Original Article

Component separation hernioplasty for huge defect midline incisional hernias, anterior versus posterior with transversus abdominis release: A prospective comparative study

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ABSTRACT

Background: Component separation techniques are an integral step in the repair of incisional hernias with huge defects. Anterior component separation (ACS) and posterior component separation (PCS) with transversus abdominis muscle release (TAR) are commonly utilized.

Aim: To compare ACS with onlay hernioplasty versus PCS-TAR with retrorectus hernioplasty to treat huge defect incisional hernias.

Patients and Methods: This is a prospective comparative study on 35 patients who underwent surgical repair for midline incisional hernias with defects more than 10 cm in width. Patients were randomly allocated into two groups. Group A included patients for ACS with onlay hernioplasty, and group B included patients for PCS-TAR with retrorectus hernioplasty. Surgeries were performed under general anesthesia and patients' follow-up was done for up to 1 year. Demographic, perioperative, and follow-up data were collected, tabulated, and analyzed by SPSS 26.

Results: Group A included 18 patients, and group B included 17 patients. There is no statistically significant difference between the two groups regarding the preoperative variable. PCS-TAR had statistically significant longer operative time, fewer days of suction drainage, lower incidence of Surgical Site Infection (SSI) and seroma, and lower incidence of recurrence.

Conclusion: In surgical repair of incisional hernias with huge defects, PCS-TAR had significantly lower wound morbidity and recurrence rates than the ACS.

Key Words: Complex midline hernia, component separation, mesh hernioplasty.

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INTRODUCTION

The main aim of abdominal wall reconstruction in patients with fascial defects is to prevent bowel herniation, strangulation, and gut perforation, which are achieved by strong, stable, and dynamic repair[1]. Component separation techniques favor anatomical muscle repair without tension and with reinforcement by mesh[2]. The advancement of the myofascial layer performed during component release was the most physiological reconstruction of large abdominal wall defects (Fig. 1). It is based on mobilization and medial advancement of the abdominal wall musculature and its fascia to obliterate the hernia defect[3]. A component separation of the abdominal wall can be achieved anteriorly by performing external oblique muscle release with skin flaps[4,5].

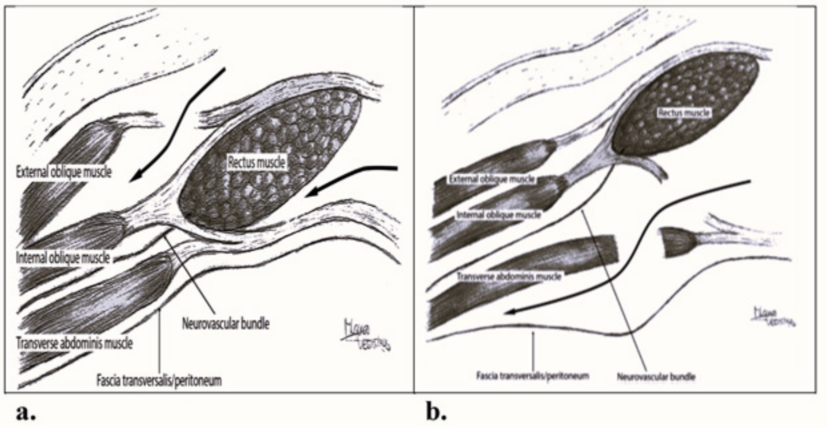

Fig. 1: Schematic overview of component separation: (a) anterior and (b) posterior[6].

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The main issue with anterior component separation (ACS), due to the use of large subcutaneous flaps, is the increased risk of skin necrosis and wound complications. Therefore, modifications have been described, such as laparoscopic ACS and perforator-preserving ACS[7]. Posterior component separation (PCS) with release of the transversus abdominis muscle (TAR) included incision of the posterior rectus sheath and anteriorly dissection of the rectus muscle. Once the lateral edge of the rectus sheath is reached, the posterior rectus sheath is incised, dividing the posterior aponeurotic sheath of the internal oblique muscle, which allows access to the plane between the internal oblique and TAR. Dissection is carried out laterally, inferiorly, and superiorly as needed, allowing for a large mesh underlay[8,9]. Subcutaneous tissue dissection is avoided, and the retro-muscular space is preserved for sublay mesh placement[10].

PCS-TAR has been gaining popularity worldwide, but the use of ACS during complex hernia repair is still quite common. Much of the clinical utilization of ACS versus PCS-TAR is pushed by surgeon preference and experience rather than objective selection of technique based on the merits offered. However, the exact anatomic basis and extent of myofascial advancement obtained by each technique have not been well elucidated[11]. Using only CSTs without mesh to repair of large incisional hernias is associated with a high recurrence rate. Therefore, this must be used only for patients for whom mesh is contraindicated[12,13]. The preferred mesh used for repair is large (30×30 cm) light-weight, macroporous, and polypropylene mesh, which is suitable for clean and clean-contaminated fields, although they should not be placed in direct contact with the intestine to avoid adhesion and obstruction[14].

The aim of the current study is to compare ACS and PCS-TAR for the management of incisional hernias with huge defects (>10 cm), as regards operative time, perioperative complication, and recurrence rate.

PATIENTS AND METHODS:

Study design

Our study was a prospective comparative study conducted at the General Surgery Department, Qena Faculty of Medicine, South Valley University. A total of 35 patients were diagnosed with huge midline incisional hernias with a width greater than 10 cm and underwent repair via the ACS or PCS-TAR between January 2021 and January 2023.

Inclusion criteria included ASA I or II adult patients with incisional hernias with a defect greater than 10 cm. Exclusion criteria included previous component separation or hernioplasty and patients with stomas. The included patients were allocated sequentially into two groups: group A included 18 patients who underwent hernial repair via the ACS, and group B included 17 patients who underwent hernial repair via the PCS-TAR. Informed written consent was obtained from all participants. Approval for the study was obtained from the local institutional ethical committee.

Preoperative assessment

Clinical history, clinical examination, and routine preoperative laboratory blood tests were done for all patients. Pelvi-abdominal ultrasound and computed tomography scan of the abdomen were performed to measure the width of the defect and to exclude other abnormalities. Perioperative antibiotics and thromboembolic prophylaxis were given.

Surgical procedure

In all patients, a long midline laparotomy ellipse incision, including the old scar, was made. All adhesions between the hernial sac and the anterior abdominal wall were dissected, and the bowel was dissected from the ventral abdominal wall. Then, proceeding in surgery according to patient group.

Group A: ACS[15] (Fig. 2).

Bilateral skin and subcutaneous tissue flap was created up to distance of 2 cm lateral to the lateral border of the rectus sheath. Then, an incision of the external oblique aponeurosis just lateral to the linea semilunaris was made by electrocautery. This incision is extended as required to permit tension-free closure of the midline, from the fascia overlying the lower ribs down to the level of the anterior superior iliac spine. Blunt dissection was performed between the external oblique aponeurosis and the internal oblique muscle. The same steps were then repeated on the opposite.

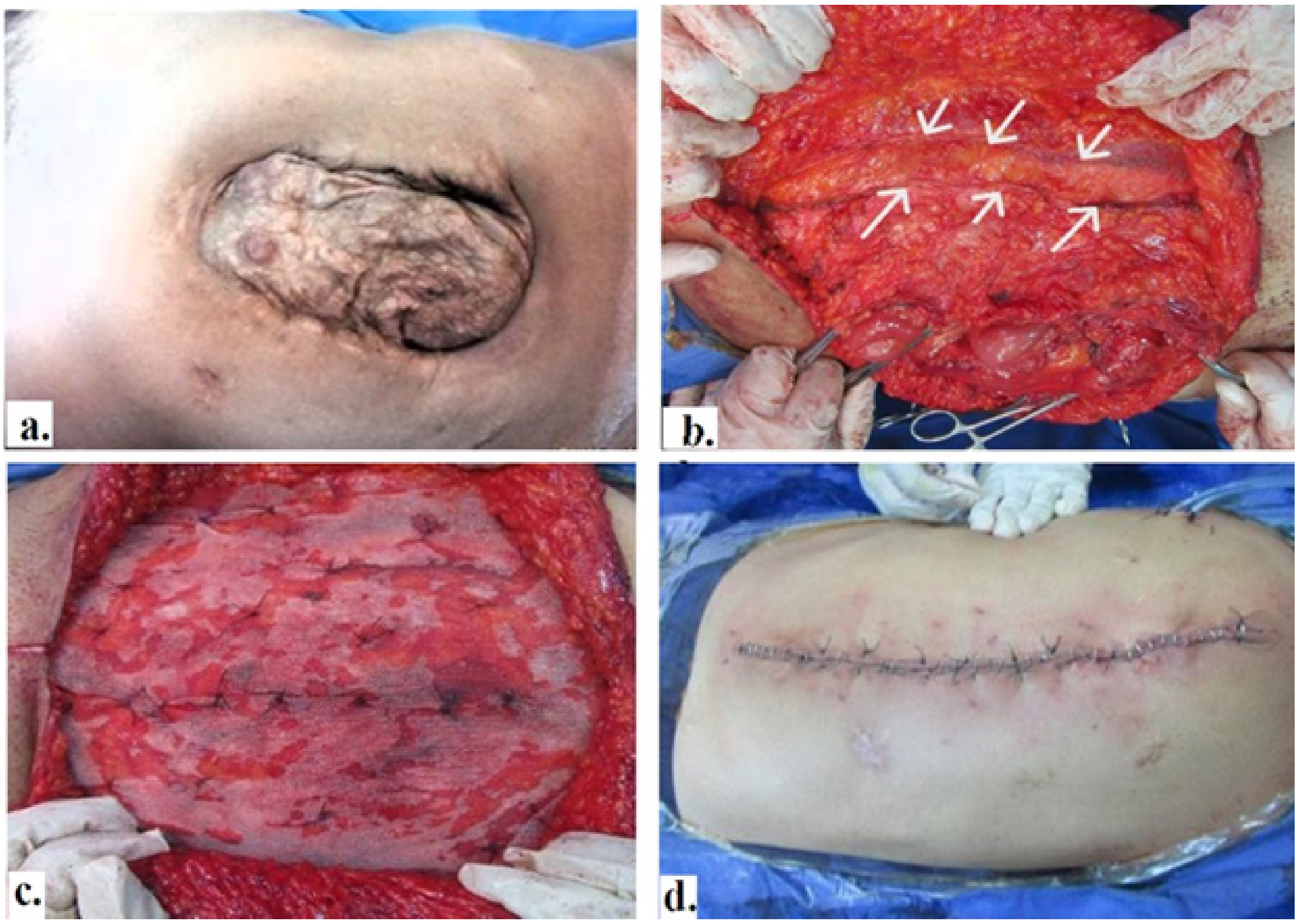

Fig. 2: Anterior component separation: (a) preoperative image. (b) Incised external oblique muscle (the white arrows). (c) Onlay 30×30 cm mesh in place. (d) Postoperative image.

The posterior rectus sheath was released by incising the sheath 2.5 cm lateral to the linea alba. Then, the fascia was closed at the midline by continuous PDS loop suture size 1.

A 12'×12' (30×30 cm) Mersilene polyester fiber mesh (Ethicon LLC.: 4545 Creek Road, Cincinnati, Ohio, 45242, United States of America.) was placed and extended laterally to the cut edge of the external oblique (the mesh was fixed using 2-0 nonabsorbable sutures). A closed suction size 18 French drain was inserted at the subcutaneous space. Closure of the subcutaneous tissues was achieved with an interrupted vicryl 2/0 suture, and the skin was closed.

Group B: PCS-TAR (Fig. 3).

The posterior rectus sheath was longitudinally cut 0.5–1 cm lateral to its medial side, and the retrorectus space was created laterally.

Upon reaching the linea semilunaris, we preserved the intercostal neurovascular bundles. Then, □0.5 cm medial to the linea semilunaris, the posterior rectus sheath was divided longitudinally with cautery to enter the plane between TAR and internal oblique muscle, allowing the transversus muscle to be retracted anteriorly. This plane can be bluntly dissected and extended laterally to the psoas muscle, iliac vessels, and, superiorly to the central tendon of the diaphragm, and inferiorly to the retropubic space.

At this point, the posterior layer comprised the fascia transversalis and, TAR, posterior rectus sheath, and peritoneum. Any fenestrations that might have happened during dissection in this posterior layer were closed using an interrupted 2/0 vicryl suture, and then, this posterior layer was closed as a single layer with a running 2/0 vicryl suture.

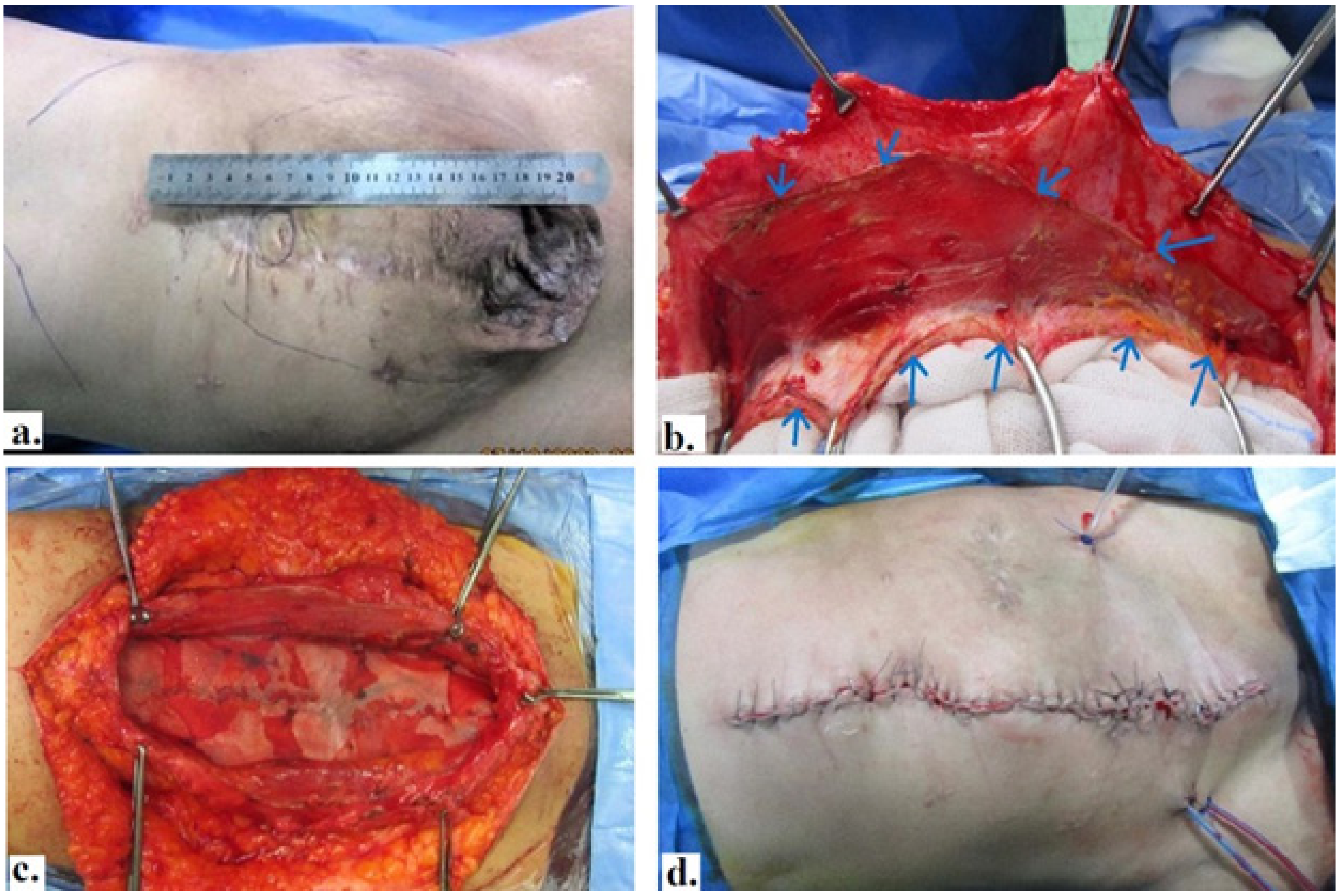

Fig. 3: Posterior component separation: (a) preoperative image. (b) Incision along the postrectus sheath and dissection of the retrorectus space. (c) Retro-muscular (sublay mesh). (d) Postoperative image.

A tailored 12'×12' (30×30 cm) Mersilene polyester fiber mesh (Ethicon LLC.) was placed in this sublay space. The mesh was secured using 2/0 proline sutures. We put a closed suction drain on the mesh and then closed the anterior layer woth continuous sutures using continuous PDS loop suture size 1. Subcutaneous tissues and the skin were closed.

Postoperative care and follow-up

Follow-up of vital data, drain output, and intestinal sounds was done. The wound was dressed daily. Oral fluids were started once audible intestinal sounds were detected. Criteria of discharge were tolerable abdominal pain, full oral feeding, and no deep SSI.

Follow-up was subsequently conducted at the outpatient clinic at 2 weeks, 1, 3, 6, and 12 months for wound care, and a pelvi-abdominal computed tomography scan was performed after 1 year to detect any hernial recurrence.

Statistical analysis

Analysis of the data was performed using SPSS, version 26 (Statistical Package for Social Sciences; SPSS Inc., Chicago, Illinois, USA). Quantitative variables are presented as the mean and SD, Student's t test is used for comparison. Qualitative variables are presented as frequencies and percentages and compared using the χ^2 test for parametric variables and the Mann–Whitney U test for nonparametric variables. *P value* of 0.05 was considered significant.

RESULTS:

Group A (ACS) included 18 patients, while group B (PCS-TAR) included 17. The patients' preoperative demographics are shown in (Table 1).

The age range was 30-63 years for group A (mean=44 years) and 29–65 years for group B (mean=46 years). The BMI of group A was 31.9±2.7 kg/m^2, whereas it was 31.5±2.8 kg/m^2 for group B. The BMI of all patients was 31.5±2.8 kg/m^2. The mean defect width was 13.1±1.1 cm for group A, while for group B, the mean width was 13.6±1.6 cm (the mean defect width for all patients was 13.4±1.3 cm).

All the preoperative demographic data showed no significant statistical differences between the two groups. The operative and postoperative data are summarized in (Table 2).

There was a statistically significant difference in the operative time between the two groups (240±21 min for group A vs. 255±28 min for group B) (*P<0.005*).

There was no full-wall-thickness visceral injury (only serosal tears). Postoperative hospital stay for group A was 4.6±0.68 days, while it was 4.7±0.7 days for group B (*P>0.005*).

The suction drain was removed at 17.9±2.4 days in group A, but for group B, it was removed at 11.6±2.1 days (*P<0.005*).

For each group, one patient missed the follow-up period.

Superficial SSI occurred in four (23.5%) out of 17 patients in group A and in two (12.5%) out of 16 patients in group B. SSI responded to antibiotic therapy and repeated dressing. There was no deep SSI among the patients in either group (*P>0.005*). Seroma was collected in five (29.4%) patients in group A after drain removal. For group B, seroma was collected in one (6.25%) patient only (*P<0.005*). Seromas were treated by ultrasound-guided repeated aspiration under aseptic conditions.

Regarding recurrence, three (17.6%) patients in group A experienced recurrence, but only one (6.25%) patient in group B experienced recurrence (*P<0.005*). Recurrence was detected by clinical evaluation and confirmed by ultrasound imaging.

Table 1: Patients' preoperative demographics

Variables	Group A (*N*=18)	Group B (*N*=17)	*P* value
Sex: male : female	10 : 8	9 : 8	*P*>0.05
Age (mean±SD) (years)	30–63(mean=44)	29–65 (mean=46)	*P*>0.05
BMI (kg/m^2) (mean±SD)	31.9±2.7	31.5±2.8	*P*>0.05
Defect width mean (cm)	13.1±1.1	13.6±1.6	*P*>0.05

Table 2: Operative and postoperative data

Variables	Group A	Group B	*P* value
Operative time	240±21 min	255±28 min	*P*<0.05
Postoperative hospital stays (mean±SD) (days)	4.6±0.68	4.7±0.7	*P*>0.05
Drain removal (mean±SD) (days)	17.9±2.4	11.6±2.1	*P*<0.05
Superficial SSI [*n* (%)]	4/17 (23.5)	2/16 (12.5)	*P*<0.05
Seroma [*n* (%)]	5/17 (29.4)	1/16 (6.25)	*P*<0.05
Recurrence [*n* (%)] (during 1st year)	3/17 (17.6)	1/16 (6.25)	*P*<0.05

DISCUSSION

Restoration of the anatomy of the abdominal wall without tension is the goal of hernial repair. In the case of a large abdominal wall defect, this may be a challenging problem[16]. So component separation which achieve tension-free closure of fascial defects is increasingly used to repair large midline incisional hernias[17].

In this study, we achieved the closure of large fascial defects of the abdominal wall by the techniques of component separation to achieve a solid repair without tension with subsequent improvement of the quality of life[18,19]. In the current study, two component separation techniques were evaluated, ACS described in 1990 by Ramirez *et al*.[15], and PCS-TAR which was developed in 2012 by Novitsky *et al*.[8].

The patient demographics between the two study groups revealed no statistically significant difference. This agrees with data reported by Soliman *et al*.[20].

In our study, the defect width mean for all patients was 13.4±1.3 cm while data published by Soliman *et al*.[20], showed it was 10.6±3 cm.

The BMI of our patients was 31.5±2.8 kg/m^2 which is larger than the BMI documented by Reilingh *et al*.[21], which was 27 kg/m^2.

Our mean operative time for the ACS group was significantly shorter than that for the PCS-TAR group (240±21 vs. 255±28 min). Soliman and colleagues showed the same results (the ACS group vs. PCS-TAR group was 254.2 vs. 267.5 min, respectively). They attributed this significant difference to their experience performing the ACS technique[20].

This finding contradicts the results obtained by Albalkiny and Helmy[19], who showed no significant difference in operative time between the two groups (215.45 vs. 217.1 min).

As regards the mean defect widths, in our study, it was 13.1±1.1 and 13.6±1.6 cm in anterior and PCS patients' groups sequentially. In a similar study by Soliman *et al*.[20], the mean defect width was 14.5±193 and 14.9±1.77 cm in anterior and PCS patients' groups sequentially and was successfully approximated. Worthy mentioning additional ways in our study that might aid the tension-free closure of the midline. Patients were kept NPO from midnight, two fleet enemas were given, one at midnight and the other at 6 a.m., a nasogastric tube was inserted after anesthesia to deflate the stomach and to be removed during patient recovery. In one patient from group A, a greater omentum was resected to allow midline closure without tension.

The present study showed no significant difference between the ACS and PCS-TAR regarding postoperative hospital stay, which is similar to the results of Soliman *et al*.[20]. However, Gala *et al*.[22] showed a significant difference in postoperative hospital stay between the two groups 13 days (7-45 days) versus 7 days (4–20 days) ($P=0.006$), likely due to the increased wound morbidity in the ACS group and the prolonged need for drains.

When we compared the duration of drain removal between the two groups, we found a statistically significant difference (17.9±2.4 vs. 11.6±2.1 days). This result is supported by the findings of Gala *et al*.[22] (25 vs. 5 days) and Soliman *et al*.[20] (14.9±1.41 vs. 13.6±2.04 days). The duration of drain removal in the ACS group was longer because these patients required extensive lipocutaneous dissection, hence the potential for seroma formation[20,22].

The incidence of SSI among group A patients was much greater than that among group B patients (23.5 vs. 12.5%). This result is comparable to studies published by Soliman *et al*.[20] (40 vs. 5%). Additionally, the incidence of seroma was significantly greater in group A than in group B (29.4 vs. 6.25%), which is similar to the incidence of seroma reported by Soliman *et al*.[20] (40% in the ACS group vs. 10% in the PCS-TAR group). The results documented by Albalkiny and Helmy[19] showed a greater incidence of subcutaneous seroma in the ACS group (70 vs. 35% in the PCS-TAR group). This difference may be explained by the onlay position of the mesh in the ACS patients and the sublay position in the PCS-TAR patients.

During the first year of follow-up, our study showed a significantly greater incidence of recurrence in patients in group A than in patients in group B (17.6 vs. 6.25%, respectively). This result is similar to that of Cobb *et al*.[23], who reported the incidence of recurrence (19.5 vs. 13.4%), but these findings were also obtained during a longer follow-up time (17 months) and for a larger sample size (104 patients). Moreover, Albalkiny and Helmy[19] reached a recurrence incidence similar to that of other studies (35 vs. 5%).

Limitations and further perspectives: further studies are needed to obtain more conclusive results. Future studies should include a larger number of patients, many other patient factors, such as DM incidence, possible indications for postoperative ventilatory needs, history of previous mesh hernioplasty, mesh exposure, and the need for negative pressure wound therapy, and finally longer follow-up periods are needed.

CONCLUSION

In surgical repair of incisional hernias with huge defects, PCS-TAR had significantly lower wound morbidity and recurrence rates than the ACS.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Ali Abdulraheem Abu-Quora M, Abd El-Monem AE-H, El-Kady S, El-Rahman A. Component separation technique for large incisionalhernia with and without mesh repair (comparative study). Al-Azhar Med J 2022; 51:953–966.

2. 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.

3. Breuing K, Butler CE, Ferzoco S, Franz M, Hultman CS, Kilbridge JF, *et al*. Incisional ventral hernias: review of the literature and recommendations regarding the grading and technique of repair. Surgery 2010; 148:544–558.

4. Sleiwah A, McAllister S. Posterior components separation with transversus abdominis release (TAR) versus alternative techniques of components separation: systematic review. Int Surg 2018; 103:355–365.

5. Scheuerlein H, Thiessen A, Schug-Pass C, Köckerling F. What do we know about component

separation techniques for abdominal wall hernia repair? Front Surg 2018; 5:24.

6. Sneiders D, de Smet GH, den Hartog F, Verstoep L, Menon AG, Muysoms FE, *et al*. Medialization after combined anterior and posterior component separation in giant incisional hernia surgery, an anatomical study. Surgery 2021; 170:1749–1757.

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

8. Novitsky YW, Elliott HL, Orenstein SB, Rosen MJ. Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction. Am J Surg 2012; 204:709–716.

9. Carbonell A, Cobb W, Chen S. Posterior components separation during retromuscular hernia repair. Hernia 2008; 12:359–362.

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

11. Majumder A, Martin-del-Campo LA, Miller HJ, Podolsky D, Soltanian H, Novitsky YW. Evaluation of anterior versus posterior component separation for hernia repair in a cadaveric model. Surg Endosc 2020; 34:2682–2689.

12. Slater NJ, van Goor H, Bleichrodt RP. Large and complex ventral hernia repair using ‘components separation technique’ without mesh results in a high recurrence rate. Am J Surg 2015; 209:170–179.

13. Eriksson A, Rosenberg J, Bisgaard T. Surgical treatment for giant incisional hernia: a qualitative systematic review. Hernia 2014; 18:31–38.

14. Kushner B, Holden S, Blatnik J. Surgical ‘error traps’ of open posterior component separation – transversus abdominis release. Hernia 2021; 25:1703–1714.

15. 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.

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

17. Jensen KK, Henriksen NA, Jorgensen LN. Endoscopic component separation for ventral hernia causes fewer wound complications compared to open components separation: a systematic review and meta-analysis. Surg Endosc 2014; 28:3046–3052.

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

19. 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; 37:335–343.

20. Soliman AM, Abd Rabo AA, Omran HM, Fouad A, Abdelrahim HS. Comparative study between posterior component separation with transversus abdominis release and anterior component separation in management of large ventral abdominal hernia. Egypt J Surg 2022; 41:587–592.

21. Reilingh TDV, van Goor H, Charbon JA, Rosman C, Hesselink EJ, van der Wilt G-J, *et al*. Repair of giant midline abdominal wall hernias:‘components separation technique’ versus prosthetic repair: interim analysis of a randomized controlled trial. World J Surg 2007; 31:756–763.

22. Gala J, Nichat P, Bhandarwar A, Dhimole N, Bhat R, Muley G. Single institute experiences in anterior and posterior component separation technique for the large ventral hernia: a retrospective review. Asian J Surg 2022; 45:854–859.

23. 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.