Clinics in Surgery

Research Article
Published: 18 Dec, 2017

Components Separation Technique (CST) in Reconstruction of Large and Complex Abdominal Wall Defects

*Tarek Abulezz**

Department of Plastic Surgery, Sohag University, Egypt

Abstract

Background: Wide or recurrent midline abdominal wall defects are usually challenging surgical problem. Midline abdominal wall dehiscence resulting as a complicated wound healing after laparotomy is the most challenging. Friability of the wound edges, concomitant infections and the debilitated general condition of the patient due to long hospitalization make the healing potential low. Ideal repair should utilize native tissue and should restore the dynamic properties of the abdominal wall.

Patient and Methods: Components Separation Technique (CST) was used to reconstruct abdominal wall defects in 20 patients (8 males and 12 females) over a period of 10 years.

Results and Conclusion: The technique of components separation is very reliable and easy to learn and to do. It is also very effective in repairing midline abdominal wall defects of various etiologies. It provides well-vascularized native tissues for the reconstruction and it restores the dynamic integrity of the abdominal wall. It is particularly useful for the repair of midline post-laparotomy wound dehiscence.

Keywords: Abdominal wall reconstruction; Components separation technique; Hernia repair; Wound dehiscence

Introduction

Large and complex defects of the anterior abdominal wall occur most commonly due to herniation following abdominal surgery, but may also be caused by trauma, infection, or tumor resection [1]. Besides the obvious aesthetic disfigurement, large abdominal wall defects can also lead to functional consequences with poor protection of the intra-abdominal viscera [2]. Large, complex and recurrent abdominal wall defects are particularly challenging surgical problem. Various methods of hernia repair using either open or laparoscopic approaches can be used to manage abdominal wall defects. However, wide hernia defects can be difficult to correct because primary hernia repair will mostly entail wound tension which is a major cause of repair failure and recurrence. On the other hand, the use of synthetic mesh carries the risk of life-long foreign body reaction and possible serious complications such as mesh infection, exposure, extrusion and fistulae. Furthermore, synthetic materials are also contraindicated in the presence of gross contamination or infection in the operative field.

The Component Separation Technique (CST) was first described by Ramirez et al. [3] in 1990. It is very effective for reconstructing large or complex midline abdominal wall defects (Figure 1) and it has the advantage of restoring the innervated dynamic abdominal wall integrity without producing undue tension on the repair [4-6]. It can be performed to reconstruct a large abdominal wall defect without the need for mesh [3,7]. Recurrence rates after the use of component separation technique ranged from 0% to 30% [2,4,8]. Endoscopic-assisted CST was performed to save the perforators of the epigastric arteries and the results were comparable to the open technique [9]. Despite the versatility of the CST and its low recurrence rates compared to the recurrence rate in the conventional repair of similar complex abdominal wall defects, the technique is still not popular in the general surgical practice. General surgeons usually refer patients with complex hernias to the plastic surgery service as a last resort. In this report, I present my personal experience with the CST and report surgical outcomes and morbidity, with the aim to raise awareness of this technique among various specialties and to advocate the plastic surgeons to get more involved in the management of these

OPEN ACCESS

Correspondence:
Tarek Abulezz, Department of Plastic Surgery, Sohag University, Sohag 82524, Egypt, Tel: +201003674340; E-mail: tabulezz@med.sohag.edu.eg

Received Date: *02 Nov 2017*
Accepted Date: *08 Dec 2017*
Published Date: *18 Dec 2017*

Citation:
Abulezz T. Components Separation Technique (CST) in Reconstruction of Large and Complex Abdominal Wall Defects. Clin Surg. 2017; 2: 1816.

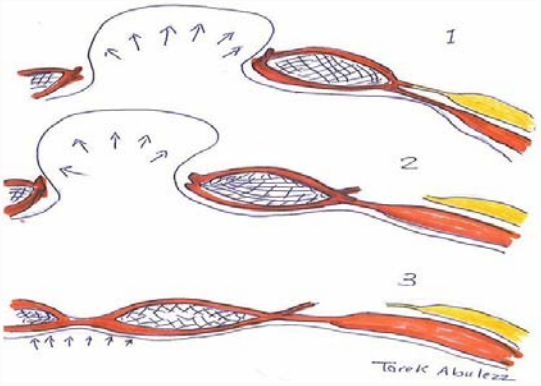

Figure 1: Illustration of the fundamental steps of component separation technique: 1. Cross-section of the anterior abdominal wall in which there is a wide separation of the recti and a midline hernia sac; 2. The external oblique aponeurosis is released lateral to the semilunar line; 3. The two rectus muscles are approximated in the midline and the hernia repaired with mobilization of the internal oblique-rectus muscle flap.

Figure 2: A- The preoperative midline dehiscence with exposed intestines; B- The operative view after performing component separation with the two paramedian myofasciocutaneous flaps approximated and sutured in the midline and the bilateral skin release defects are skin-grafted; C- The early postoperative result after 7 days of operation; D, E and F are the right, anterior and left views of the patient after one years of operation respectively.

complex cases.

Patients and Methods

The study was approved by the committee for research ethics in Faculty of medicine, Sohag University, and an informed written consent was obtained from the patients or their guardians. There were 20 patients (8 males and 12 females) operated in the period from March 2005 till October 2015. The age ranged from 6 years to 68 years with an average of 45. The defect size ranged from 70 to 459 square centimeters with an average of 162. The operation was performed under either general or spinal anesthesia. Midline closure of the abdomen was performed with running # "1" Vicryl or PDS sutures with few interrupted of the same material. When mesh reinforcement was deemed necessary, this was used as an onlay, secured with continuous 3'0 Prolene sutures. The average follow up period was 5.5 years. The defects resulted from different etiologies (Table 1). Early postoperative complications were comparable to conventional repairs and included: 3 cases of seroma, one case of postoperative hematoma and 2 cases of mild wound infection that was controlled with systemic antibiotics for 5 days. However, there was no mortality or dehiscence.

Figure 3: The right photo is the preoperative front view of a child with incisional hernia after lower paramedian exploration; the left photo is the operative view showing the defect (partially occluded by a towel and the release of the external oblique aponeurosis.

Case Presentation

Case 1: 25-year old male patient previously in the emergency section for a retroperitoneal hematoma resulted from blunt trauma. The patient had a burst abdomen after 8 days postoperative. My colleagues in general surgery department tried twice to close the abdomen with tension sutures, unfortunately, the wound was disrupted again. The patient was referred to plastic surgery with a defect measuring 17 cm × 27 cm diameter in the anterior abdominal wall with exposed intestines and ragged macerated wound edges. After cleansing of the wound and dissection of adherent intestinal loops, the wound edges were refreshed and bilateral relaxing skin incisions were made one inch lateral to linea semilunaris. The lateral skin flaps were dissected from the abdominal muscles while the paramedian flaps were left attached to the underlying rectus muscles. Component separation was performed and the two rectus muscles with the attached skin flaps were approximated and sutured in layers in the midline. Split-thickness skin grafts were applied to cover the secondary skin defects (Figure 2). This was the first case of the series and it has been published separately by the same author in a short report in 2008 [10].

Case 2: 6-year old child was presented with incisional hernia after a right paramedian incision one year ago for a complicated appendicitis. The defect was measuring 13 cm × 6 cm. Component separation technique was performed on the right side and closure of the hernial defect in two layers using Vicryl 1 suture (Figure 3).

Case 3: 37-year old male patient presented with sicatricial incisional hernia after right paramedian exploration for complicated appendicitis. The defect measured 12 cm × 20 cm in diameters and the patient was having cervical lymphadenopathy that proved to be tuberculous and the patient received antituberculous treatment for 6 weeks before the CST operation and then he completed his antituberculous regimen for 6 months (Figure 4).

Case 4: 68-year old female presented with midline incisional hernia of 7-years duration, with the defect 16 cm × 11 cm. She had a scar in the left flank. In operation, a suprapubic incision was done and the skin was dissected from the abdominal muscle and fascia upward towards the costal cartilage (a bit shorter on the left side). Releasing incision was made in the external oblique aponeurosis 1 cm lateral to the linea semilunaris from above the inguinal ligament upward to the costal margin. Simple closure of the hernia defect and reconstruction of the linea alba was accomplished using continuous Vicryl 1 sutures.

Figure 4: Preoperative photos of the patient with large incisional hernia after right paramedian exploration.

Figure 5: A and B the front and lateral views of the patient with huge incisional hernia, note the thin skin and the scar in the left flank; B and C after marking the operative plan, the suprapubic incision; E and F: the early postoperative result with epidermolysis in the edge of the abdominal skin flap in the left side of the wound.

There was an area of epidermolysis in the left side of the wound that healed spontaneously within 2 weeks (Figure 5).

Case 5: 28-year old female patient presented with recurrent incisional hernia with multiple hypertrophic scars. The hernia defect was measuring 19 cm × 11 cm. Bilateral elliptical excision of the scars, dissection of hernia off the skin and performing bilateral CST with an onlay Prolene Mesh reinforcement were done (Figure 6).

Case 6: 62-year old male patient presented with huge and pendulous infraumbilical hernia that was hiding the pubic region. The defect was measuring 13 cm × 20 cm. Component separation technique was performed with the release of external oblique aponeurosis of about 7 cm on each side. The hernia was repaired in the midline in two layers using Vicryl 1 suture and an onlay Prolene mesh used to reinforce the repair (Figure 7).

Figure 6: A: preoperative view showing the multiple ugly scars and the hernia; B: the early postoperative photo of the same patient after excising of the scars and repair of the hernia; C: operative view showing excision of the scars to get an access for the hernia; D: the multiple hernia sacs are shown; E: after hernia repair and onlay mesh reinforcement.

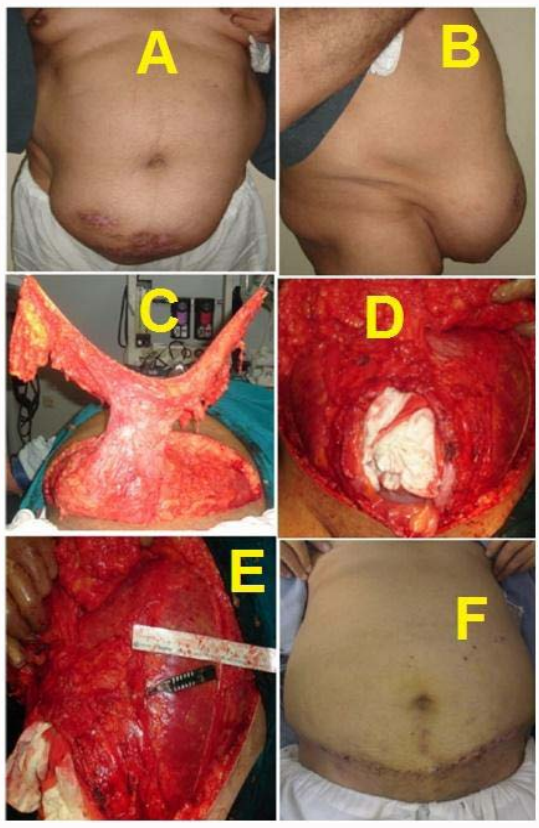

Figure 7: A and B: preoperative views of the patient with his huge hernia, pendulous abdomen and burned skin; Middle: operative view: C the excess skin with the attached hernia sac, D: after excising the hernia sac with a towel occluding the defects; E the measurement of the release of the external oblique with the ruler and blade handle and F the postoperative result of the patient.

Case 7: 22-year old male patient presented with recurrent lower midline incisional hernia with history of repeated operations. The hernia defect was measuring 10 cm × 15 cm and the covering skin was stretched scars with the hernia partially hiding the penis. After dissecting the hernia and excision of its covering stretched scarred skin, bilateral skin release was done to allow the composite

Figure 8: The right and middle photos are the preoperative views of the patient, the left photo is the postoperative view showing the grafted bilateral skin releases that were made to help to excise the midline scared skin overlying the hernia.

myofasciocutaneous flap to be mobilized medially repairing the midline defects. The two secondary skin defects were skin-grafted (Figure 8).

Discussion

The primary objective of abdominal wall reconstruction is to restore the dynamic integrity of abdominal wall with an ethically-acceptable body contour [11]. The most difficult abdominal wall defect is the midline post-laparotomy abdominal wall dehiscence that can be a challenging problem in which the wound is usually heavily contaminated and the patient is typically debilitated with lowered resistance and weak healing power. After adequate debridement, it is often impossible to achieve edge-to-edge fascial closure under acceptable tension because of genuine loss of tissue and retraction of the remaining healthy abdominal wall [12]. This necessitates the recruiting of healthy tissue in the form of pedicled or free flaps. Pedicled flaps, e.g. tensor fascia lata, are usually harvested from lateral positions, so it is usually difficult to advance them to the midline [13]. Technical and expertise requirements are sometimes not available for free flaps; moreover time-consuming free flaps are not encouraged for those debilitated patients. On the other hand, prosthetic reconstruction has some advantages as the shorter operative time, the avoidance of donor-site morbidity and the unlimited availability. However, beside the inherent complications of the prosthetic materials, such as erosion, extrusion and fistula, their use in such dehiscent wounds is contraindicated because of the concomitant wound sepsis [14]. In this particular situation, the components separation technique stands as an excellent option. This technique was developed in 1990 by Oscar Ramirez and colleagues in 1990 [3], who gave it its current name; the component separation. Over years, CST has used and was repeatedly modified by many surgeons [4,7,15-21]. It provides an innervated well-vascularized muscle flap, the rectus abdominis/internal oblique/transversus abdominis, for dynamic support of the reconstructed abdominal wall which redistributes the stress applied to the abdominal wall over a larger surface area [22]. This is particularly useful in the treatment of midline abdominal wall defects [7,23-25]. In midline dehiscence, instead of dissecting the abdominal skin from medial to lateral, I used two bilateral skin releasing incisions placed lateral to the linea semilunaris to access the external oblique aponeurosis. This modified CS technique enables the closure of the skin defect as well as the myofascial defect by medial mobilization of the bilateral integral myofasciocutaneous flaps without disturbing of the paramedian musculocutaneous perforators; thus, a well-perfused skin is available to reconstruct midline open wound. In obese patients, the access to the external oblique aponeurosis and its release can be performed through and abdominoplasty incision and after the repair of the abdominal musculatures the excess fat and redundant skin can be excised. There is a wide range of surgical indications for the CST [7,26], however the most common indication was previous abdominal surgeries with subsequent abdominal wall dehiscence in the early postoperative course or herniation later on [1]. Although the technique was originally described without the use of mesh, subsequent modifications of the CST have incorporated the use of prosthetic materials when strongly required, with consequent reductions in hernia recurrence rates and with no significant increase in major or minor postoperative complications [27]. In this series, I used Prolene mesh to reinforce the repair and reduce tension on the suture closure in 3 patients. Complications encountered after the operation are almost the same found after any abdominal hernia operations [28]. Wound complications such as dehiscence, infection, hematoma, and seroma have been reported by many authors and are attributed to the wide undermining of the subcutaneous tissues [4,8]. A randomized-controlled trial compared autologous CST hernia repair with prosthetic mesh hernia repair showed a favorable outcome for the CST [29]. Data from large case series with long-term follow-up, demonstrated the efficacy of this technique. A review 200 patients who underwent CST showed a 22.8% hernia recurrence rate for primary CST after a mean follow-up period of 10 months [27]. Another separate study with a longer follow-up (4.4 years) reported a 19.8% hernia recurrence rate. The use of endoscopic and minimally invasive techniques have been shown to reduce wound complications, possibly by preserving local blood supply and thereby minimizing tissue ischemia [9].

Conclusion

The CS technique is a versatile technique that can be modified according to the situations. It is an easy-to-learn technique and can achieve reliable results with preserving the dynamic integrity of the abdominal wall. It is particularly helpful for the reconstruction of large midline post-laparotomy dehiscence. The major advantage is the usage of native autologous muscular tissues in the repair and avoiding all the sequelae of unnecessary synthetic material. The patients in our series were referred from a wide variety of specialties, mainly general surgeons, and in order to optimize the outcome of surgery, a surgical team including, at least a general and a plastic surgeon, should work together to evaluate the patient preoperatively, to accomplish the surgery in the operative room and also to follow up the patients postoperatively.

References

1. Adekunle S, Pantelides NM, Hall NR, Praseedom R, Malata CM. Indications and outcomes of the components separation technique in the repair of complex abdominal wall hernias: experience from the cambridge plastic surgery department. Eplasty. 2013;13:e47.
2. George CD, Ellis H. The results of incisional hernia repair: a twelve year review. Ann R Coll Surg Engl. 1986;68(4):185-7.
3. 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(3):519-26.
4. de Vries Reilingh TS, van Goor H, Rosman C, Bemelmans MH, de Jong D, van Nieuwenhoven EJ, et al. "Components separation technique" for the repair of large abdominal wall hernias. J Am Coll Surg. 2003;196(1):32-7.
5. Shestak KC, Edington HJ, Johnson RR. The separation of anatomic components technique for the reconstruction of massive midline abdominal wall defects: anatomy, surgical technique, applications, and limitations revisited. Plast Reconstr Surg. 2000;105(2):731-8.
6. De Silva GS, Krpata DM, Hicks CW, Criss CN, Gao Y, Rosen MJ, et al. Comparative radiographic analysis of changes in the abdominal wall

musculature morphology after open posterior component separation or bridging laparoscopic ventral hernia repair. J Am Coll Surg. 2014;218(3):353-7.

7. Vargo D. Component separation in the management of the difficult abdominal wall. Am J Surg. 2004;188(6):633-7.

8. DiBello JN Jr, Moore JH Jr. Sliding myofascial flap of the rectus abdominus muscles for the closure of recurrent ventral hernias. Plast Reconstr Surg. 1996;98(3):464-9.

9. Albright E, Diaz D, Davenport D, Roth JS. The component separation technique for hernia repair: a comparison of open and endoscopic techniques. Am Surg. 2011;77(7):839-43.

10. Abulezz T. Repair of recurrent midline abdominal wall dehiscence using the components separation technique. J Plast Reconstr Aesthet Surg. 2008;61(8):997-9.

11. Rohrich RJ, Lowe JB, Hackney FL, Bowman JL, Hobar PC. An algorithm for abdominal wall reconstruction. Plast Reconstr Surg. 2000;105(1):202-16.

12. Hirsch EF. Repair of an abdominal wall defect after a salvage laparotomy for sepsis. J Am Coll Surg. 2004;198(2):324-8.

13. Mathes SJ, Steinwald PM, Foster RD, Hoffman WY, Anthony JP. Complex abdominal wall reconstruction: a comparison of flap and mesh closure. Ann Surg. 2000;232(4):586-96.

14. Bleichrodt RP, Simmermacher RK, van der Lei B, Schakenraad JM. Expanded polytetrafluoroethylene patch versus polypropylene mesh for the repair of contaminated defects of the abdominal wall. Surg Gynecol Obstet. 1993;176(1):18-24.

15. Maas SM, de Vries RS, van Goor H, de Jong D, Bleichrodt RP. Endoscopically assisted "components separation technique" for the repair of complicated ventral hernias. J Am Coll Surg. 2002;194(3):388-90.

16. Sukkar SM, Dumanian GA, Szczerba SM, Tellez MG. Challenging abdominal wall defects. Am J Surg. 2001;181(2):115-21.

17. Ewart CJ, Lankford AB, Gamboa MG. Successful closure of abdominal wall hernias using the components separation technique. Ann Plast Surg. 2003;50(3):269-73.

18. Ramirez OM. Inception and evolution of the components separation technique: personal recollections. Clin Plast Surg. 2006;33(2):241-6.

19. Thomas WO III, Parry SW, Rodning CB. Ventral/incisional abdominal herniorrhaphy by fascial partition/release. Plast Reconstr Surg. 1993;91:1080-6.

20. Voigt M, Andree C, Galla TJ, Walgenbach KJ, Stark GB. Reconstruction of abdominal-wall midline defects--The Abdominal-Wall Components Separation. Zentralblatt fur Chirurgie. 2001;126(12):1000-4.

21. Dumanian GA, Denham W. Comparison of repair techniques for major incisional hernias. Am J Surg. 2003;185(1):61-5.

22. Girotto JA, Ko MJ, Redett R, Muehlberger T, Talamini M, Chang B. Closure of chronic abdominal wall defects: a long-term evaluation of the components separation method. Ann Plast Surg. 1999;42(4):385-94.

23. Howdieshell TR, Proctor CD, Sternberg E, Cué JI, Mondy JS, Hawkins ML. Temporary abdominal closure followed by definitive abdominal wall reconstruction of the open abdomen. Am J Surg. 2004;188(3):301-6.

24. Schecter WP, Ivatury RR, Rotondo MF, Hirshberg A. Open abdomen after trauma and abdominal sepsis: a strategy for management. J Am Coll Surg. 2006;203(3):390-6.

25. van Geffen HJ, Simmermacher RK, van Vroonhoven TJ, van der Werken C. Surgical treatment of large contaminated abdominal wall defects. J Am Coll Surg. 2005;201(2):206-12.

26. Ekeh AP, McCarthy MC, Woods RJ, Walusimbi M, Saxe JM, Patterson LA. Delayed closure of ventral abdominal hernias after severe trauma. Am J Surg. 2006;191(3):391-5.

27. Ko JH, Wang EC, Salvay DM, Paul BC, Dumanian GA. Abdominal wall reconstruction: lessons learned from 200 "components separation" procedures. Arch Surg. 2009;144(11):1047-55.

28. Tong WM, Hope W, Overby DW, Hultman CS. Comparison of outcome after mesh-only repair, laparoscopic component separation, and open component separation. Ann Plast Surg. 2011;66(5):551-6.

29. de Vries Reilingh TS, van Goor H, Charbon JA, Rosman C, Hesselink EJ, van der Wilt GJ, 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(4):756-63.