

## Open Anterior Component Separation Reconstruction Technique for Large Ventral Incisional Abdominal Wall Hernias

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### ABSTRACT

**Background:** Eleven percent of all abdominal laparotomies are complicated with ventral abdominal wall hernias, which is an increasing problem.

**Aim:** To assess complication rates as well as outcomes of the open anterior component separation (ACS) technique for large ventral and incisional abdominal wall repair.

**Patients and Methods:** This prospective research was conducted on twenty cases who underwent open ACS procedure for large incisional hernia. Clinical and routine studies including investigations of blood and radiological investigations, as abdominal US, were performed for all cases.

**Results:** Regarding operative data, the duration of the operation varied from 123 to 167 min with a mean of  $142.6 \pm 14.5$  min, and blood loss varied from 318 to 712 ml with a mean of  $495.7 \pm 130.41$  ml. Regarding prevalence of 30-day readmission, 4 (20%) individuals were readmitted to the hospital within a month after operation. Regarding wound complications, 5 (25%) patients had infection, 3 (15%) patients had seroma, 2 (10%) patients had hematoma, and 1 (5%) patient had skin necrosis. Regarding GIT complications, 3 (15%) patients had paralytic ileus and 1 (5%) patient had fistula. No cases had systemic complications.

**Conclusions:** The open anterior components separation technique still a good option for detecting primary fascial closure in treating giant ventral hernias. Preserving perforator vessels and retromuscular mesh placement are to be installed to original method to reduce wound problems and rather high recurrence rate.

**Keywords:** Large Ventral and Incisional Abdominal Wall Reconstruction, Open Anterior Component Separation Technique, Hernia repair, Incisional hernia.

### INTRODUCTION

Eleven to twenty three percent of all abdominal laparotomies are becoming increasingly complicated by ventral abdominal wall hernias. In contemporary general surgery, the execution of dependable and long-lasting ventral hernia repairs accompanied by minimal morbidity and recurrence has emerged as a substantial challenge <sup>(1)</sup>.

For instance, open mesh repair encounters a failure rate of as much as thirty-two percent, whereas primary suture repair encounters twenty-five to fifty four percent <sup>(2-4)</sup>.

Open suture methods for the repair of incisional hernias produced unacceptably high recurrence rates; these methods were abandoned in the early 2000s in favor of mesh restorations, which could be performed laparoscopically or openly <sup>(5)</sup>.

Despite mesh repair, however, large and recurrent incisional hernias remained a significant clinical concern because sac's size, contents, and compromised abdominal wall functions <sup>(6)</sup>.

The method of ACS was initially established in 1990 by Ramirez *et al.* <sup>(7)</sup> to assist with medial fascial advancement and final repair. According to them, the posterior rectus sheath was released first in their component separation procedure. Then, a wide skin flap exposure was created, and the external oblique was released.

Since its inception, the components separation technique (CST) has evolved to include a number of distinct CSTs in addition to the open method involving

the anterior release of aponeurosis of external oblique muscle. A differentiation must be established among the release executed through an anterior or posterior approach, with respect to the separation of components. Additionally, there have been developments of endoscopic variations of the anterior and posterior CST. Utilizing open, laparoscopic, and robotic surgical armamentarium; every technique has been documented to date <sup>(8)</sup>.

Therefore, we aimed to evaluate open ACS method for large ventral and incisional abdominal wall reconstruction regarding complications as well as outcomes.

### PATIENTS AND METHODS

#### Patient selection:

This prospective research was performed on twenty cases who underwent open anterior component separation method for large incisional hernia at the Department of Surgery, Damanhur Medical National Institute, Elbehiera, Egypt, throughout duration from January 2021 to June 2023.

**Inclusion criteria** were hernia following a midline incision, a reducible hernia, a primary hernia that is either recurrent or primary, a horizontal defect exceeding twelve cm in length, or numerous deficiencies with a combined transverse dimension surpassing 12 cm. Patients with BMI > 40 and with hernias smaller in diameter were excluded.

### Preoperatively:

The medical records of every patient were obtained, encompassing details such as age, gender, concurrent conditions, and surgical procedures. A clinical examination was conducted both globally, assessing vital signs for example body mass index and locally, examining the incisional hernia. Blood tests and radiological examinations, for instance an abdominal US, were routine.

Age and gender were among the demographic variables gathered from the patients. Furthermore, the study included information on medical comorbidities, including diabetes, smoking and alcohol behaviors, body mass index, COPD, and ASA score.

### Operative Techniques:

#### *Anterior component separation*

Our approach to ACS was comparable to that, which **Ramirez et al.** [7] outlined in 1990. As a result of a thorough midline laparotomy, every visceral adhesion to anterior abdominal wall was eliminated. A skin incision was established to expose external oblique muscle, and the subcutaneous space was excised using cautery. The space was released at a distance of 2 cm laterally to linea semilunaris. Additionally, external oblique aponeurosis lateral to the rectus sheath was severed using cautery.

As required, this incision was made from the beginning of fascia immediately above ribs to anterior superior iliac spine. On the opposite side, release of the external oblique fascia was subsequently repeated. In order to liberate the posterior rectus sheath, an incision was made in sheath 2.5 cm laterally to linea alba. The fascia was subsequently closed in the midline.

Laterally to the cut edge of the external oblique, the mesh was positioned. Through usage of 2-0 non-absorbable sutures, the mesh was secured. Irrigation of the subcutaneous tissues was exhaustive. One or two subcutaneous drains were typically positioned over the fascia, contingent upon the degree of subcutaneous dissection. Following this, an interrupted absorbable suture was used to close the subcutaneous tissues, and absorbable subcuticular stitch or staples were employed to close the epidermis.

### Postoperatively:

A. Short term result:

1. Duration of hospitalization following surgery.
2. Readmission and reoperation within a month
3. Complications

- Wound complications: seroma, infection, hematoma,
- GIT complications: paralytic ileus and fistula.

Systemic Complications (Pneumonia and deep vein thrombosis).

B. Long term result: Recurrence.



**Figure 1: Preoperative photo for patient with large midline incisional hernia.**



**Figure 2: Postoperative photo for patient with large midline incisional scar**

**Ethical consideration:**

Before beginning the procedure, the Institutional Review Board (IRB) of the Damanhur Medical National Institute in Elbehiera was consulted in order to acquire their consent for the research project. A thorough explanation of the study's purpose and goals was provided to the participants in the research project by the researcher. The researcher gave their word that the data collected from the subjects would be kept anonymous as well as secret. Subjects were informed that they had the right to withdraw from the study at any time without providing any explanation, in addition to they were free to select whether or not they wanted to take part in the research study. The subjects' ethics, morals, culture, as well as faith were honored throughout the process. In addition, it was necessary to gain the participants' consent in order to include them in the research. For the reason of conducting research with human subjects, this work was done depending on the Declaration of Helsinki, which is the Code of Ethics of the World Medical Association.

**Statistical analysis**

SPSS v26 was utilized for the statistical analysis (IBM Inc., Armonk, NY, USA). For quantitative variables, the mean, standard deviation (SD), and range were provided. When describing qualitative variables, frequency and percentage were utilized. **Results** Regarding demographic data of the studied cases, the average age was  $47.9 \pm 10.3$  years. There were 12 (60%) males. Mean weight was of  $83.2 \pm 12.31$  kg. Mean height was of  $1.7 \pm 0.06$  m. Mean BMI was  $29.8 \pm 5.68$  kg/m<sup>2</sup>. 5 (25%) patients were smokers (Table 1).

**Table 1: Demographics of examined cases**

|                          |           | n=20            |
|--------------------------|-----------|-----------------|
| Age (years)              | Mean ± SD | 47.9 ± 10.3     |
|                          | Range     | 26 - 60         |
| Sex                      | Man       | 12 (60 percent) |
|                          | Woman     | 8 (40 percent)  |
| Weight (Kg)              | Mean ± SD | 83.2 ± 12.31    |
|                          | Range     | 59 - 100        |
| Height (m)               | Mean ± SD | 1.7 ± 0.06      |
|                          | Range     | 1.59 - 1.76     |
| BMI (kg/m <sup>2</sup> ) | Mean ± SD | 29.8 ± 5.68     |
|                          | Range     | 22.21 - 38.37   |
| Smoking                  |           | 5 (25%)         |

Data are presented as mean ± SD, frequency and percentage. BMI: Body mass index.

Most common comorbidities of the studied patients were hypertension and diabetes mellitus (Table 2).

**Table 2: Comorbidities of examined cases**

|                   | n=20    |
|-------------------|---------|
| Diabetes mellitus | 7 (35%) |
| Hypertension      | 8 (40%) |
| COPD              | 4 (20%) |

COPD: Chronic obstructive pulmonary disease.

7 patients had previous hernia repair. Mean operative time was  $142.6 \pm 14.5$  min, and mean blood loss was  $495.7 \pm 130.41$  ml. Average duration of hospitalization was  $5.6 \pm 1.58$  days (Table 3).

**Table 3: Prevalence of previous hernia repair and operative data in the studied patients**

|                                |           | n=20           |
|--------------------------------|-----------|----------------|
| Previous hernia repair         |           | 7 (35%)        |
| Operative time (min)           | Mean ± SD | 142.6 ± 14.5   |
|                                | Range     | 123 - 167      |
| Blood loss (ml)                | Mean ± SD | 495.7 ± 130.41 |
|                                | Range     | 318 - 712      |
| Length of hospital stay (days) | Mean ± SD | 5.6 ± 1.58     |
|                                | Range     | 2-8            |

Data are presented as mean ± SD, frequency and percentage.

4 cases were readmitted to hospital within a month after operation. Most common wound complication in the studied patients, was infection in 5 cases. Regarding GIT complications, 3 patients had paralytic ileus. No cases had systemic complications (Table 4).

**Table 4: Prevalence of 30-day readmission and complications in the studied cases**

|                                    |                      | n=20    |
|------------------------------------|----------------------|---------|
| 30-day readmission and reoperation |                      | 4 (20%) |
| Wound complications                | Infection            | 5 (25%) |
|                                    | Seroma               | 3 (15%) |
|                                    | Hematoma             | 2 (10%) |
|                                    | Skin necrosis        | 1 (5%)  |
| Systemic complications             | Pneumonia            | 0 (0%)  |
|                                    | Deep vein thrombosis | 0 (0%)  |
| GIT complications                  | Paralytic ileus      | 3 (15%) |
|                                    | Fistula              | 1 (5%)  |

Data are presented as frequency and percentage.

## DISCUSSION

Before **Ramirez et al.** <sup>(7)</sup> who re-described and popularized the procedure in 1990, **Albanese** <sup>(9)</sup> initially documented the utilization of anterior components separation (ACS) to close abdominal wall defects. Without the requirement of musculofascial membranes, this method is distinctive in that the abdominal wall is supported in a dynamic and robust manner by the functional transfer of abdominal musculature.

ACS was the cornerstone of abdominal wall reconstruction for cases with large incisional hernias for thirty years. On-lay or underlay mesh reinforcement was a crucial adjunct in enhancing results owing to its exceptionally low recurrence rate. Numerous surgeons were apprehensive about employing it on account of the logical repercussions associated with the elevation of substantial myofascial and subcutaneous flaps. Proximal complications that may arise include seroma, hematoma, and infection, necrosis of the skin margin, wound collapse, and recurrence of the hernia <sup>(10)</sup>.

Regrettably, standard anterior CST is correlated with substantial rates of wound complications <sup>(11,12)</sup>. To reach lateral border of rectus muscle, a substantial lateral dissection is required, during which substantial subcutaneous skin flaps must be incised. Insufficient consideration by surgeons regarding the preservation of vital vascular supply to abdominal wall may result in necrosis of fat, wound dehiscence and skin, and seroma formation within this expansive area of deceased tissue. It has been demonstrated that wound infection rates range from twenty percent to over seventy percent <sup>(13,14)</sup>.

In light of the elevated incidence of complications linked to the anterior open CST, clinical guidelines advise the utilization of alternative methods for myofascial release, including endoscopic approaches, perforator sparing methods, or posterior CST methods <sup>(15)</sup>.

However, in the case of endoscopic anterior CST, medial advancement may be marginally restricted due to subcutaneous mobilization limitations, whereas perforator sparing CST may inhibit skin necrosis without limiting dead space. An additional strategy to mitigate postoperative wound morbidity could be to utilize talcage of the subcutaneous space, which has been shown to significantly reduce seroma formation <sup>(16)</sup>. However, contrary reports have surfaced regarding the efficacy of talc utilization in this particular context <sup>(17,18)</sup>.

Our study reported that 4 (20%) cases were readmitted to the hospital at day 30 after operation. Regarding wound complications in the studied patients, 5 (25%) patients had infection, 3 (15%) patients had seroma, 2 (10%) patients had hematoma, and 1 (5%) patient had skin necrosis. Regarding GIT complications, 3 (15%) patients had paralytic ileus and 1 (5%) patient had fistula. No cases had systemic complications.

Recurrence rates following ACS reportedly range from seven percent to thirty-two percent <sup>(19-21)</sup>.

**Kesicioglu et al.** <sup>(22)</sup> showed that with three years passed, a recurrence rate of 18.0% seems reasonable. They performed ACS without mesh on a series of cases. After ACS without mesh, **Muse et al.** <sup>(23)</sup> documented a recurrence rate of 28%; however, by incorporating a Rives-Stoppa retromuscular mesh closure into ACS, that rate was considerably reduced to 9.1%. Rives-Stoppa repair of complex ventral hernias has been the subject of a succession of articles detailing its low recurrence charge <sup>(24,25)</sup>.

In their study of thirty-five individuals, **DiBello and Moore** <sup>(26)</sup> utilized the ACS method. Not a single patient underwent posterior rectal sheath release; instead, 15 cases had midline closure maintained by an on-lay prosthesis. After surgery wound complications were documented in fourteen percent of cases, with nine percent of cases exhibiting recurrence following an average follow-up period of twenty-two months.

The original technique was implemented on 30 patients by **Giroto et al.** <sup>(27)</sup>. The average of twenty-one months of follow-up revealed a recurrence rate of six percent for postoperative wound complications, which accounted for twenty-seven percent of the cases reported.

In the series of thirty individuals examined by **Lowe et al.** <sup>(28)</sup>, complications following surgery were more prevalent. An average of a year of follow-up revealed reherniation in ten percent of the cases.

Twenty patients who underwent ACS were followed for one year in the research conducted by **Albalkiny and Helmy** <sup>(29)</sup>. SSI was stated in fifty percent of cases, with wound dehiscence accounting for thirty-five percent; necrotizing wound infections arisen in 4 individuals and required surgical wound debridement as well as removal of portions of the mesh. Thirty-five percent of cases experienced recurrence after one year of follow-up.

A prior CST may be a viable alternative to mesh repair for individuals with large midline abdominal incisional hernias in clean-contaminated, contaminated, or infected fields; however, outcomes may be suboptimal in these cases compared to mesh <sup>(30,31)</sup>.

**Tong et al.** <sup>(32)</sup> revealed that persons who underwent an open anterior myofascial release with mesh experienced a lower risk of hernia recurrences (16.7 % with mesh compared to 27% without mesh) as well as looked to fare better than those who performed open CST alone. When it came to the care of giant incisional hernias, the authors of a qualitative systematic evaluation came to the conclusion that mesh repair appeared to have a lower recurrence rate than CST with no mesh <sup>(33)</sup>.

**Cornette et al.** <sup>(19)</sup> were among the initial researchers to compare the transverse abdominis approach, the perforator-preserving approach, the laparoscopic or endoscopic approach, and the classical anterior component. They concentrated on hernias accompanied by loss of domain and enormous hernias. Ventral hernias that exceed ten cm in width, with or

without loss of domain, are referred to as giant ventral hernias. During their investigation, they discovered a total of 36 articles related to data analysis. Out of these, 22 articles focused on the open anterior technique, which involved 1,348 cases. Additionally, 8 articles discussed the transversus abdominis release method, which involved 761 cases. Furthermore, 13 articles explored the endoscopic anterior approach, which involved 193 individuals. Surprisingly, only five researches at that time included the perforator preserving approach, which involved 242 cases. According to the research provided, the open anterior CST group had a surgical site occurrence rate of 21.4%, compared to 23.7 percent for TAR, 20.3 percent for the endoscopic approach, and 16.0 percent for the perforating sparing cases. The observed difference was not significant, with a p-value of 0.092.

The findings on recurrence rates were consistent throughout the studies. The pooled analysis revealed a cumulative recurrence rate of 11.9% after a follow-up period of 22 months. In contrast, TAR reported 40 recurrences, accounting for 5.3% of cases, over an average follow-up duration of 17 months. One could argue that these studies were conducted during the early stages of TAR, which may have introduced significant bias into the results. It is surprising that the rate of SSO was not significantly better in TAR individuals in contrast to those who underwent open anterior CST. This is despite the fact that similar findings were reported by **Hodgkinson et al.** <sup>(34)</sup> as well as recently by **Pereira-Rodriguez et al.** <sup>(35)</sup>.

#### LIMITATION

There were certain limitations to our research, including a relatively small sample size, the fact that it was done at a single centre, as well as a short duration of follow-up.

#### CONCLUSIONS

The use of the open anterior CST continues to be a viable choice for achieving primary fascial closure. This approach has the ability to effectively cure large ventral hernias in individuals who are at high risk. However, to reduce wound complications and the relatively high risk of recurrence, the original procedure should be enhanced with modern changes, including the preservation of perforator vessels and the implantation of a retromuscular mesh.

#### DECLARATIONS

- **Consent for publication:** I attest that all authors have agreed to submit the work.
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** no conflicts of interest.

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