

Research Article

Mesh-reinforced Anterior Component Separation for Repair of Large Ventral Hernia: Ten-year Experience in Multiple Centers

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Keywords: Large ventral hernia; Hernioplasty; Anterior component separation and Onlay mesh technique



Abstract

Background: Repair of a large ventral hernia is a challenge for surgeons. Component Separation Technique (CST) is a novel technique for closure of the midline with live tissues without undue tension. This can further be reinforced by a prosthesis. We wanted to see the outcome of mesh-reinforced open Anterior Component Separation (ACS) for large complex ventral hernia repair. We aimed to see the duration of surgery, hospital stay, Surgical Site Occurrence (SSO), and recurrence within the first year after surgery.

Materials and methods: We analyzed data of patients operated from January 2014 to January 2024 for a period of 10 years in three centers. There were 13 patients with divarication of recti without any previous surgery. Rest 44 patients had either incisional hernia or port site hernia. All patients had defect sizes more than 8 cm. Open bilateral anterior component separations were done to achieve midline closure. Medium-pore soft Prolene mesh was used to reinforce the midline closure by an on-lay technique. Patients were followed up to 1 year after surgery to assess efficacy and complications of the procedure.

Results: The average operating time was 73 ± 12 min. Hospital stay was 3 to 7 days, mean was 5.3 days. Surgical site occurrence was 14%. These include seroma formation, major wound infection, and abscess formation. There was no flap necrosis nor mesh removal. There was no recurrence within one year of follow-up after surgery.

Conclusion: Open mesh Anterior Component Separation (mACS) is an easy and effective way of treating large and complex ventral hernia. Operating time is substantially less than posterior component separation. Reinforcement with mesh reduces recurrence.

Introduction

Closure of the midline defect in a large ventral hernia is a big challenge. Any ventral hernia where the defect is more than 8 cm in diameter is considered large. It becomes difficult to close the large midline defect, especially with loss of domain. Non-closure of the midline has adverse effects on postural maintenance, respiration, micturition, and

defecation. These have a profound impact on the patients' overall physical capacity and quality of life. The component separation technique can achieve closure of the midline defect with live tissue and without tension. This technique was first described by Albanese and later by Oscar Ramirez in the early nineties of the last century [1,2]. This is a novel technique of tension-free closure of the midline in giant ventral hernia, especially with loss of domain (Figure 1). The external

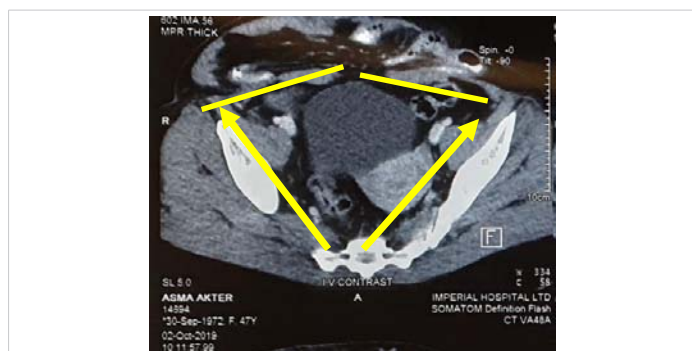


Figure 1: CT scan showing loss of domain.

oblique fascia at the lateral border of the rectus compartment on the semilunar line is avascular. Incision is given on this line and extended downwards up to the inguinal region and upwards up to the costal margin to divide the external oblique fascia completely (Figure 2,5). The External Oblique Release (EOR) is done from the internal oblique by sweeping with a finger. This can gain a length of a maximum of 8 cm on either side of the midline of the anterior abdominal wall. If bilateral anterior component separation (Figure 6) is done, a maximum of 16 cm length can be gained at the level of the umbilicus [3]. This procedure allows tension-free and easy closure of the midline with live tissue. Afterwards non non-absorbable Prolene mesh is placed in an on-lay technique, which reinforces the abdominal wall further and prevents recurrence [4,5]. Reinforcement by prolene mesh also prevents lateral bulge due to division of the external oblique aponeurosis (Figure 7). This technique involves the creation of a large abdominal skin flap and a lot of devascularization. As a result, this procedure has a higher incidence of Surgical Site Infection (SSI). Later, Posterior Component Separation (PCS) was introduced with Transversus Abdominis Release (TAR), which can get almost the same benefit as tension-free closure. Again, PCS requires a long operating time compared to ACS and also requires difficult dissection at the retro-muscular plane (behind the rectus muscle). There is an increased risk of intra-abdominal injury as well. Due to the sub-lay position of the mesh in PCS and TAR, the outcome of the repair is superior to on-lay repair. But wound infection can be very deep-seated, and there is a possibility of sinus or fistula formation in PCS and TAR [6].

Materials and methods

We present 57 patients with large ventral hernia who were repaired with the anterior component separation technique of abdominal reconstruction. This was further reinforced with synthetic mesh placed by an on-lay technique. We analyzed data of patients operated on from January 2014 to January 2024 for a period of 10 years in three centers. There were 13 patients with divarication of recti without any previous surgery (Table 1). Rest 44 patients had either incisional hernia or port site hernia (Figure 3). Twenty-nine patients had having fresh incisional hernia. Nine patients had

recurrent issues with a single or multiple attempts of repair in the past (Figure 4). Female to male ratio was 7:1. The diameter of the defect was 8cm to 16 cm. Ventral hernia with a strangulated intestine or a gangrenous intestine was excluded from this study.

All these patients' abdomens were opened with midline (Figure 9,10) or transverse incision (Figure 8), depending on the previous scar. The sac was isolated and excised.

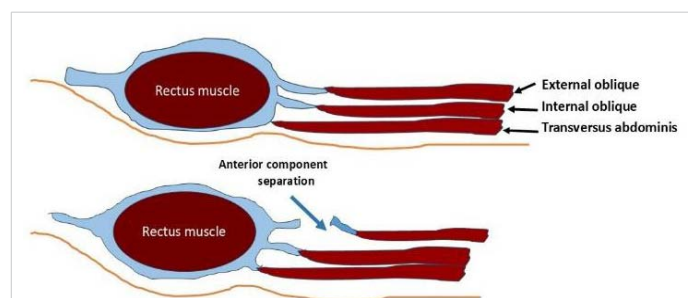


Figure 2: Diagrammatic Anterior component separation.



Figure 3: Large port site hernia.

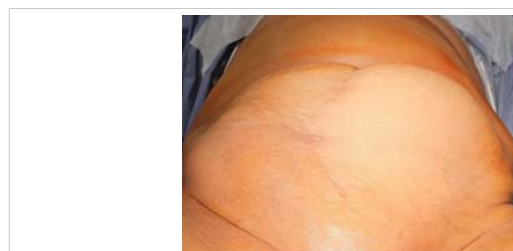


Figure 4: Recurrent incisional hernia.

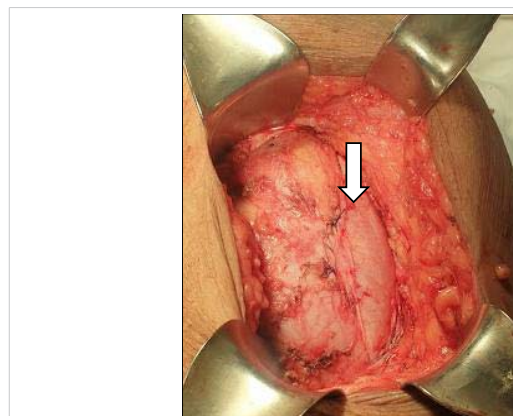


Figure 5: Anterior component separation.

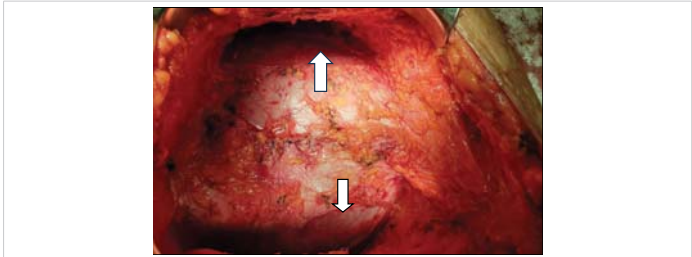


Figure 6: Closure of the midline after bilateral ACS.



Figure 7: Mesh reinforced (On-lay) ACS.



Figure 8: Transverse incision is closed.



Figure 9: Large incisional hernia.



Figure 10: mACS with midline incision.

Intra-abdominal adhesions were released. Bilateral anterior component separation was done along the semilunar line on both sides. Release of the External oblique was then performed by a sweeping action of the finger. Afterwards midline was closed with a number 1 prolene suture without tension. A large single or multiple pieces of medium-pore soft Prolene mesh were used with an on-lay technique (Figure 10). The mesh was stitched with 2/0 Prolene sutures to the cut edge of the external oblique aponeurosis on either side of the abdomen and also to the anterior rectus sheath. At least 3 cm overlapping with the cut edge of the external oblique aponeurosis was maintained. Sufficient overlapping was ensured between meshes if multiple pieces of mesh were used. At least two vacuum drains were placed in the subcutaneous space to prevent of collection of blood or serous fluid. Contused edges of skin and excess fat were trimmed until fresh bleeding was seen to prevent flap necrosis. Apposition of Skin flaps was done with a skin stapler. Drain and staples were removed after 2 to 3 weeks.

Results

The average operating time is 73 ± 12 min. Hospital stay was 3 to 7 days, mean was 5.3 days.

Surgical Site Occurrence (SSO) occurred in 8 cases (14%). Six had seroma formation, and two had abscess formation. One patient required secondary suture (Table 2). The rest of them healed spontaneously.

Wound complications were more severe in obese and morbidly obese patients. There was no flap necrosis. There was no incidence of mesh removal. The period of complete wound healing required 16 to 90 days. The average time of healing was 23 ± 9 days. Patients who were repaired with a midline incision did not have any surgical site infections at all. There was no incidence of recurrence within one year of follow-up. A handful of patients complained of mild pain over the on-lay mesh, but it resolved spontaneously.

Discussion

Mesh reinforcement is an important step after ACS, which substantially reduces recurrence and improves the outcome of the repair. Some common complications are possible, and these include seroma, hematoma, infection, skin edge necrosis, wound breakdown, and hernia recurrence [6-8]. The complications resulting from ACS can be reduced by using minimally invasive ACS, such as perforator sparing

Table 2: Summary of outcome.		
Parameters of outcome		Results
Duration of Operation		73 ± 12 min
Average Hospital stay		5.3 days
Surgical site occurrence (SSO)		8 (14%)
Mesh removal		Nil
Mortality		Nil
Recurrence after 1 year		Nil

Table 1: Distribution of varieties of ventral hernia.		
Distribution of hernia type		Number
Incisional hernia (Fresh)		29
Incisional hernia (Recurrent)		9
Port site hernia		6
Di-verification of recti (no surgery before)		13
Female-male ratio(F:M)		7:01



endoscopic techniques [9,10]. However, it should be noted that, in these procedures, the prosthesis will be placed in the sublay position, which increases the duration of operation, complexity, and costs of the operation. Furthermore, in these technical variants, the prosthesis will not protect the weak area resulting from the external oblique release. PCS and TAR give firm and strong repair due to the sub-layer position of the mesh, and the overall outcome is superior [5]. PCS and TAR can be done by laparoscopy and robotic surgery (eTEP TAR) also [8]. That gives the full benefit of minimal invasive surgery.

The information found in the literature related to incisional hernia is often contradictory. On the one hand, the ACS with on-layer mesh retains its purpose and role of tension-free repair [11,12].

ACS with mesh reinforcement has a high rate of wound complications [13,14]. On the other hand, PCS and TAR are complex operations with longer operating times. There is a possibility of intra-abdominal injury, deep-seated wound infection, and sinus formation. Some authors view ACS-EOA and PCS-TAR as having comparable outcomes in complex abdominal wall reconstruction of midline ventral incisional hernias [15].

A substantial number of surgical site occurrence in ACS-EOR is mentioned in different series. Those are not due to EOR rather due to extensive subcutaneous dissection to reach the semilunar line to perform ACS. Excessive accumulation of seroma occurs due to a reaction at the mesh-fat interface. We believe that all these complications can be minimized by careful hemostasis, trimming of excess fat, and the contused and devascularized skin flap. Keeping the vacuum drain for at least 2 weeks helps minimize seroma collection and secondary infection. Our rate of SSO was reduced in the later part of our series, when we paid attention to these factors. In our series, there was no deep-seated wound infection, and there was no need to remove the mesh either. This suggests that all the SSOs are superficial and are easily manageable. In our experience, we found that patients with midline incisions did not have surgical site infections and achieved good healing of the wound. This suggests that less flap devascularization occurs in the midline incision. This can be explained by the distribution of the arterial supply of the abdominal wall [16]. All the blood vessels meet at the midline in a relatively avascular line. As a result, less number of blood vessels are cut during subcutaneous dissection of flaps. But in transverse incision, though more cosmetic, branches of superior or inferior epigastric vessels get cut during the raising of skin flaps.

Conclusion

Open mesh reinforced anterior component separation is an easy and effective way of treating large ventral hernia. The duration of operation is shorter. Meticulous surgical

technique and rigorous use of vacuum drain can minimize surgical site infections. This method provides very strong repair of the hernia, comparable to transversus abdominal release with posterior component separation. Recurrence rate is also minimal.

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