Med. J. Cairo Univ., Vol. 91, No. 1, March: 75-81, 2023
www.medicaljournalofcairouniversity.net

Comparative Study between Posterior Component Separation with Transversus Abdominis Release and Anterior Component Separation in Management of Large Ventral Abdominal Hernia

MOHAMED H. ABDELAZIZ, M.Sc.; AHMED M. KAMAL, M.D.; HESHAM M. OMRAN, M.D. and HOSSAM S. ABDELRAHIM, M.D., M.R.C.S.

The Department of General Surgery, Faculty of Medicine, Ain Shams University

Abstract

Background: Primary closure of ventral abdominal hernia (VAH) with a large efect size is considered a major problem for surgeons. Anterior component separation (ACS) is a good technique for repairing but incidence of wound seroma is relatively high but, posterior component separation with transversus abdominis release (PCS-TAR) had less incidence of wound complication.

Aim of Study: This work aims to compare between posterior component separation with transversus abdominis release and anterior component separation in management of large ventral abdominal hernia, as regard post-operative outcome and complications.

Patients and Methods: This is prospective comparative research done at the hospitals of Ain Shams University from July 2019 to July 2021 on 40 patients diagnosed as having large ventral abdominal hernia with surface area ranged from $100cm^2$ to $300cm^2$. Two equal groups of subjects: A: Repair with ACS and B: Repair with PCS-TAR.

Results: No notable differences were found to exist in the two groups in terms ofoperative data, the mean operative time for ACS was 196.25 minutes versus 213.25 minutes for PCS-TAR. The mean blood loss in ACS was 472.5ml versus 455ml in group PCS-TAR. There was no failure or injury in both groups. As regarding the mean hospital stay for ACS was 5.8 days versus 5.6 days for PCS-TAR with non-significant difference. PCS-TAR showed significant shorter time for drain removal than ACS, the mean time was 14.15 days for ACS, and was 9.95 days for PCS-TAR. Regarding post-operative complications, there was wound infection in 15% of cases of ACSversus 10% of cases of PCS-TAR, with non-significant difference. Patients developed seroma were significantly less in PCS-TAR than in ACS [5% of cases of PCS-TAR versus 35% of cases of ACS]. Both groups did not show a significant difference in recurrence within 12 months of follow-up. We had no post-operative bleeding in both groups.

Conclusion: PCS-TAR is an effective technique for repairing large ventral hernia with fewer postoperative wound complications compared to ACS. We recommend putting this technique to be the first choice in repairing of large ventral hernia.

Key Words: *Ventral hernia – Component separation – Transversus abdominis release – Wound complications.*

Correspondence to: Dr. Mohamed H. Abdelaziz,
E-Mail: mm.hassanein25@gmail.com

Introduction

SURGEONS are confronted with an increase in the size and complexity of abdominal wall hernias, some of which include severe loss of domain. These hernias present a challenge to surgeons due to the wide defect and the sac's contents made from the abdominal organs **[1]**.

To prevent problems and also to enhance quality of life, it is important to repair such big hernia. Numerous methods have been developed to treat such hernias. In such settings, it is obvious that sheath closure under tension leads in compartmental syndrome, massive seroma, and inevitably high rates of recurrence **[2]**.

Options for sealing big and complicated abdominal wall hernias, include primary closure, with mesh insertion, and musclar flap, have resulted in unsatisfactory outcomes **[3]**. Typically, anterior component separation (ACS) procedures entail the relaxation of the external oblique muscle (EOM) and fascia. This method outlined by Ramirez requires the production of enormous skin flaps **[4]**.

Open ACS technique had many problems over the years. Seroma, wound infections, and abscess development were correlated with subcutaneous dissection. The use of minimal intervening ACS, including perforator sparing or endoscopy maneuver, minimised these problems, however these approaches are not applicable in all instances **[5]**.

Consequently, several adaptations to this method have been devised. Utilization of the preperitoneal space or construction of an intramuscular plane with PCS are examples of such new technique. Dissection of intermuscular space between transversus abdominis muscle (TAM) and internal oblique muscle has the risk of injury of neurovascular supply of abdominal wall muscles. So, the recent modification of PCS technique is PCS-TAR in which we dissect in avascular plane between TAM and fascia transversalis [6].

In this study, we aimed to study (ACS) and (PCS-TAR) for patients with wide ventral hernia.

Patients and Methods

This is a non randomized controlled study done between July 2019 and July 2021 on 40 patients diagnosed with a big ventral abdominal hernia at Ain Shams University Hospitals. The study was approved by the ethics committee of the department of general surgery, and all participants provided written informed permission after receiving an explanation of the study.

Inclusion criteria:

Patients aged from 20 to 70 years old, having primary or recurrent ventral hernia with defect surface area between 100 and 300cm^2, with grade 1 or 2 (no loss of domain) were candidates for this study.

Exclusion criteria:

Patients with hernia defect more than 300cm^2 or less than 100cm^2, underwent previous component separation, grade 3 (loss of domain), having stoma, or unfit for surgery were not candidates for the study.

The included patients were divided randomly by closed envelopes to 2 groups:

- Group (A): Included 20 patients who underwent hernia repair by anterior component separation.
- Group (B): Included 20 patients who underwent hernia repair by posterior component separation with transversus abdominis muscle release.

Pre-operative assessment:

Patient history: Includes age, weight, work, and any medically significant habits, such as smoking.

Present history: Number of prior laparotomies, past hernia repair, and an examination of other bodily systems, including chest symptoms, gastrointestinal issues such as constipation, and urine issues, including prostate disease.

Past medical history: Especially diabetes, medication allergy, prior blood transfusion, and prior surgical procedures.

Complete examination:

General evaluation:

- Heart rate, blood pressure, temperature, and respiratory rate.
- Chest examination.
- Cardiological examination.
- Body mass index (BMI).

Local examination:

To assess hernia defect size, contents, reducibility and the grade of hernia.

Investigation:

- Laboratory testing including a complete blood count (CBC), bleeding time, blood coagulation time, liver and kidney function tests, and fasting blood glucose.
- Radiological, including CXR, abdominal ultrasound, and abdomino-pelvic computed tomography (C.T) with contrast.
- Specific investigations were sought for individuals with specific symptoms, such as pulmonary function testing for patients with COPD, and Electrocardiography (ECG) and Echocardiography (Echo) for patients older than 40.

Operative technique:

1- *Anterior component separation:*

The patient received general anesthesia and put in supine position. After a longmidline laparotomy, all adhesions to the anterior abdominal wall were disected. A subcutaneous flap was created exposing the EOM by the subcutaneous space until reaching two centimeters lateral to the linea semilunaris. Then cautery was used to cut the EO aponeurosis lateral to the lineasemilunaris (Fig. 1). This incision was widened as necessary from the fascia slightly above the ribs to the level of the anterior superior iliac spine, followed by blunt dissection of the EO aponeurosis from the internal oblique muscle. The EO fascia release was then done on the other side. The posterior rectus sheath was released by making an incision 0.5 to 1cm lateral to the linea alba. Then, retro rectus was dissected till the linea semilunaris, while conserving the neurovascular bundles (Fig. 2).

Then the posterior fascia was closed in the midline by Vicryl 2/0 continuous then sublay insertion of a polyprolene mesh was done which was

fixed to the posterior fascia by prolene 2/0 sutures. Then continuous suturing of the anterior sheath at midline was made by polydioxanone suture (PDS) size 0. Then applying a suction drain in the subcutaneous space was don then skin closure.

2- *Posterior component separation with transversus abdominis release:*

After a large midline laparotomy, all visceral adhesions to the anterior abdominal wall were dissolved, with care taken to protect the posterior rectus sheath and peritoneum (Fig. 3).

According to ACS procedure, the retro rectus was divided until to the linea semilunaris, and the intercostal neurovascular bundles were identified and conserved. Before continuing superiorly and inferiorly, the posterior rectus sheath was incised 0.5cm central to the linea semilunaris, and the TA muscle was divided using electro cautery. By releasing the transversus TA while preserving its location central to the linea semilunaris, skeletal nerves and rectus innervation are conserved. Once split, the TAM can be retracted anteriorly, and the wide, retromuscular plane can be established by blunt separation.

This plane travels laterally to the psoas, superolateral to the central tendon of the diaphragm (fascia diaphragmatic a), infero-laterally to the inguinal ligament, and inferiorly to the bladder neck (Fig. 4).

Subsequently, the transversalis fascia, posterior rectus sheath, and peritoneum of the posterior layer were sutured (as described in ACS). The majority of posterior layer fenestrations were closed with Vicryl suture to keep the intestine away from the mesh and prevent internal herniation. Supporting the posterior layer and laterally the TAM or medially the rectus abdominis, the polypropylene mesh was positioned in the avascular plane. The mesh was attached to the posterior layer in accordance with the ACS protocol. After applying a closed suction drain to the mesh, the front layer was sutured according to ACS guidelines (Fig. 5).

Fig. (1): Incision of external oblique muscle after subcutaneous flap dissection.

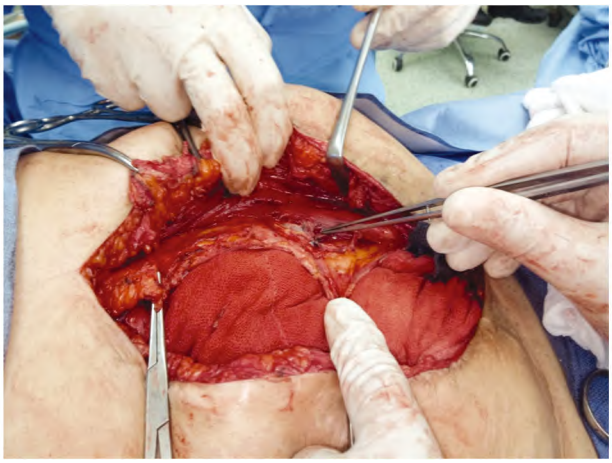

Fig. (2): Retro rectus dissection up to the neurovascular bundles.

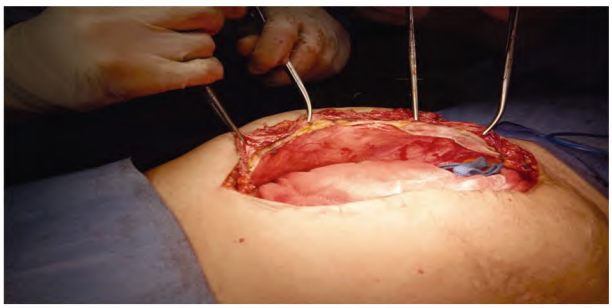

Fig. (3): Midline incision and adhesolysis.

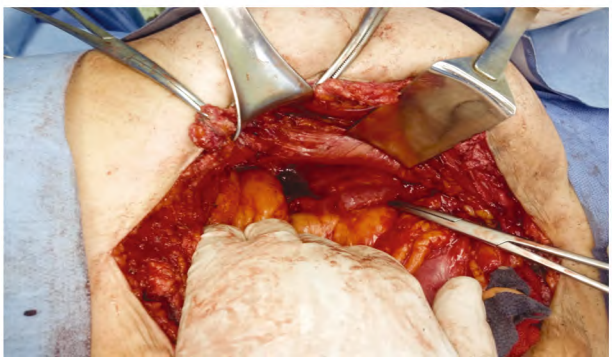

Fig. (4): Dissection up to retroperitoneal space and exposing psoas muscle.

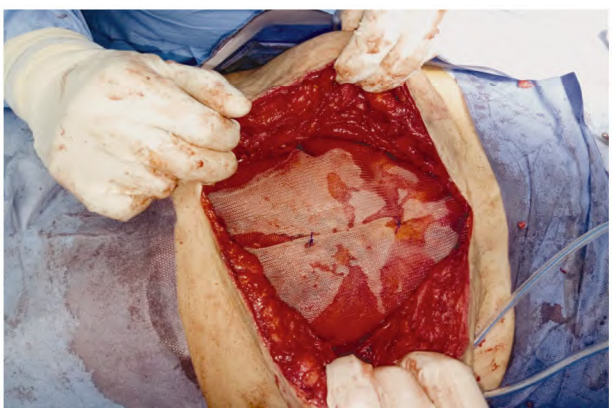

Fig. (5): Polyprolene mesh fixed to posterior layer.

Postoperative workup:

All patients received intravenous fluids, antibiotics, and analgesics. Daily wound dressing was done and oral intake was started once good audible intestinal sounds then the patient was discharged with tolerance to oral intake and stable general condition. All patients were followed-up in outpatient clinicatone week, one month, 3 months, 6 months and 12 months post-operative.

Data collection:

The following data were collected from both groups:

A- Preoperative: Demographic data as age, sex, BMI, presence of COPD, and type of hernia if primary or recurrent.

B- Intra-operative: Duration of surgery, intra-operative blood loss, visceral injury, and failure of the technique.

C- Postoperative data: Post-operative haemorrhage, daily output of the drain, wound infection, and hospital stay duration and early recurrencedetected by CT after 12 months.

Statistics:

Data was revised, coded, uploaded on a computer and analysed using SPSS version 26 for Windows (SPSS Inc, Chicago, IL, USA). Using the Shapiro-Kruskal test, the normality of quantitative data was evaluated, and the mean and standard deviation were calculated and reported. The Student *t*-test was utilised to compare quantitative factors between the two research groups. The qualitative information was represented by frequencies (n) and percentages (%). The connection between qualitative factors was examined using Chi-square and Fisher exact tests. *p*-values 0.05 were regarded as significant.

Results

This study was a prospectivestudy conducted on 40 patients having large ventral hernia aimed to compare between PCS with transversus abdominis release (20 patients) and ACS (20 patients, as regard post-operative outcome and complications.

No notable differences existed in the two groups regarding the demographic data of the patients, the mean age for group (A) was 39.85 years, and for group (B) was 42 years, in group (A) there were 9 males (45%) and 11 females (55%) but in PCS-TAR there were 7 males (35%) and 13 females (65%), the rest of patient demographics (Table 1).

Insignificant difference existed in the two groups regarding data as shown in (Table 2), operative time for group (A) was 196.25 minutes as mean time versus 213.25 minutes for PCS-TAR. The mean blood loss in group (A) was 472.5ml versus 455ml in group (B). There was no failure or injury in both groups.

Table (1): Patient demographics.

Variable	Group A ACS (20)	Group B PCS+TAR (20)	Test value	*p*-value	Sig.
Age (mean ± SD) years	39.85±8.45	42.00±9.22	0.767	0.448*	NS
Sex (No, %):					
Male	9 (45%)	7 (35%)	0.417	0.519**	NS
Female	11 (55%)	13 (65%)			
BMI (mean ± SD) kg/m^2	32.2±4.56	34.35±6.06	1.268	0.212*	NS
COPD (No, %):					
Yes	4 (20%)	5 (25%)	0.143	0.705**	NS
No	16 (80%)	15 (75%)			
Type of hernia (No, %):					
Primary	16 (80%)	19 (95%)	2.057	0.151**	NS
Recurrent	4 (20%)	1 (5%)			

* Independent sample *t*-test. ** Chi square.

Table (2): Operative data.

Variable	Group A ACS (20)	Group B PCS+TAR (20)	Test value	*p*-value	Sig.
Operative time (mean ± SD) min	196.25±45.97	213.25±59.39	1.012	0.318*	NS
Blood loss (mean ± SD) ml	472.5± 164.22	455.00± 156.36	0.345	0.732*	NS

* Independent sample *t*-test.

The mean hospital stay for group (A) was 5.8 days versus 5.6 days for group (B) with non-significant difference. Group (B) showed significant shorter time for drain removal than group (A), the mean time was 14.15 days for group (A), and was 9.95 days for group (B) (Table 3).

Regarding post-operative complications as shown in (Table 4), there was wound infection in 15% of patientsof group (A) versus 10% of patients of group (B), with non-significant difference. Patients developed seroma were much fewer in group (B) [5% of cases of group (B) versus 35% of cases of group (A)]. During the 12 months of follow-up there was recurrence in one case of group (A) versus zero cases in group (B), with non-significant difference in-between. We had no post-operative bleeding in both groups.

Patients who developed seroma were diagnosed clinically and by ultrasound, all were managed by aspiration. Cases with wound infection were treated by drainage, frequent dressing and broad-spectrum antibiotics. The recurrent case was planned to be repaired by PCS-TAR.

Table (3): Post-operative data.

Variable	Group A ACS (20)	Group B PCS+TAR (20)	Test value	*p*-value	Sig.
Hospital stay (mean ± SD) days	5.8±1.44	5.6±1.57	0.420	0.677*	NS
Time to drain removal (mean ± SD) days	14.15±4.67	9.95±3.9	3.087	0.004*	S

* Independent sample *t*-test.

Table (4): Post-operative complications.

Variable	Group A ACS (20)	Group B PCS+TAR (20)	Test value	*p*-value	Sig.
Wound infection (No, %)	3 (15%)	2 (10%)	0.229	0.633**	NS
Seroma (No, %)	7 (35%)	1 (5%)	5.625	0.018**	S
Recurrence (No, %)	1 (5%)	0 (0%)	1.026	0.311**	NS

** Chi square test.

Discussion

As a consequense of midline incision in the abdominal wall, ventral hernia has become a world-wide condition that happens often. However, umbilical and other linea alba hernias are the most prevalent types of primary hernias. Spigelian and lumbar hernias are far less prevalent than primary ventral hernias **[7]**. Component separation procedures are crucial for healing abdominal hernias with major defects or domain loss and rebuilding abdominal wall **[8]**.

In our study we compared between ACS (group A) and PCS-TAR (group B) in ventral hernia repair in patients with defect size from 100cm^2 to 300cm^2.

Insignificant difference existed in both groups included in our study regarding operative time. In a study by Albalkiny S. et al., the mean operative time for ACS was 215 minutes versus 217 minutes for PCS-TAR with non-significant difference. That was due to small size of hernia defect, there was not major intra operative complication, and also we have surgeons with good experience in component separation **[9]**.

The two groups of our study had non-significant difference regarding the mean blood loss but in a study by J. Gala, et al., the mean blood loss was 189 ml for ACS and 225ml for PCS-TAR that was due small defect sizes they operated on. Their mean defect size was 120cm^2 for ACS versus 131cm^2 for PCS-TAR **[10]**.

No significant difference existed in the two groups regarding wound complications except in seroma which was significantly less in PCS-TAR due to the extensive dissection done in ACS. This was different from a study was done by Rashid S. over 19 patients underwent ACS which resulted in postsurgical infection in patients with no seroma operation, the incidence of seroma was lower than

our study due to small defect size which resulted in less dissection (the mean size in their study was 10.11cm) [11].

In a study done by Petro CC, et al., conducted on 34 patients who underwent PCS-TAR there was infection in 23.5% of cases and seroma in 2.9% of cases. Infection rate was relatively high in their study as, 14.7% of patient had parastomal hernias and 61.8% of patients had contaminated wounds due to enterocutaneous fistula, enterostomy revision, or enterostomy reversal [12].

There was significant difference between the two groups regarding time for drain removal which was shorter in PCS-TAR. That was due to less incidence of wound seroma in PCS-TAR than ACS. In a study by J. Gala, et al., done over 25 patients, the mean time for drain removal was 25 days for patients with ACS versus 5 days for patients with PCS-TAR. Results for ACS was relatively higher than ours due to increased wound complications, infection happened in 8 cases (32%) 5 of them needed wound debridement [10]. In this study,No significant difference existed in the two groups regarding the mean hospital stay. In a study by J. Gala, et al., done over 25 patients the mean hospital stay for ACS was 13 days which was longer than our study as 8 patients (32%) had wound complications, 5 of them (62.5% of total infections) needed surgical debridement, also 5 patients (20%) were admitted to ICU [10]. In a study by Novitsky YW. The mean hospital stay for PCS-TAR was 5.1 days with non-significant difference [13].

Recurrence rate was insignificant in both two groups of our study. This was different from a study done by Krpata DM, et al., conducted over 56 patients had ACS and 55 patients had PCS-TAR, there was recurrence in 14.3% of ACS cases versus 3.6% of PCS-TAR cases. Higher recurrence rate in their study was multifactorial; first the mean defect sizes were larger ($531cm^2$ for ACS, $472cm^2$ for PCS-TAR), the second factor was there was wound complications in 27 cases of ACS (11 major and 16 minor) versus 14 wound complications (6 major and 8 minor). Another factor was that 8 patient were immunosuppressed (5 of ACS and 3 of PCS-TAR) [14].

Conclusion:

PCS-TAR is an effective technique for repairing large ventral hernia with less postoperative wound complication compared to ACS. We recommend putting this technique to be the first choice in large ventral hernia.

Disclosure:

All contributors have no related conflicts of interest to declare.

Financial aid:

This investigation received no funding.

References

1- SAJID M.S., BOKHARI S.A., MALLICK A.S., CHEEK E. and BAIG M.K.: Laparoscopic versus open repair of incisional/ventral hernia: a meta-analysis. Am. J. Surg., 197: 64-72, 2009.

2- TRUJILLO C.N., FOWLER A., AL-TEMIMI MOHAMMED H., ALI A., JOHNA S. and TESSIER D.: Complex ventral hernias: A review of past to present. Perm J., 22: 17-015, 2018.

3- SWITZER N.J., DYKSTRA M.A., GILL R.S., LIM S., LESTER E., DE GARA C., et al.: Endoscopic versus open component separation: Systematic review and meta-analysis. Surg. Endosc., 29(4): 787-95, 2015.

4- DE VRIES REILINGH T.S., VAN GOOR H., CHARBON J.A., ROSMAN C., HESSELINK E.J., VAN DER WILT G.J. and BLEICHRODT R.P.: Repair of giant midline abdominal wall hernias: 'components separation technique' versus prosthetic repair: Interim analysis of a randomized controlled trial. World J. Surg., 31: 756-763, 2007.

5- GHAZI B., DEIGNI O. and YEZHELYEV M.: Current options in the management of complex abdominal wall defects. Ann. Plast. Surg., 66: 488-492, 2011.

6- CARBONELL A.M., COBB W. S. and CHEN S.M.: Posterior components separation during retromuscular hernia repair. Hernia, 12 (4): 359-62, 2008.

7- BITTNER J.G., EDWARDS M.A., SHAH M.B., MACFADYEN B.V. and MELLINGER J.D.: Mesh-free laparoscopic Spigelian hernia repair. Am Surg., 74: 713-20, 2008.

8- SNEIDERS D., YURTKAP Y., KROESE L.F., JEEKEL J., MUYSOMS F.E., KLEINRENSINK G.J. and LANGE J.F.: Anatomical study comparing medialization after Rives-Stoppa, anterior component separation, and posterior component separation. Surgery, May 165 (5): 996-1002, 2019.

9- ALBALKINY S. and HELMY M.: Anterior component separation versus posteriorcomponent separation with transversus abdominus release in abdominal wall reconstruction for incisional hernia. Egypt J. Surg., 37: 335e343, 2018.

10- GALA J., NICHAT P., BHANDARWAR A., et al.: Single institute experience with anterior and posterior component separation techniques for large ventral hernias: A retrospective review, Asian Journal of Surgery, 07.042, 2021.

11- RASHID S.: Anterior component separation with sublay polypropylene meshplacement: An ideal way to deal with large ventral abdominal hernias. Professional Med. J., 28 (5): 731-736, 2021.

12- PETRO C.C., COMO J.J., YEE S., PRABHU A.S., NOVITSKY Y.W. and ROSEN M.J.: Posterior component separation and transversus abdominis muscle release for

complex incisional hernia repair in patients with a history of an open abdomen. J. Trauma Acute Care Surg., Feb. 78 (2): 422-9, 2015.

13- NOVITSKY Y.W., ELLIOTT H.L., ORENSTEIN S.B. and ROSEN M.J.: Transversusabdominis muscle release: A novel approach to posteriorcomponent separation during complex abdominal wallreconstruction. Am. J. Surg., 204: 709-716, 2012.

14- KRPATA D.M., BLATNIK J.A., NOVITSKY Y.W. and ROSEN M.J.: Posterior and open anterior components separations: A comparative analysis. Am. J. Surg., Mar. 203 (3): 318-22, 2012.

دراسة مقارنة بين طريقة فصل المكون الخلفى لعضلات جدار البطن مع تحرير العضلة المستعرضة لجدار البطن وطريقة فصل المكون الأمامى لعضلات جدار البطن فى علاج الفتق البطنى الكبير

من أهم المشاكل التى تواجه الجراحين هى إصلاح الفتق الكبير بجدار البطن، حيث يشكل هذه الفتق تحدياً للجراح بسبب الخلل الكبير ومحتويات كيس الفتق باستمرار خارج تجويف البطن. يصبح إصلاح هذه الفتق الكبير إلزامياً لمنع المضاعفات وأيضاً تحسين نوعية حياة المريض. تم ابتكار العديد من التقنيات لمعالجة مثل هذه الفتق. وغنى عن القول أن إغلاق البطن تحت التوتر فى مثل هذه الحالات يؤدى إلى متلازمة المقصورة فى البطن، يوجد خيارات عديدة لإغلاق عيوب جدار البطن الكبيرة والمعقدة بما فى ذلك الإصلاح الأساسى، والشبكة، والرقع البعيدة من العضلات، أسفرت عن نتائج دون المستوى الأمثل.

وقد واجهت تقنية فصل المكونات الأمامية المفتوحة العديد من المشكلات على مر السنين. مثل تكون السوائل تحت الجلد، والتهابات الجرح وتشكيل الخراج. تم تقليل هذه المضاعفات عن طريق استخدام فصل المكون الأمامى الأقل توغلاً، مثل تقنيات التجويف المثقبة أو التنظير الداخلى، لكن هذه التقنيات غير ممكنة فى جميع الحالات. نتيجة لذلك، تم تطوير العديد من التعديلات على هذه التقنية. تتضمن هذه الأساليب المبتكرة استخدام مساحة ما قبل الصفاق أو تطوير مستوى عضلى باستخدام تقنية فصل المكون الخلفى.

وتمتار تقنية فصل المكون الخلفى لعضلات جدار البطن مع تحرير العضلة المستعرضة لجدار البطن أنها تحافظ على جزء كبير من الدم فى جدار البطن، ويحسن الشفاء ويقلل من إصابة الجروح بالعدوى فى المرضى الذين يعانون من فتق جراحى أو بطنى كبير (عيوب أكبر من ١٠ سم فى العرض، وفقدان المجال)، والهدف من ذلك هو وضع شبكة خارج الغشاء البريتونى وتقليل الشد على البطن وارتفاع الضغط بداخلها مع إمكانية وضع شبكة بين طبقتين فى جدار البطن.