CASE REPORT

Combined therapy of NPWT and bipedicled 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 bipedicled flaps with the components separation technique and V.A.C.® system.

Key Words

open abdomen, abdominal wall defects, bipedicled 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 bipedicled 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-relaparotomy 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.
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 x 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 cavity by skin flap cover, not by rectus sheath closure. A 1.5 x 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.

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.
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their abdominal rectus muscles could have been displaced
before abdominal closure [2,5]. Had the patients survived,
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ment, but infection and circulating blood volume are difficult
to manage. In the current data, 39,
~43%, of the patients died
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 manage-
ment, 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
defined 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 pro-
vide 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], muscu-
locutaneous 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. aerugi-
nosa. So we forecasted that the skin graft on the bowel had
failed. It was no longer possible to wait for the edema to
diminishing using only the V.A.C.® system in view of the gen-
eral 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 components 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 impos-
sible to close central abdominal fascia simultaneously; we
can close the fascia secondarily after the edema has settled.

Conclusion

The combination of bipedical flap with the components
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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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 him-
self. And 8 months after the operation, the skin graft on the bowel
had no trouble with oral intake and bowel movement, though
the central abdominal hernia (Figure 5).
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