

CASE REPORT

Combined therapy of NPWT and bipediced flap as an alternative approach for giant abdominal wall defect with significant visceral edema: report of a case

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Abstract

Open abdomen management is commonly used for the critically injured patients to avoid abdominal compartment syndrome. But it usually continues for days to weeks and finally results in abdominal wall defect that is too wide to close at once. This article presents an alternative approach to close the giant abdominal wall defect by using the combination of bipediced flaps with the components separation technique and V.A.C.[®] system.

Key Words

open abdomen, abdominal wall defects, bipediced flap, V.A.C.[®] system, components separation technique

History

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Introduction

Multiple techniques have been explored for temporary abdominal closure, including mesh closure, intravenous fluid bags [1] or other materials to bridge the gap in the abdomen, and vacuum packing [2] using suction applied under an occlusive dressing to control abdominal fluid drainage. These are very easy techniques to close the defect, but they often give rise to the problem of serious infection. If fascial closure is not possible in the days after initial laparotomy because of the continued edema, all these techniques rely on the creation of ventral hernia with skin grafted to underlying bowel. Abdominal reconstruction is planned at a later date, usually several months after discharge. But in some cases, the abdominal wall rebuilding should be done without waiting for the reduction of retroperitoneal and visceral edema to start early ventilator weaning and ambulation exercise.

This article presents a case of giant abdominal wall defect with visceral edema after endovascular aneurysm repair of abdominal aortic aneurysm, necessitating open abdomen management to prevent infection of the stent. For abdominal closure as early as possible, combination therapy of bipediced flap following V.A.C.[®] system procedure was performed. Eight months post surgery, the patient was able to be discharged and could walk by himself, although the abdominal hernia remained an unresolved problem.

Skin grafting on the viscera directly is the standard technique for giant abdominal wall defect. But it cannot be used for the infected surface and is very weak for substitution. In this report, we suggest a new method to close the giant infected abdominal wall defect.

Case presentation

The patient is a 72-year-old Japanese male who was suffering from rupture of an abdominal aortic aneurysm. He underwent immediate repair of the endovascular aneurysm. An intra-abdominal hemorrhage was seen on his abdominal CT the next day. Laparotomy was performed again to remove the hemorrhage and arrest the bleeding. Five days later, due to the suspicion of intraperitoneal infection, re-laparotomy was performed and a 5 mm perforation was found at the jejunum. Due to the significant visceral edema, he was taken back to the ICU with an open abdomen. A perforated polyethylene sheet was placed over the viscera and tucked under the wound edges as before. The polyurethane sponge (V.A.C.[®] system, KCI) was then placed over the plastic sheet, pushing the viscera down. After ensuring that the sponge was in contact with full thickness of the wound edges, the surrounding skin was coated with benzoin, and suction tubing and adhesive dressing were applied

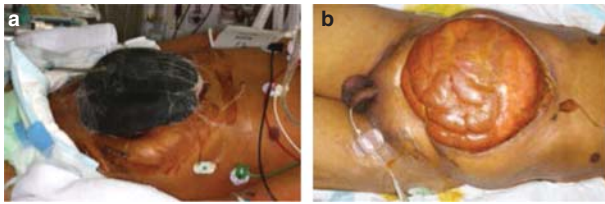


Figure 1. (a) At our initial visit, V.A.C.[®] system was attached to the front of the abdominal wall defect. (b) When the V.A.C.[®] system was removed, open abdominal wall remained.

(Figure 1a). After an occlusive seal was obtained, suction was applied. One month post start of open abdomen management, the visceral and retroperitoneal edema still persisted. The patient was unable to sit upright due to abdominal hernia from the open abdomen, and it prevented ventilator weaning. We planned to perform the operation of abdominal closure. Suction drainage was about 600 ml/day. When the V.A.C.[®] system was removed, open abdominal wall still remained. There was scarring over the surface of the visceral edema and his intestine adhered to each other (Figure 1b). The abdominal defect was 29 × 31 cm. Visceral and retroperitoneal edema was clearly seen on abdominal CT (Figure 2). Ventilator weaning was necessary for the patient to sit upright and the abdominal wall defect prevented rehabilitation.

Although there was no abdominal wall defect originally, abdominal cavity narrowed because of swelling of the retroperitoneum and intestinal prolapse was still remarkable. Because of infection, we did not use the fascial skin graft for abdominal wall reconstruction surgery. The abdominal wall defect between the rectus sheath edges was over 30 cm in transverse diameter. Bipedicled flaps were designed for both lateral regions. The skin incision was on the midaxillary line and the flaps were separated from the anterior layer of rectus abdominis sheath. We added the incision to the aponeurosis of external abdominal oblique muscles pursuant to components separation techniques (Figure 3a). The abdominal hernia was diminished owing to the expansion of the abdominal

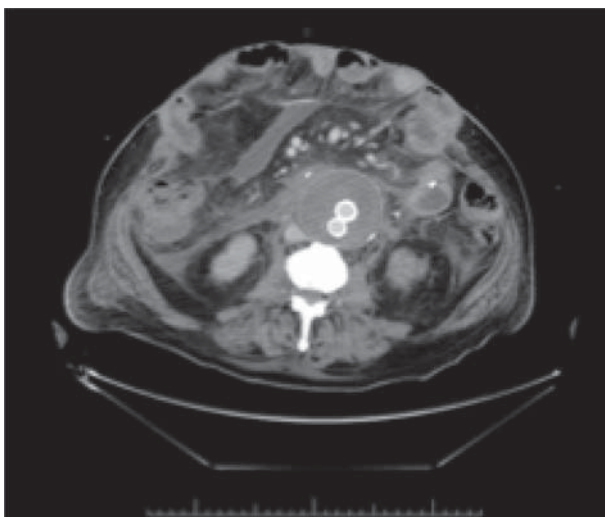


Figure 2. The abdominal computed tomographic scan at the initial visit. The abdominal wall defect was over 30 cm, and visceral and retroperitoneal edema was clearly seen.

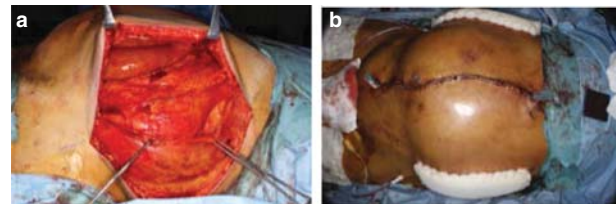


Figure 3. Surgical findings. (a) Bipedicled flaps were designed for both lateral regions. We added the incision to the aponeurosis of external abdominal oblique muscles pursuant to components separation techniques. (b) Completion of surgery. A 1.5× meshed split-thickness skin graft(12/1000 in.) was taken from the anterior surface of both thighs to the defects on the both side of the abdomen. The graft was attached by Reston[®] Self-Adhering Foam Pads.

cavity by skin flap cover, not by rectus sheath closure. A 1.5× meshed split-thickness skin graft(12/1000 in.) was taken from the anterior surface of both thighs for the defects on both sides of the abdomen. The graft was attached by Reston[®] Self-Adhering Foam Pads and the operation was completed (Figure 3b).

Three days post surgery, the respirator was removed. And 8 days post surgery, when the exudate was seen from the edge of the graft (Figure 4a), the Reston[®] Self-Adhering Foam Pads was changed to continuous negative-pressure and irrigation treatment [3] (Figure 4b). When multi-drug resistant *Pseudomonas aeruginosa* was not detected in abdominal wound culture, the continuous irrigation device was changed to the V.A.C.[®] system to drain the exudate (Figure 4c). After 4 weeks from the start of the V.A.C.[®] system, the exudate decreased gradually; we operated the fistula closure under the flap and that became a drainage route (Figure 4d).

Two weeks later, the patient could start ambulation exercise with the gait trainer and rehabilitation therapy of the joints. The fistula disappeared 1 month after the operation

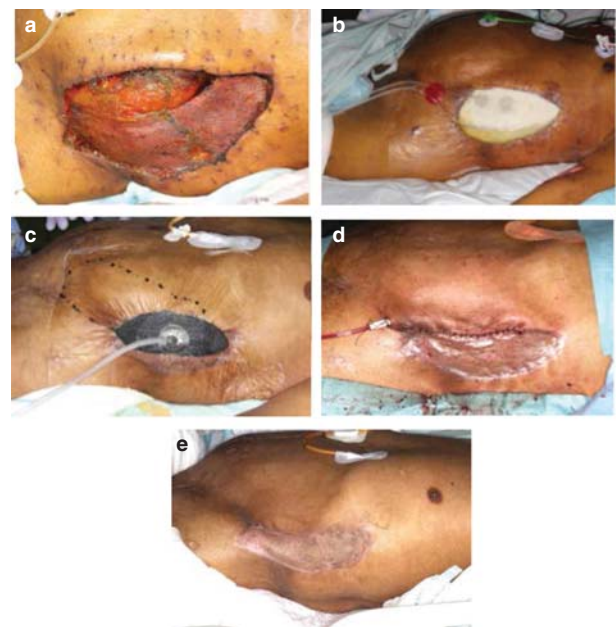


Figure 4. (a) Eight days post surgery, exudate was seen from the edge of the graft. (b) Continuous negative-pressure and irrigation treatment was started for the wound. (c) The V.A.C.[®] system was attached to drain the exudate. (d) After 4 weeks post beginning of the V.A.C.[®] system, we operated the fistula closure under the flap that became a drainage route. (e) 1 month past from the second operation.

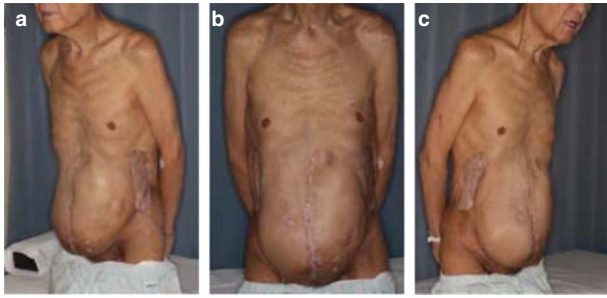


Figure 5. After 8 months from the operation. (a) The left side view. (b) The front view. (c) The right side view.

(Figure 4e). It took about 6 months of medical management due to the liver dysfunction and the systemic infection. After that, the patient could get out of the hospital on foot by himself. And 8 months after the operation, his abdominal CT showed no intestinal edema or intraperitoneal abscess. He had no trouble with oral intake and bowel movement, though he had to use the abdominal bandage while walking because of the abdominal hernia (Figure 5).

Discussion

In digestive or cardiovascular surgery, there sometimes occurs significant retroperitoneal and visceral edema that makes abdominal closure impossible for days to weeks [4]. It then becomes necessary to use the open abdomen management, but infection and circulating blood volume are difficult to control. In the current data, 39, ~43%, of the patients died before abdominal closure [2,5]. Had the patients survived, their abdominal rectus muscles could have been displaced laterally and a giant abdominal wall defect might have been created due to the long-term management. The defect then would no longer have been able to be closed with the simple suture.

The open abdomen management with the V.A.C.[®] system can remove the intraperitoneal collection of fluid and provide constant medial tension on the abdominal wall. Finally, the management can reduce the intraperitoneal volume. Some reports say that the abdominal wall defect decreases gradually and can be closed at last [2,5].

A variety of techniques have been used to close abdominal wall defects; polypropylene mesh [6], fascial graft [7], musculocutaneous flap [8,9], the hinge flap of rectus abdominis fascia [10,11], component separation techniques [12], combined component separation techniques with the hinge flap of rectus abdominis fascia [13] and so on. But 16 cm is the maximal width of the defect that can be reconstructed without hernia on the whole. If the defect is wider than that, it has to rely on the creation of a ventral hernia with skin grafted to underlying bowel [5,14]. A few months later, when the edema decreases, the skin graft would have to be removed from the surface of the bowel and abdominal reconstruction managed [15].

In our case, the defect ranged over 30 cm, so it was impossible to close without hernia. Moreover, the exudate fluid from the abdominal cavity exceeded 600 ml/day, and the wound culture revealed multi-drug resistant *P. aeruginosa*. So we forecasted that the skin graft on the bowel had failed. It was no longer possible to wait for the edema to

diminish using only the V.A.C.[®] system in view of the general status. And the central abdominal wall defect prevented from starting ventilator weaning and ambulation exercise. These problems were overcome by our new method. Though it was impossible to close the central abdominal fascia, the abdominal cavity could be expanded by incision to the aponeurosis of external abdominal oblique muscles pursuant to component separation technique, and the defect ranging over 30 cm was successfully closed. By applying VAC system on the flap donor sites, the exudate fluid from the abdominal cavity was successfully drained through the slits of lateral edge of the flaps. After closure of the central defect, the patient started ventilator weaning and ambulation exercise.

The advantage of this method is that it is able to close the giant abdominal wall defect (>30 cm) at once and also manage the infectious exudate on the lateral side of the body. The disadvantage of this method is that it is impossible to close central abdominal fascia simultaneously; we can close the fascia secondarily after the edema has settled.

Conclusion

The combination of bipediced flap with the component separation technique and following V.A.C.[®] system is a useful method to close giant abdominal wall defect with significant visceral edema and infection.

Declaration of interest:

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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