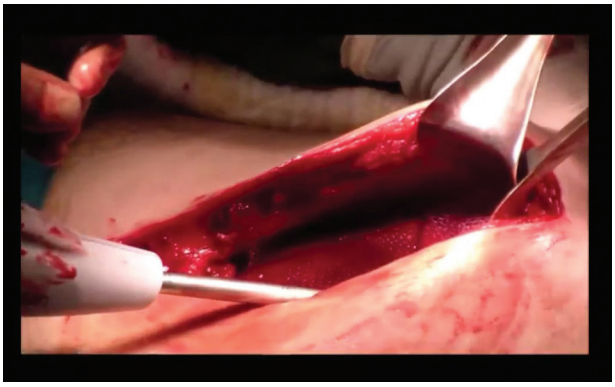
All patients underwent preoperative pelviabdominal ultrasound. Nasogastric tubes were used only if necessary. Urinary catheters were inserted to drain the bladder and monitor urine output. The operation was performed in general anesthesia, with the patients mainly in flat position. Skin flab was elevated to expose the linea alba at the anterior rectus sheath on both sides (bilaterally). Division of the external oblique aponeurosis was performed ~1–2 cm lateral to the lateral border of the rectus muscle sheath. The retrorectus space is developed by incising the anterior rectus fascia along the medial rectus muscle border. The rectus muscle is freed from the underlying posterior rectus sheath with blunt dissection, like a pedicle transverse rectus abdominis myocutaneous flap. The anterior rectus sheath is left attached to the rectus muscle to maintain its vascularity. For most patients, the plane of dissection extends from the xiphoid to the

Figure 7



Abdominoplasty incision showing retrorectus with preperitoneal space after dissection.

Figure 8



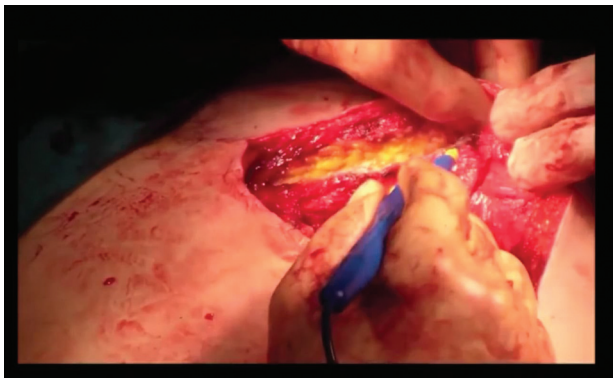
Approximately 7-cm width mesh is fixed above posterior rectus sheath under the rectus muscle.

symphysis, but in small cases, especially in men with isolated supraumbilical rectus muscle diastasis, the rectus muscles are elevated to just below the umbilicus above the arcuate line. We used polypropylene mesh, 7–8 cm in transverse dimension, which is anchored with up to 30–40 interrupted subrectus 0 polypropylene sutures with bites taken 4–5 cm from the incised edge of anterior rectus sheath. These sutures are each placed ~2–3 cm apart from each other. The rectus muscles and overlying anterior rectus fascia are then approximated in the midline (after releasing incision of external oblique sheath 1–2 cm lateral to lateral border of rectus sheath if needed) with interrupted 0 polypropylene sutures to achieve a direct supported repair with polypropylene onlay mesh; the most frequent size we used was 15×15 cm (Figs 5–9).

Ventral abdominal hernia

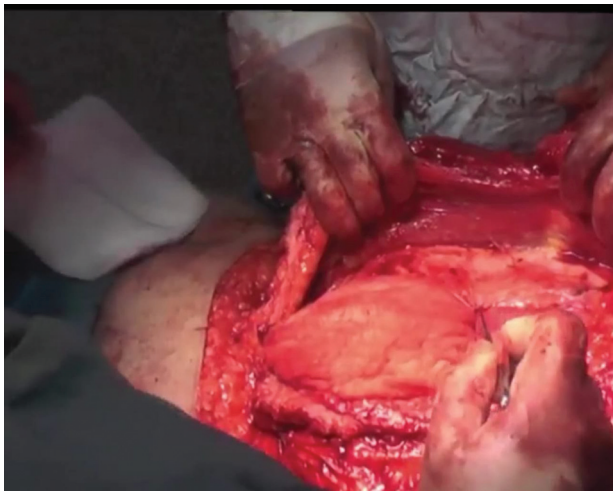
After exposure of the hernia sac content and entry into the abdominal cavity, release the adhesions of the

Figure 9



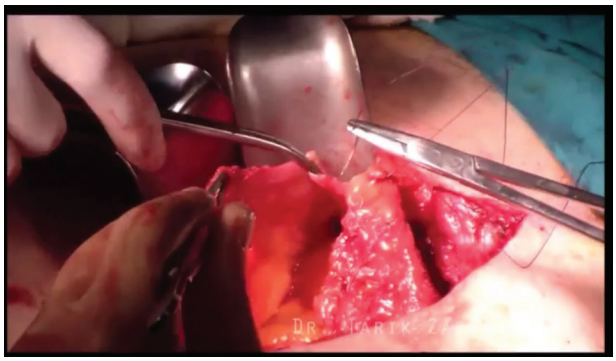
Subcutaneous dissection of the skin to expose the anterior rectus sheath for onlay mesh fixation.

Figure 10



Abdominoplasty transverse incision in female with ventral hernia and severe rectus diastasis.

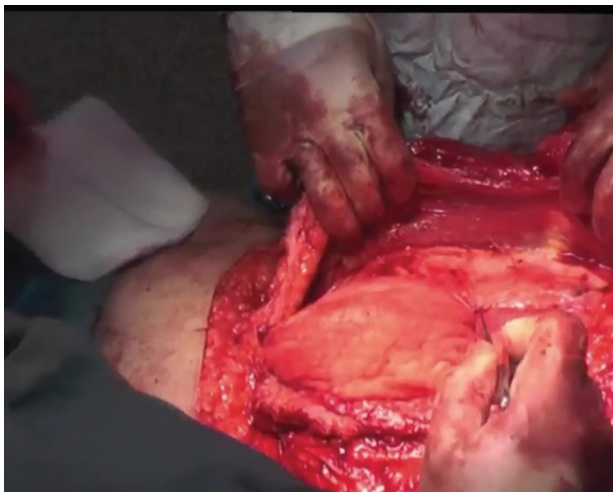
Figure 11



Closure of the peritoneum after sac dissection.

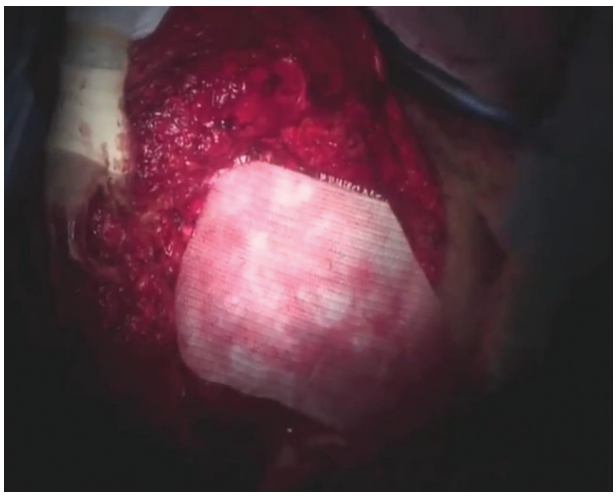
viscera to the posterior aspect of the sac and the abdominal wall are taken down bluntly. The retrorectus space is entered bilaterally on both sides and extended both superiorly and inferiorly with the same previous steps by sublay mesh, and ended by onlay

Figure 12



Onlay mesh fixation on anterior rectus sheath.

Figure 13



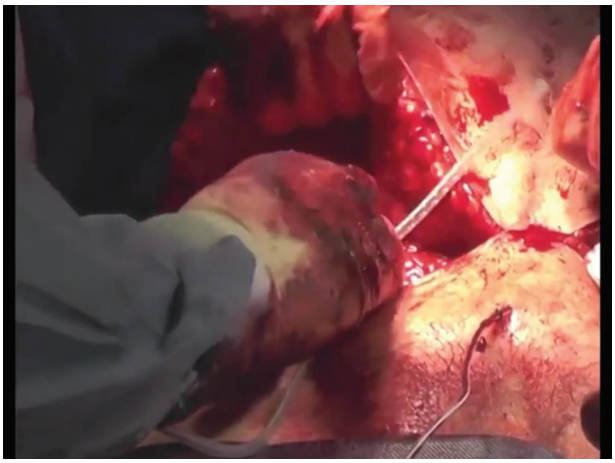
Another patient before onlay mesh fixation.

mesh after approximation of anterior rectus fascia (Figs 10–13).

Skin incision and handling

The most frequently used incision in male pattern rectus diastasis repair was vertically from xiphoid to umbilicus. However, in female, rectus diastasis repair is more often performed by horizontal abdominoplasty pattern incision. Subrectus good blunt dissection on both sides, superior and inferior, is done to achieve good mesh fixation. Skin elevation must be wide above the anterior rectus sheath for suture placement (≤3 cm on both sides from lateral border of rectus sheath) or more if needed to achieve proper skin and onlay mesh covering. Simultaneous ventral hernia repair with abdominoplasty can be performed through either a vertical or a horizontal incision or both (with vertical

Figure 14



Suction draine fixation on above onlay mesh subcutanous and another above sublay mesh posterior to rectus muscle.

Figure 15

Another patient after closure of abdominoplasty incision with two suction drain one subcutaneous above the onlay mesh (to right) and another above the sublay mesh.

subumbilical midline incision after horizontal abdominoplasty). The skin and subcutaneous tissue were then closed over two closed suction drains, one subcutaneous above the onlay mesh and another subrectus above the sublay mesh. At the time of skin closure, good and generous resection of excessive skin and subcutaneous tissue was performed, leaving only the cosmetic amount necessary for closure (Figs 14–16).

Neoumbilicus creation

After initial marking of the umbilical position in the coronal plane, which is helpful in vertical skin patterns, the umbilicus is excised and reconstructed again. To create a new umbilicus, 'pumpkin teeth' flaps are designed along the medial aspect of the planned skin excision and then tacked down to the abdominal wall.

Figure 16

Another patient 10 days after operation.

Figure 17

40 days postoperative female after repair of rectus diastasis by double-mesh repair with neoumbilicus.

A circular dermal 'scratch' is made with the no. 15 blade to create a circular incision. The umbilicus is reconstructed by separate four to five stitches (Fig. 17).

Results

From May 2016 to January 2018, we had 16 patients who underwent cosmetic abdominal repair either for a ventral hernia repair with mesh or a rectus diastasis repair with mesh. Three patients had (isolated) rectus diastasis alone. The mean age of the patients was 55 years, with a range of 35–75 years of age. Overall, 92% of the patients were female. The mean BMI of the patients was 32 kg/m^2 (range: 25–40 kg/m^2). The most common comorbid disease was hypertension (n=11), followed by smoking (n=1) and diabetes (n=6). The greatest separation of the rectus complexes measured was a mean of 6.5 cm (range: 3.5–9.5 cm). The average time from entry into the operating room to leaving the room with dressings in place was 160 min (range: 80–240 min). The more complex ventral hernia repairs had longer operative times. The three patients with operative times over 200 min had abdominal wall procedures combined with additional bowel adhesion, or resection. The patient was observed at night in hospital. Pain was well controlled. Drains over the sublay mesh and that in the subcutaneous plane (onlay position) were removed after 2 weeks. The patient demonstrated rapid recovery. No evidence of hernia recurrence at 12 months was seen.

Early follow-up

During the first 30 days of follow-up, the ventral hernia group had surgical-site occurrences for abdominal wall surgery such as an infection, a wound dehiscence, a seroma, or the development of an enterocutaneous fistula. Three patients had a surgical-site occurrence, and they had prolonged seromas requiring drainage by local anesthesia and redrain for 5 days. One patient had partial skin gangrenes at her lower abdominal skin flap, which was successfully treated with local wound debridement. One patient was readmitted to the hospital 3 days after discharge for peptic ulcer bleeding thought to be related to analgesic nonsteroidal anti-inflammatory drug use (not requiring transfusion), and another patient with a DVT, who was treated by heparin infusion. All other patients had smooth postoperative courses.

Late follow-up

Follow-up of 18 women was done for 6 or more months, and observation revealed no infection, dehiscence, recurrence, or bulging or any problem related to both meshes.

A total of 14 patients were followed up for 1 year, and there were no hernial bulge or recurrences or abdominal wall complications that needed reoperation. Four patients need liposuction for refining of the abdominal contour (Figs 18–20).

Figure 18

Preoperative and postoperative female patient with severe rectus diastasis undergoing combined retrorectus and onlay repair with standard abdominoplasty.

Discussion

Although there is consensus that hernias are best repaired using mesh as opposed to simple suturing, no more agreement exists for the repair of severe cases of rectus diastasis. The recurrence of rectus muscle diastasis in certain patient populations has been reported as high as 100 percent with the use of the plication technique [1]. Previous studies had recommended mesh overlay to support the midline after plication in patients with marked musculoaponeurotic weakness or laxity [2,3]. Some surgeons have recommended posterior rectus sheath plication with rectus muscle advancement [4]. General surgeons have recommended a laparoscopic mesh-

reinforced technique with rectus diastasis a 'hernia but without a defect' and worthy of hernia repair techniques [5]. Still others do not believe that rectus diastasis repair will remain with large intra-abdominal fat volume or male rectus diastasis and therefore recommend against such repair [6]. In *Schwartz's principles of surgery*, by Schwartz and Brunicardi, the authors express concern that rectus sheath plication could actually be complicated by ventral hernia development [8]. These concerns have prevented many surgeons to repair significant diastasis, particularly in male type diastasis.

Reconstruction repair of both hernias and significant rectus diastases needs a cosmetic sensitive and long-lasting procedures. It is proved that repair of ventral hernias with mesh is more durable and has acceptable results than suture repair alone, but prosthetic mesh was avoided by many surgeon because of the risk of infections that need mesh removal. High rates of surgical-site occurrences are not compatible with cosmetic surgical procedures. Therefore, a surgical technique allows reestablishment of the linea alba with a low rate of surgical-site occurrences and skin affection. Al-Qattan noted a frustrating 100% return of musculoaponeurotic laxity 1 year after vertical midline

Figure 19

Preoperative and postoperative female patient with severe rectus diastasis undergoing combined retrorectus and onlay repair with standard abdominoplasty.

Figure 20

Rectus diastasis in female patient before and after abdominoplasty with double-mesh technique.

plication and abdominoplasty in twenty multiparous females with severe abdominal wall laxity and weakness. The author suggest the long durability of plication and reinforced mesh repair may be more suitable [1]. In a systematic literature review, Hickey *et al.* [13] noted varying evidence for recurrence after plication alone without mesh. This ranged from 0% in computed tomography follow-up of 12 women in a study by Nahas *et al.* at an average of 81 months after surgical procedure of plication alone, and 17–40% in 63 women at an average of 64 months of follow-up on ultrasound evaluation by van Uchelen *et al.* [14].

The main reason that simple suture approximation and repair of the rectus muscles sheath may not provide a durable repair for both rectus diastasis and hernias is suture pull-through, because the running and interrupted sutures, when placed under tension, can cut through the anterior rectus fascia, leading to hernia recurrence and weakness of stretched rectus diastasis procedures. However, the best esthetic abdominoplasty procedure is probably the technique that achieves the highest tension distributed support without cut through. The mesh is fixed into place by number of sutures placed in three vertically oriented lines. An increased number of sutures decrease the force at each suture-tissue interface with each, thereby decreasing suture pull-through despite on individual suture so, the high overall tension of the repair [10].

A review by Montgomery [7] supports our idea that placement of mesh in the retromuscular sublay position is the safest position and provides the most durable repairs. Iqbal and colleagues reported long-term outcomes for the modified Rives-Stoppa technique for hernia repair, with a relatively low 3% prosthetic infection in complex ventral hernias [15]. Rives-Stoppa hernia repair often involves posterior more components releases; he use large meshes, and develop the area of retrorectus space from psoas muscle to psoas muscle [16]. The meshes are typically held in place with several anchoring sutures placed far away the midline. Our procedure described before uses a narrow mesh 7–8 cm width with narrow suture line pledget – distributing to decrease suture pull-through to provide a durable repair without pain. The mesh overlay mesh is used to support three lines of vertical plication of rectus diastasis. They followed 18 women for 6 or more months and observed no infection, dehiscence, or extrusion related to both meshes. They encouraged the use of another mesh overlay position in patients with marked musculoaponeurotic weakness 'as though an extensive hernia, gave a durable repair.

In the term of 'sandwich' procedure used for repair of large incisional hernia by preperitoneal mesh and another onlay mesh, the long-term outcomes for primary hernia repair with biologic materials are under investigation in the case of infected or even contaminated fields; the evidence-based recommendations of the Ventral Hernia Working Group highlight the growing role of absorbable meshes in the reconstruction of a wide variety of abdominal wall defects [3].

Prado and colleagues described their experience with three different position pattern of polypropylene mesh strip overlay reinforcement of the abdominal wall in 20 women with rectus diastasis with or without midline ventral hernias [3]. At an average of 36 months of follow-up, none of the patients had infectious site complications or visible recurrence of abdominal bulge hernia.

In a Letter to the Editor, Horndeski and Gonzalez [12] describe a midline hernia repair using the horizontal type of abdominoplasty skin incision for exposure. They then use a large mesh overlay to cove the anterior abdominal wall to prevent shearing at the midline force and prevent further recurrence 'biomechanical failure factors'. None of their 14 patients developed a recurrence or surgical-site infection. All of previous mentioned studies include the use of a mesh overlay, the placement of which, as noted by Marques and colleagues, can obscure abdominal muscle contour. The technique described in this study uses a mesh underlay, which allows for the normal muscular contour to be appreciated through the redraped skin flap. In addition, overlay mesh both gave strength and durability.

The cosmetic appearance after surgery is the greatest concern, and this technique allows for both abdominal wall functional and cosmetic repair and safe skin contouring. The ability of this technique to tighten the abdomen with confidence is far greater than for one mesh alone. The vertical abdominoplasty allows for excellent narrowing of the waistline appearance and the creation of a new umbilicus. For patients with standard horizontal abdominoplasty, incision allows for complete access to the hernia sac or severe rectus diastasis and excellent postoperative contour. A previous study done by Martín-Cartes and colleagues reported reinforcement of tense midline repair of incisional hernia with intraperitoneal mesh combined with onlay mesh has significantly reduced the incidence of this type of hernias. It is likely the low recurrence rates are owing to the combination of both material and surgical technique in their study.

Conclusion

For patients with significant rectus diastasis, with concomitant hernias, the described double-mesh repair is both safe and durable. Although this operation requires additional dissection and prosthetic mesh replacement in the retrorectus plane, it may be safely combined with standard horizontal or vertical abdominoplasty. The use of double-mesh technique for ventral hernia and severe rectus diastasis demonstrates the safety and feasibility of esthetically sensitive and durable repair. This procedure uses familial combined in a straightforward manner that allows for a durable technique and achieve good repair within operative times acceptable to most surgeons.

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Nil.

Conflicts of interest

There are no conflict of interest.

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