Comparative study between posterior component separation with transversus abdominis release and anterior component separation in management of large ventral abdominal hernia

Abdallah M. Soliman, Ayman A. Abd Rabo, Hesham M. Omran, Ahmed Fouad, Hossam S. Abdelrahim

Department of General surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Abdallah M. Soliman, BSC, MSC, MD, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo 11772, Egypt.
Tel: +01009076467;
e-mail: budasoliman@gmail.com

Received: 10 February 2022
Revised: 10 February 2022
Accepted: 10 February 2022
Published: 04 January 2023

The Egyptian Journal of Surgery 2023, 41:587–592

Background

Component separation is the ideal management for large ventral abdominal hernia. There are different techniques of component separation used for repair. The most popular of them are posterior component separation with transversus abdominis release and anterior component separation (ACS). In this study, we aimed to compare between both techniques in the management of large midline ventral abdominal hernia.

Patients and methods

This is a prospective comparative study on 40 patients diagnosed as having large midline ventral abdominal hernia with a surface area defect between 300 and 600 cm^2, with a defect width more than 10 cm, presented to Ain Shams University hospitals. Patients were divided into two groups, with 20 patients in each. Group A underwent hernial repair by ACS, and group B underwent hernial repair by using posterior component separation with transversus abdominis muscle release (PCS-TAR).

Results

We had no statistically significant difference in the preoperative demographic data between both groups. Regarding the operative data, the mean operative time in the PCS-TAR group was significantly higher than the ACS group (267.5 vs. 254.25 min, respectively). There was a nonsignificant difference in the blood loss between both groups. Regarding the postoperative data, the mean time of drain removal was significantly higher in the ACS group than the PCS-TAR group (14.9 vs. 13.6 days, respectively). The incidence of wound seroma and infection was significantly higher in the ACS group than the PCS-TAR group. After 12 months of follow-up, we had only one (5%) case with recurrence in the PCS-TAR group versus six (30%) patients in the ACS group, and this difference was statistically significant.

Conclusion

Posterior component separation with TAR is preferred over ACS in terms of wound complications and recurrence in large midline ventral hernia with defect surface area between 300 and 600 cm^2 but with longer operative time.

Keywords:
component separation, recurrence, transversus abdominis muscle release, ventral hernia

Egyptian J Surgery 2023, 41:587–592

1110-1121

Introduction

There have been revolutions in the component separation techniques for repair of large and complex midline ventral hernias. The new techniques favor anatomical muscle repair without tension and reinforced by mesh. These new techniques led to improvement of short-term and long-term complications in comparison with bridging mesh, such as double-face mesh [1]. Component separation had improved the quality of life by decreasing the use of flaps and then its complication for abdominal wall reconstruction to close the large defects [2].

The first one to discuss open anterior component separation (ACS) was Ramirez and colleagues by developing avascular plane between the external and internal oblique muscle layers through relaxing incisions lateral to the rectus sheath. This bilateral advancement of recti to the midline was up to 10 cm at the epigastric area and 6 cm at the suprapubic area [3–5].

However, a main issue with this technique, due to raising large subcutaneous flaps puts patients at risk for skin necrosis and wound complication. To avoid these complications, modifications have been described for ACS such as laparoscopic ACS and perforator-preserving ACS [6].

Novitsky *et al.* [7] described the technique of posterior component separation and transversus abdominis muscle release (PCS-TAR). This modification allows us to develop the retromuscular space laterally as far as the retroperitoneum and psoas muscle.

Nevertheless, we avoided the subcutaneous tissue dissection and allowed preservation of a retromuscular space for sublay mesh placement. This technique became the best choice for most surgeons for local myofascial advancement in complex ventral hernia repair [8,9]. In our study, we aimed to compare between ACS and PCS-TAR in the management of large midline ventral abdominal hernia with defect surface area between 300 and 600 cm^2 with defect width more than 10 cm.

Patients and methods

Study design

This was a prospective comparative study conducted at the General Surgery Department of Ain Shams University Hospitals. It included 40 patients diagnosed as having large midline ventral hernia with surface area defect between 300 and 600 cm^2 and width more than 10 cm who underwent repair with ACS or PCS-TAR between September 2019 and November 2021. This research was performed at the Department of General Surgery, Ain Shams University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

Inclusion criteria

We included cases of primary or recurrent midline incisional hernia with mesh with surface area defect between 300 and 600 cm^2 [measured by pelvi-abdominal computed tomography (CT)] and hernia width more than 10 cm with age span ranged from 20 to 70 years old.

Exclusion criteria

The excluded cases were with a surface area defect less than 300 cm^2 or more than 600 cm^2, width less than 10 cm, previous component separation, patient with stoma (due to increased risk of contamination), and cases with loss of domain.

The included cases were divided sequentially into two groups: group A included 20 patients who underwent hernial repair by ACS, and group B included 20 patients who underwent hernial repair by using PCS-TAR.

Randomization

Patients were allocated to each group using the closed envelope technique for randomization.

Preoperative assessment

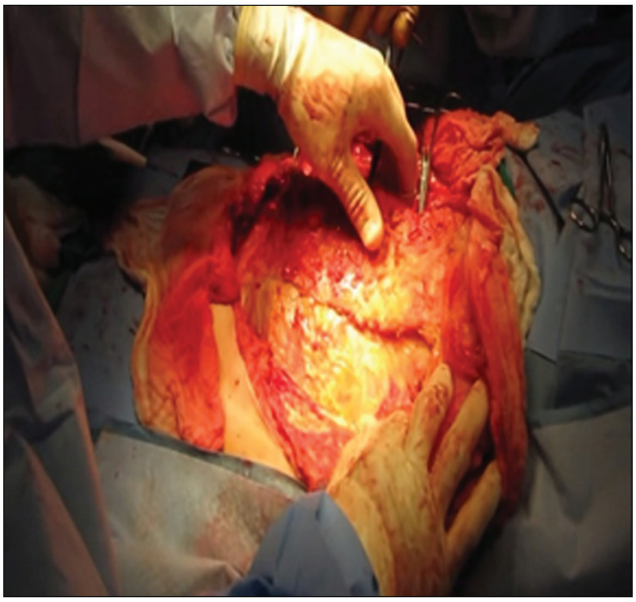
Clinical history and clinical examination were done for all cases with routine preoperative blood tests. Pelvi-abdominal CT scan with contrast was done to measure the surface area of the defect and to detect loss of the domain.

Surgical technique

Anterior component separation

After a generous midline laparotomy, removal of the old scar, and adhesiolysis to the hernial sac from the anterior abdominal wall, the bowels were dissected from the ventral abdominal wall. A skin flap was created with dissection out of the subcutaneous space until reaching 2 cm lateral to the linea semilunaris. Cautery was used to incise the external oblique aponeurosis just lateral to the linea semilunaris. This incision was extended as needed from the fascia just overlying the ribs, down to the level of the anterior superior iliac spine, and then blunt dissection was done between external oblique aponeurosis from internal oblique muscle (Fig. 1). Posterior rectus sheath release was performed by incising the sheath 0.5–1 cm lateral to the linea alba and retrorectus dissection was done till reaching linea semilunaris. Then, the posterior rectus sheath was closed in the midline by 2/0 vicryl, continuous suturing. Then, closure of linea alba at midline was done by continuous PDS loop 1, and then sublay insertion of a prolene mesh was done, which was fixed by 2/0 prolene. Closed suction drain was inserted at the subcutaneous space. Then subcutaneous tissues were closed with an interrupted absorbable suture, and the skin was closed.

Figure 1



Lateral incision of external oblique aponeurosis.

Posterior component separation with TAR

After a generous midline laparotomy and removal of the old scar to allow postoperative healing, all visceral adhesions to the anterior abdominal wall were lysed taking care to avoid injury to the posterior rectus sheath and peritoneum as possible (Fig. 2). The posterior rectus sheath was incised 0.5–1 cm lateral to linea alba. A retrorectus dissection was carried out, freeing the entire posterior rectus sheath from the rectus muscle. As the dissection reached the linea semilunaris, the intercostal neurovascular bundles were identified and preserved. Approximately 0.5 cm medial to the linea semilunaris, the posterior rectus sheath was incised, and the transversus abdominis muscle fibers were divided with cautery and then continued superiorly and inferiorly. Once the muscle was divided, it could be retracted anteriorly and the large avascular retromuscular plane could be dissected bluntly. This wide plane extended laterally to the psoas muscle, iliac vessels, and the kidney; superiorly to the central tendon of the diaphragm; and then inferiorly to retropubic space. Next, the posterior layer, consisting of the transversalis fascia, posterior rectus sheath, and peritoneum, was closed as a single layer with a running 2/0 vicryl suture. Any fenestrations in the posterior layer were closed primarily with 2/0 vicryl suture to prevent bowel from contacting with the mesh. The mesh was placed in this sublay space. The mesh was secured by 2/0 prolene sutures. Closed suction drain was placed on the mesh and then we closed the anterior layer by continues PDS loop 1. Then, subcutaneous tissues were closed with an interrupted absorbable suture and then the skin was closed.

Postoperative follow-up

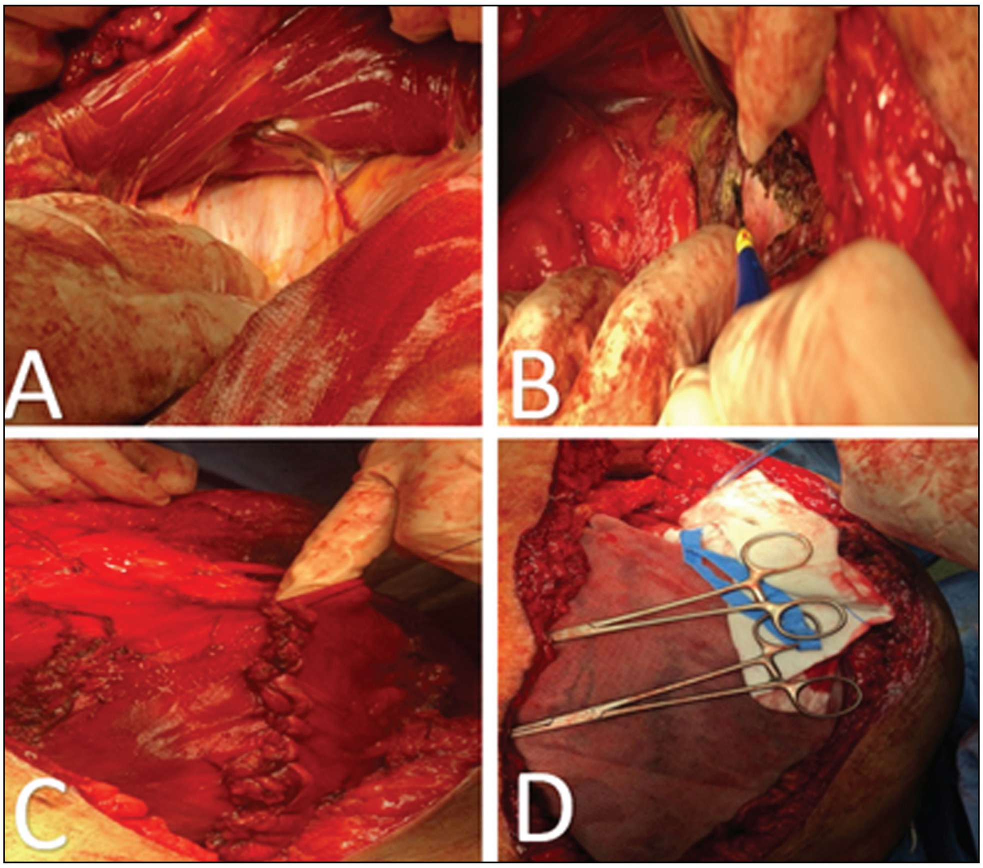
Follow-up of vital data and drain output was done with daily dressing of the wound. We started fluid diet once audible intestinal sound was detected. Patients were discharged once tolerating abdominal pain and fluid diet with no wound complications.

Then follow-up at our outpatient clinic was done at 2 weeks, 1 month, 3, 6, and 12 months for wound care, and pelvi-abdominal CT scan was done after one year to detect any hernial recurrence.

Data collection

We collected from our cases the following data: preoperative data (age, sex, diabetes mellitus, smoking, BMI, defect surface area, and type of previous repair), operative data (operative time, blood loss, and visceral injury), and postoperative data (hospital stay, time of

Figure 2



(a) The neurovascular bundles were preserved in retrorectus dissection. (b) The transversus abdominis muscle fibers were divided with cautery. (c) Closing the posterior layer. (d) Mesh was placed in this sublay space.

drain removal, postoperative pain by the visual analog scale (VAS), wound infection, seroma, and recurrence. The VAS is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10-cm line that represents a continuum between 'no pain' and 'worst pain.' All the previous data were collected to compare between both techniques of component separation [10].

Data management and analysis

Data were revised, coded, and entered into a computer and analyzed using SPSS, version 26 for Windows (SPSS Inc., Chicago, Illinois, USA). Quantitative data were described as mean and SD. Student *t* test was used for comparing quantitative variables between two study groups. χ^2 and Fisher exact tests were used to test the association between qualitative variables. *P* value less than or equal to 0.05 was considered significant, and *P* value less than or equal to 0.001 was considered highly significant.

Results

We had 20 patients in each group. The mean age was slightly higher in group B, with male predominance, but these differences were statistically nonsignificant. The mean defect size in group B was higher than group A, with mean surface areas of 428 and 398.5 cm^2 respectively, but this difference was statistically nonsignificant. Moreover, there was no statistically significant difference in other preoperative demographic data, as shown in Table 1.

Regarding operative data, the mean operative time in group B was significantly higher than group A, with *P* value 0.040. There was no significant difference in blood loss, with *P* value 0.201. Only one case in group B had intraoperative visceral injury in the small bowel that was managed by primary repair, with no visceral injury found in group A, but this difference in visceral injury between the two groups was nonsignificant (Table 2).

There were no statistically significant differences in hospital stay or the postoperative pain VAS score, but the mean time of drain removal was significantly higher in group A patients, with *P* value 0.024. Regarding postoperative complications, the wound infection and seroma were significantly higher in group A.

During long-term follow-up after 12 months, we found only one case with recurrence in group B,

Table 1 Preoperative data

Variables	Group A ACS (20)	Group B PCS-TAR (20)	Test value	*P* value	Significance
Age (mean±SD) (years)	42.3±10.29	44.55±7.94	0.774	0.444*	NS
Sex [*n* (%)]					
Male	10 (50)	13 (65)	0.921	0.337**	NS
Female	10 (50)	7 (35)			
DM [*n* (%)]					
Yes	5 (25)	6 (30)	0.125	0.723**	NS
No	15 (75)	14 (70)			
Smoking [*n* (%)]					
Yes	3 (15)	5 (25)	0.625	0.429**	NS
No	17 (85)	15 (75)			
BMI (kg/m^2) (mean±SD)	32.5±3.74	33.5±2.8	1.006	0.321*	NS
Defect surface area (mean±SD) (cm^2)	398.5±63.27	428±67.09	1.431	0.161**	NS
Defect width (mean±SD) (cm)	14.5±193	14.9±1.77	0.682	0.500*	NS
Previous repair [*n* (%)]					
With mesh	18 (90)	17 (85)	0.229	0.633**	NS
Without mesh	2 (10)	3 (15)			

ACS, anterior component separation; DM, diabetes mellitus; NS, nonsignificant; PCS-TAR, posterior component separation with transverses abdominal release. *Student *t* test. **χ^2 test.

Table 2 Operative data

Variables	Group A ACS (20)	Group B PCS-TAR (20)	Test value	*P* value	Significance
Operative time (mean±SD) (min)	254.25±22.79	267.5±16.1	2.124	0.040*	S
Blood loss (mean±SD) (ml)	236.5±29.96	251.5±41.96	1.301	0.201*	NS
Visceral injury [*n* (%)]					
Yes	0	1 (5)	1.026	0.311**	NS
No	20 (100)	19 (95)			

ACS, anterior component separation; NS, nonsignificant; PCS-TAR, posterior component separation with transverses abdominal release; S, significant. *Student *t* test. **χ^2 test.

Table 3 Postoperative data

Variables	Group A ACS (20)	Group B PCS+TAR (20)	Test value	*P* value	Significance
Hospital stay (mean±SD) (days)	3.6±0.68	3.7±1.12	0.339	0.736*	NS
Time of drain removal (mean±SD) (days)	14.9±1.41	13.6±2.04	2.347	0.024*	S
VAS pain score (mean±SD)	4.65±1.81	4.3±0.8	0.789	0.437*	NS
Wound infection [*n* (%)]	8 (40)	1 (5)	7.025	0.008**	S
Seroma [*n* (%)]	8 (40)	2 (10)	4.800	0.028**	S
Recurrence [*n* (%)]	6 (30)	1 (5)	4.329	0.037**	S

ACS, anterior component separation; NS, nonsignificant; PCS-TAR, posterior component separation with transverses abdominal release; S, significant; VAS, visual analog scale. *Student *t* test. **χ^2 test.

whereas six patients in group A had a recurrence. This difference was statistically significant, with *P* value 0.037 (Table 3).

Discussion

Incisional hernia is a common complication of open abdominal surgery, with many complications such as incarceration, strangulation, and obstruction of abdominal contents, which require an emergency surgery with associated morbidity and mortality. The goal of hernial repair is to restore the anatomy of the abdominal wall without tension, but in large abdominal wall defect, it may be a challenging problem [2,11].

For this reason, the component separation techniques have gained popularity among general surgeons in the management of giant abdominal hernia to achieve proper repair without tension and to improve the quality of life [12,13].

The most commonly performed component separation repairs are ACS, first popularized in 1990 by Ramirez *et al.* [4], and the posterior component separation with transversus abdominis release, which was developed in 2012 by Novitsky *et al.* [7].

The patient demographics between two groups in our study showed no statistically significant difference. The mean age in group A (ACS) was 42.3 years, whereas in group B (PCS with TAR) was 44.5 years. The mean defect size in group A (ACS) was 398.5 cm^2 versus 428 cm^2 for group B (PCS with TAR).

Regarding the mean operative time, it was significantly shorter in the ACS group than the PCS with TAR group (254.2 vs. 267.5 min, respectively). This difference was mostly because we are more experienced in the ACS technique.

In the study by Novitsky *et al.* [7] entitled 'The first study conducted on case series on PCS with TAR,' the mean operative time was 251 min, which was close to our study, whereas in the study by Albalkini and Helmy [13] entitled 'Comparative study between ACS and PCS with TAR,' there was a nonsignificant difference between both techniques (215 min in ACS vs. 217 min in PCS with TAR). Their mean operative time in both techniques was less than ours mostly because we had a concomitant surgery in the ACS group (open cholecystectomy) and one case of bowel injury, which was managed by primary repair in the PCS-TAR group [7,12].

Regarding the mean operative blood loss, it was 236.5 ml in group A (ACS) versus 251.5 ml in group B (PCS with TAR), with no significant difference. In the study by Novitsky *et al.* [7], the mean blood loss was 188 ml, which was less than our study because Novitsky *et al.* [7] were the first to describe the TAR technique, having more experience in this technique.

Only one case in group B (PCS with TAR) had intraoperative visceral injury in small bowel, which was managed by primary repair, with no visceral injury in group A (ACS), but this difference was nonsignificant.

The mean postoperative hospital stay was 3.6 days in the ACS group versus 3.8 days in the PCS with TAR group, and this difference was statistically nonsignificant. This result was less than the mean length of hospitalization for TAR patients included in the study by Novitsky and colleagues (5.9 days) owing to more incidence of wound complication in their study than ours [6]. We did not find any statistically significant difference in the postoperative pain VAS score between both groups; it was 4.6 in the ACS group versus 4.3 in the PCS with TAR group.

Regarding the incidence of wound seroma and wound infection, there was a significant difference between the two groups in favor of the PCS with TAR group (40% in ACS group vs. 10% in PCS-TAR group in seroma and 40% in ACS group vs. 5% in PCS with TAR group in wound infection). These results were explained by the excessive subcutaneous dissection in ACS, leading to more risk of seroma and flap necrosis. In comparison with the study by Albalkiny and Helmy [13], the incidence of wound seroma was higher than ours (70% in the ACS group versus 35% in the PCS with TAR group) because of the on-lay position of the mesh in their ACS cases, but in our study the mesh was positioned in sublay, which decreased the incidence of seroma. Moreover, they had more incidence of wound infection than ours (50% in ACS vs. 20% in PCS with TAR).

In the study by Krpata *et al.* [14], the incidence of wound infection was 48.2% in the ACS group versus 25.5% in the PCS with TAR group. Their results were more than ours owing to more incidence of wound seroma besides more diabetic patients enrolled in their study than ours.

Regarding the time of drain removal, it was significantly lower in the PCS with TAR group than the ACS group (13.6 vs. 14.9 days, respectively). These results were mostly due to the more incidence of wound seroma in the ACS group.We had more significant recurrence rate in the ACS group than the PCS-TAR group within 12month follow-up (30 vs. 5%, respectively). The large difference between both techniques in our study was mostly owing to more incidence of wound complication in the ACS technique than the PCS with TAR technique.

The study by Albalkiny and Helmy [13] had a recurrence rate in both techniques close to ours (35% in the ACS vs. 5% in the PCS with TAR). Moreover, Novitsky *et al.* [7] had a 3.7% recurrence rate in PCS with TAR (close to our study) with longer follow-up duration.

In the study by Cobb *et al.* [15], the recurrence rate was 19.5% in the ACS group, which was lower than our study because they had lower incidence of wound complication in their ACS cases than ours. Moreover, they had 13.4% recurrence rate in the PCS with TAR group, which was more than our result owing to their longer time for follow-up (17 months) and a larger sample size (104 patients) than our PCS with TAR group.

There were several limitations in our study, such as the small sample size and short period of follow-up owing to time limitation. Further studies on these patients will need to be conducted.

Conclusion

Posterior component separation with TAR is preferred over ACS in terms of wound complications and recurrence rate in large midline ventral abdominal hernia with defect surface area between 300 and 600 cm^2 and defect width more than 10 cm but has a longer operative time.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Booth JH, Garvey PB, Baumann DP, Selber JC, Nguyen AT, Clemens MW, *et al*. Primary fascial closure with mesh reinforcement is superior to bridged mesh repair for abdominal wall reconstruction. J Am Coll Surg 2013; 217:999–1009.

2 Ammar S. Management of giant ventral hernia by polypropylene mesh and host tissue barrier: trial of simplification. J Clin Med Res 2009; 1:226–229.

3 Stoppa R, Petit J, Abourachid H, Henry X, Duclaye C, Duclaye C, *et al*. Original procedure of groin hernia repair: interposition without fxation of Dacron tulle prosthesis by subperitoneal median approach. Chirurgie 1973; 99:119–123.

4 Ramirez OM, Ruas E, Dellon AL. Components separation‘ method for closure of abdominal-wall defects: an anatomic and clinical study. Plast Reconstr Surg 1990; 86:519–526.

5 Torregrosa-Gallud A, Sancho Muriel J, Bueno-Lledó J, García Pastor P, Iserte-Hernandez J, Bonafé-Diana S, *et al*. Modifed components separation technique: experience treating large, complex ventral hernias at a University Hospital. Hernia 2017; 21:601–608.

6 Rosen MJ, Jin J, McGee MF, Williams C, Marks J, Ponsky JL. Laparoscopic component separation in the single-stage treatment of infected abdominal wall prosthetic removal. Hernia 2007; 11:435–440.

7 Novitsky Y, Elliott H, Orenstein S, Rosen M. Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction. Am J Surg 2012; 204: 709–716.

8 Novitsky YW, Fayezizadeh M, Majumder A, Neupane R, Elliott HL, Orenstein SB. Outcomes of posterior component separation with transversus abdominis muscle release and synthetic mesh sublay reinforcement. Ann Surg 2016; 264:226–232.

9 Cornette B, De Bacquer D, Berrevoet F. Component separation technique for giant incisional hernia: a systematic review. Am J Surg 2018; 215: 719–726.

10 Haefeli M, Elfering A. Pain assessment. Eur Spine J 2006; 15(Suppl 1): S17–S24.

11 Flament JB, Rives JPJ. Major incisional hernia. In: Chevrel JP, (editor) Hernia and surgery of the abdominal wall. New York: Springer 1995. 116–144

12 Cassar K, Munro A. Surgical treatment of incisional hernia. Br J Surg. 2002; 89:534–545.

13 Albalkiny S, Helmy M. Anterior component separation versus posterior component separation with transversus abdominus release in abdominal wall reconstruction for incisional hernia. Egypt J Surg 2018; 37:335.

14 Krpata DM, Blatnik JA, Novitsky YW, Rosen MJ. Posterior and open anterior components separations: a comparative analysis. Am J Surg 2012; 203:318–322.

15 Cobb WS, Warren JA, Ewing JA, Burnikel A, Merchant M, Carbonell AM. Open retromuscular mesh repair of complex incisional hernia: predictors of wound events and recurrence. J Am Coll Surg 2015; 220: 606–613.