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Review Article

# Anterior Component Separation Technique for the Repair of Abdominal Wall Incisional Hernias

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**ABSTRACT:** An abdominal wall incisional hernia is one of the common complications of abdominal surgery. An incisional hernia causes a bulge in the abdominal wall and may lead to incarceration or bowel obstruction. Open incisional hernia repairs can be described as simple suture repair, mesh repair, component separation repair, or other repairs. If the hernia defect has a small transverse axial length, simple suture repair can be performed. However, in cases with large hernia defects, a variety of ingenious techniques is required. The anterior component separation technique is an effective method for reconstructing large or complex midline abdominal wall incisional hernias. This technique can restore abdominal wall functionality for defects up to 15 cm at the waistline. One of the benefits of this technique is that autologous tissues are used. Thus, reconstructions can be performed in the presence of contamination or infection in which the use of mesh is contraindicated. On the other hand, this technique has two weak points. First, there are many wound complications following this technique, with the most severe complication being skin flap necrosis. To prevent skin flap necrosis, periumbilical perforator sparing is an effective method. The second is that the reconstruction of defects is slightly more difficult at the subxiphoid and suprapubic regions. Therefore, recurrence is more common in these two regions compared with the mid abdominal region. To reduce the recurrence rate, it is effective to add underlay/sublay mesh repair to this technique. This technique is an effective method for abdominal wall reconstruction with large midline incisional hernias, but it is essential to understand its advantages and disadvantages well.

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**KEYWORDS:** incisional hernia, abdominal wall reconstruction, anterior component separation technique, periumbilical perforator sparing method, mesh repair

## Introduction

An abdominal wall incisional hernia is a common

complication of abdominal surgery and is an iatrogenic condition. Primary incisional hernias occur in from 11% to 20% of patients following laparotomy.<sup>1-3)</sup> Patients complain

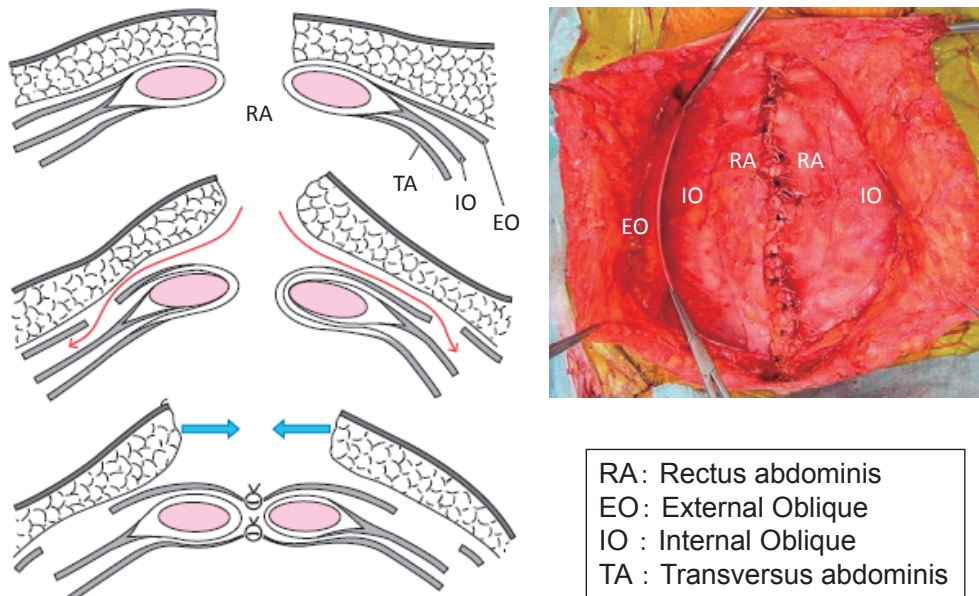


Fig. 1 Anterior Component Separation Technique  
Reprinted from [13]

of a bulge in the abdominal wall, and the hernia contents protrude through the abdominal wall defects. Cosmetic concerns decrease the quality of life, and there is a risk of incarceration causing bowel obstruction.

The goal of abdominal wall incisional hernia repair is to reduce hernia content and prevent recurrent herniation. At the same time, another important purpose is to restore abdominal wall function. To restore abdominal wall function, it is important to completely close hernia defects. In midline abdominal wall incisional hernias, it is necessary that the bilateral rectus abdominis muscles adhere at the midline.

The options for open incisional hernia repair can be described as simple suture repair, mesh repair (onlay, inlay, sublay, underlay),<sup>4)</sup> intraperitoneal onlay mesh repair,<sup>5)</sup> rectus turnover flap,<sup>6)</sup> anterior rectus abdominal sheath turnover flap,<sup>7)</sup> and component separation repair (anterior,<sup>8)</sup> endoscopic,<sup>9)</sup> posterior<sup>10,11)</sup>). If the hernia defect has a small transverse axial length of 2 to 3 cm or less, simple suture repair is possible. However, repair of large defects by the simple suture technique is often impossible or leads to recurrent herniation rates of up to 46%.<sup>12)</sup> With large defects, a variety of ingenious techniques is required.

The anterior component separation technique was first described in 1990 by Ramirez and colleagues.<sup>8)</sup> This technique is a very effective method for abdominal wall

reconstruction in patients with large midline hernias that cannot be closed primarily. In this article, the author describes the surgical technique of open incisional hernia repair using the anterior component separation technique.

### Surgical Technique (Fig. 1)

Anterior component separation is performed in the following manner using an open approach.<sup>13)</sup> After midline laparotomy, the abdominal cavity is entered. The small and large bowels are dissected free from the ventral abdominal wall. In the first step of this technique, the skin and subcutaneous tissues are carefully dissected free from the anterior sheath of the rectus abdominis muscle and aponeurosis of the external oblique muscle. After dissection of the skin and subcutaneous tissues, a longitudinal incision is made in the external oblique aponeurosis about 2 cm lateral to the semilunar line. A longitudinal incision is made that extends from the costal margin cephalad to the inguinal ligament caudally. Then, the external oblique muscle is separated from the underlying internal oblique muscle as far laterally as possible. This technique is performed bilaterally. The rectus abdominis muscle is then advanced medially. If primary closure is impossible with undue tension, the rectus abdominis muscle can be dissected free of its posterior sheath. In this way, a total of 15 cm of advancement is often possible at the waistline

without tension.<sup>14)</sup> Closed-suction drains are left under the skin and subcutaneous tissues bilaterally to prevent fluid collections. Finally, the fascia and skin are closed.

### Pros and Cons

The anterior component separation technique is a very effective method for reconstructing large or complex mid-line abdominal wall defects. About 15 cm of advancement at the waistline is often possible without the need for mesh. One of the benefits of this technique is that autologous tissues are used. Thus, reconstructions can be performed in the presence of contamination or infection, in which the use of mesh is contraindicated.

On the other hand, this technique has two weak points. First, there are many wound complications, such as surgical site infections, seromas, hematomas, and skin flap necrosis. The second is that the reconstruction of defects is slightly more difficult at the subxiphoid and suprapubic regions. Therefore, recurrence is more common in these two regions than in the mid abdominal region.

### Prevention of Wound Complications

Wound complications occurred in 26% to 33% of cases after anterior component separation.<sup>15-17)</sup> The most common complication is wound infection, and the most severe complication is skin flap necrosis. The blood supply of the skin and subcutaneous tissue of the anterior abdominal wall arises from the superficial inferior epigastric arteries, from perforators arising from the rectus sheath, and from branches of the intercostal arteries. Extensive elevation of the skin flaps during the anterior component separation technique disrupts the perforators from the rectus sheath and may lead to ischemia of the skin and subcutaneous tissues. To prevent wound complications, the blood supply to the skin and subcutaneous tissue is the most important factor. To ensure adequate blood flow to the skin and subcutaneous tissue, preservation of the rectus abdominis perforators is effective. Such a method is called the periumbilical perforator sparing technique (Fig. 2).<sup>18)</sup> Wound complications following anterior component separation with the periumbilical perforator sparing method occurred in 4.9% to 26.3% of cases, less than after anterior component separation without the periumbilical perforator sparing method.<sup>18-20)</sup> Additionally, there are two methods other than the periumbilical perforator sparing method for avoiding skin flap necrosis. The first is the endoscopic component separation technique, and the

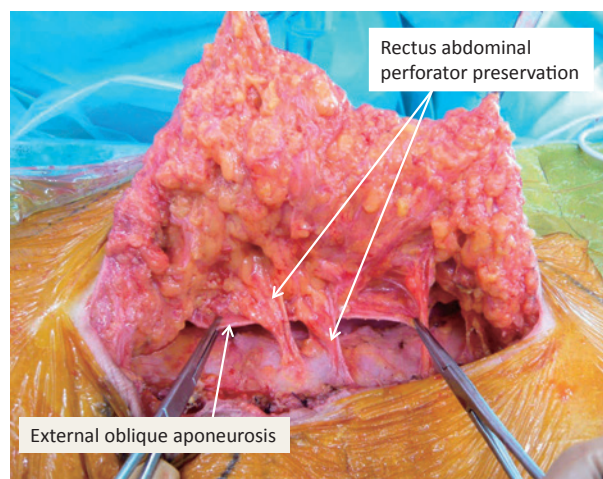


Fig. 2 Periumbilical Perforator Sparing Method  
Reprinted from [13]

other is the posterior component separation technique.

The endoscopic component separation technique was first described in 2000 by Lowe and colleagues.<sup>9)</sup> In this technique, the skin and subcutaneous tissues are not elevated from the underlying anterior sheath of the rectus abdominis muscle, and an incision of the external oblique aponeurosis is made endoscopically. Therefore, the rectus abdominal perforators are preserved, and skin flap necrosis can be avoided.<sup>21, 22)</sup>

On the other hand, the posterior component separation technique was described in 2008 by Carbonell and colleagues,<sup>10)</sup> and the transversus abdominis muscle release technique was described in 2012 by Novitsky and colleagues.<sup>11)</sup> With these techniques, skin flap creation can be avoided. Krpata and colleagues<sup>23)</sup> reported that wound complications occurred in significantly more anterior component separation patients than posterior component separation patients, and the recurrence rate was also higher in the anterior component separation group.

Wound complications of the periumbilical perforator sparing method, of the endoscopic technique, and of the posterior component separation technique are less than of open anterior component separation. These methods are called minimally invasive component separation.

### Prevention of Recurrent Herniation

Recurrence rates for anterior component separation repair without mesh range from 0% to 32%.<sup>8, 15)</sup> Ko and colleagues<sup>24)</sup> examined 200 cases of anterior component separation repair and reported that the recurrence rate was

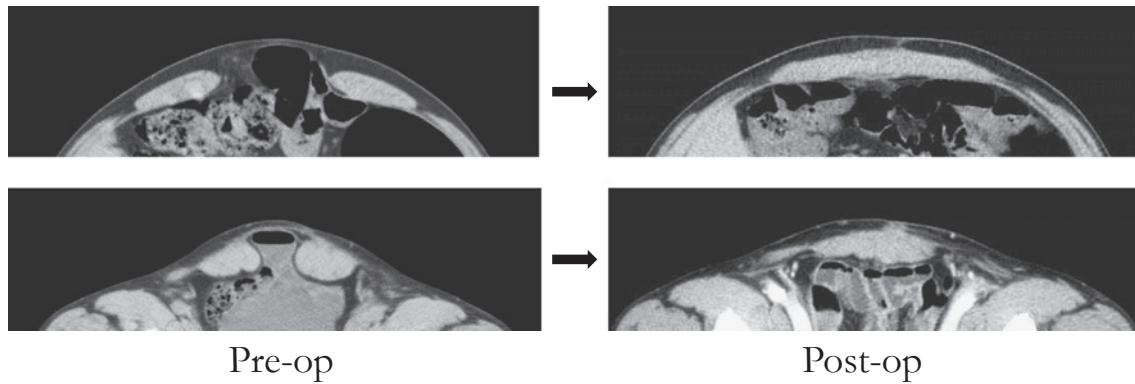


Fig. 3 CT scans in patient after anterior component separation repair  
The bilateral rectus abdominis muscles adhere at the midline.

Reprinted from [13]

22.8%. To reduce the recurrence rate, a variety of ingenious techniques is required. Such methods include anterior component separation with mesh repair, posterior component separation, and the abdominal wall closure method.

### 1. Anterior component separation with mesh repair

One of the advantages of the anterior component separation technique is that it can reconstruct large abdominal wall defects using only autologous tissues, without the need for mesh. However, when the rectus abdominis muscle is advanced medially with undue tension, the risk of recurrent herniation after reconstruction increases.

Additionally, at the subxiphoid and suprapubic regions, the reconstruction of defects is more difficult, and the recurrence rate is higher than at the mid abdominal region.

To reduce the recurrence rate, adding mesh repair to the anterior component separation technique is effective. Recurrence rates were lower in those who received mesh repair, ranging from 7% to 22%.<sup>16,17)</sup> The mesh can be placed as an underlay (within the peritoneal cavity), sublay (within the retrorectus space),<sup>25)</sup> or as an onlay.<sup>26)</sup> de Vries Reilingh and colleagues<sup>27)</sup> compared three operative techniques (onlay, inlay, and underlay) and found that the onlay technique had significantly more wound complications than the other techniques. The recurrence rate of the inlay technique was significantly higher than after the underlay technique and tended to be higher than the onlay technique. Therefore, the underlay technique seems to be the better technique. The author prefers underlay/sublay placement of a lightweight, macroporous, polypropylene soft mesh.

### 2. Posterior component separation<sup>10,11)</sup>

Posterior component separation methods are based on the Rives–Stoppa–Wantz retrorectus repair, and the mesh is typically placed between the rectus abdominis muscle and the posterior rectus sheath in a sublay fashion.<sup>28–30)</sup> Krpata and colleagues<sup>23)</sup> examined 56 patients with anterior component separation and 55 patients with posterior component separation, and they reported that the recurrence rate was lower in the posterior component separation than in the anterior component separation group (3.6% vs. 14.3%).

### 3. Abdominal wall closure method

The author uses layered closure and interrupted, slowly absorbable sutures. In this method, the most important point is adhesion of bilateral rectus abdominis muscles at the midline with the aim of reinforcing the median part. The thick muscle tissue of the bilateral rectus abdominis muscles is interposed in the most vulnerable midline region, and a strong abdominal wall is formed (Fig. 3).<sup>31)</sup>

## Conclusion

The anterior component separation technique is an effective method for reconstructing large or complex midline abdominal wall incisional hernias. However, there are many wound complications following this method. Many of the wound complications are related to ischemia of the skin flaps. To prevent skin flap necrosis, which is the most severe wound complication, periumbilical perforator sparing is an effective method. At the same time, the other wound complications, such as surgical site infections, can

be reduced. The advantage of this technique is that it can repair incisional hernias without the need for mesh. However, the reconstruction of defects is difficult at the subxiphoid and suprapubic regions. To prevent recurrent herniation, reconstruction with underlay/sublay mesh is the more effective method.

This technique is a method reported from the field of plastic surgery. Thus, its adoption in the field of general and gastroenterological surgery remains insufficient. This technique has a very wide application range and is a procedure that can be relatively easily acquired by surgeons, but it is essential to understand its advantages and disadvantages well.

**Conflicts of interest:** The authors have no conflicts of interest to disclose.

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#### Academic Association Positions

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 Councilor of the Japan Surgical Association  
 Councilor of the Japanese Society of Hospital General Medicine  
 Councilor of the Japanese Society for Abdominal Emergency Medicine