—Case Reports—

The Pedicled Omental Flap Technique for Treating Extensive Defects or Soft-Tissue Infection of the Pelvic Area: A Report of 2 Cases

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Severe trauma injuries, such as open pelvic fractures and degloving injuries, have recently become salvageable. However, extensive soft-tissue defects often remain and can lead to disuse atrophy of the extremities, prolonged hospital stays, and numerous other problems. Such injuries can be easily and effectively treated by a general trauma surgeon performing the pedicled omental flap technique. We report on 2 highly diverse and complicated cases of soft-tissue defect that were both successfully treated with this technique. One case was an extensive right-sided defect of the pelvic soft-tissue in a 20-year-old woman. The other case was in a 55-year-old man who underwent emergency artificial vessel replacement surgery for a femoral artery tear with severe damage to the surrounding muscle. Although the surgery was successful, a methicillin-resistant *Staphylococcus aureus* infection developed around the artificial vessel 10 days after surgery. In both cases, the pedicled omental flap technique was successfully performed and yielded epithelization without serious infection and with the infection subsiding with wound-area healing. To our knowledge, the pedicled omental flap technique has rarely been used to treat severe trauma, and our results suggest its usefulness for both preventing infection in large wounds and healing infected wounds. (J Nippon Med Sch 2016; 83: 257–261)

Key words: severe trauma, pedicled omental flap, soft tissue defect, infection

Introduction

Severe cases of trauma, such as open pelvic fractures, degloving injuries, and refractory infection of the pelvis, can be effectively treated with wound-covering materials and intensive care. However, despite treatment extensive soft-tissue defects often remain. In addition, after severe trauma in the pelvic area is surgically repaired, infection often develops in artificial vessels. In case of soft-tissue defects, major problems include disuse atrophy of the extremities because of prolonged bed rest, extended periods of injury, and a persistent, an algesic infection. The greater omentum is a network-forming tissue covering the intraperitoneal intestinal tract; this tissue contains a rich blood supply and lymphoid tissues and plays a role in localized intra-abdominal immune functions and inflammation[1].

In the present study, we report 2 highly diverse and complicated cases of soft-tissue defect: a case of extensive soft-tissue defects of the pelvis and a case of refractory infection around an artificial vessel. Both cases were successfully treated with the pedicled omental flap technique.

Case 1

A 20-year-old woman had fallen from the 11th floor of an apartment building in an unsuccessful suicide attempt but had sustained bilateral open fractures of the humerus, hemopneumothorax, and femoral and an open pelvic fracture with intestinal prolapse. Soon after being brought to our hospital by helicopter the patient was in a state of shock with severe bradycardia; therefore, we performed aortic clamping via emergency thoracotomy. We

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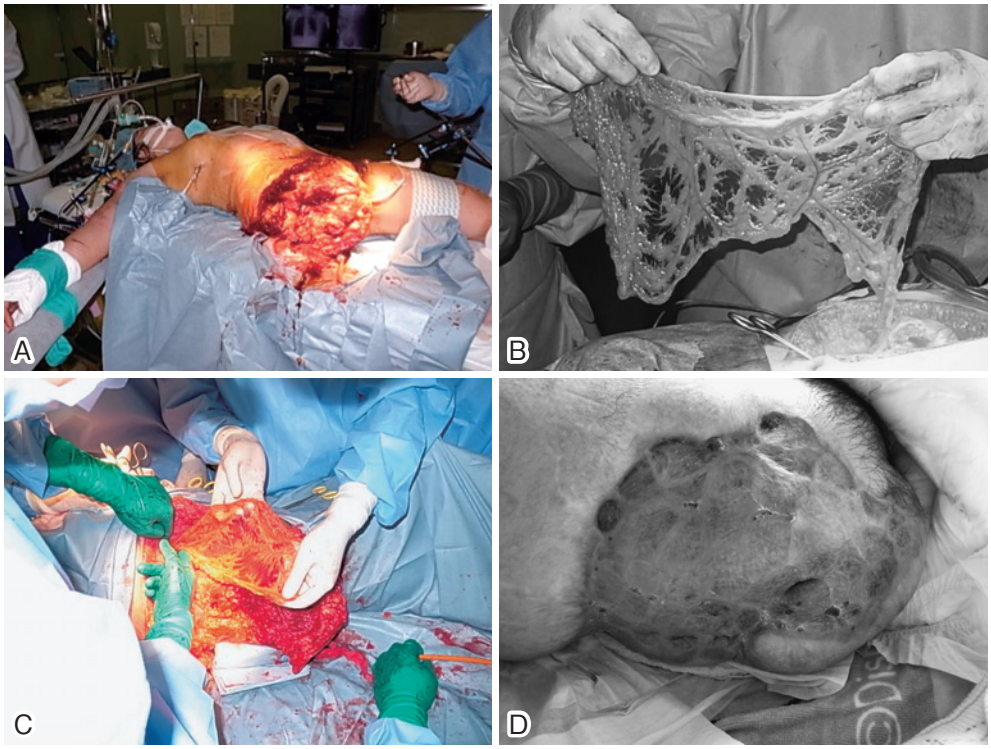

Fig. 1 **A**: After surgery on the day of injury in the emergency department.
B: The pedicled omental flap was made during a stoma operation (2 days after injury).
C: The pedicled omental flap was used to cover the extremely large soft-tissue defect.
D: Sixty days after injury

concluded that preserving the patient's right lower limb was impossible and attempted to save her life by immediately performing a right hemipelvic amputation in the emergency department. After constriction surgery and massive blood transfusion were performed, the patient was transferred to the intensive care unit. The patient's life was saved but extensive soft-tissue defects remained around the right pelvic area (**Fig. 1A**).

Two days after the operation, we performed surgery again to construct a stoma. We used a caulescent pedicled omental flap, with the right gastroepiploic artery as the feeding artery, to create an opening via an epigastric median section in the right retroperitoneum, through which we covered the retroperitoneal injury with the flap (**Fig. 1B, 1C**). After surgery, negative-pressure therapy was performed for the wound area; consequently, good granulation appeared without any signs of infection. We transplanted free split-thickness skin grafts on the 26th and 41st days after the accident; after approximately 60 days, the patient acquired epithelization without severe infection (**Fig. 1D**).

Case 2

A 55-year-old man was crushed under heavy goods at his workplace and sustained an injury to the left inguinal region. When he arrived at our hospital, he was in a state of shock with severe inguinal swelling and no blood flow in the left lower limb. Because the femoral artery had been torn and was surrounded by severely damaged muscle it was replaced with an artificial vessel during an emergency surgery. With this surgery the patient's life was saved and the injured limb was preserved. However, on the 10th day after the operation, an infection do to methicillin-resistant *Staphylococcus aureus* was detected around the artificial vessel (**Fig. 2A**). Because the infected wound had not healed dispite systemic administration of antibiotics and local irrigation, we confirmed the presence of the infection on the 18th day after the initial injury and created a pedicled omental flap to cover the infected wound. Consequently, the infection subsided, and the wounded area was healed (**Fig. 2B**).

Discussion

Omental flaps have been used to treat perforation of the

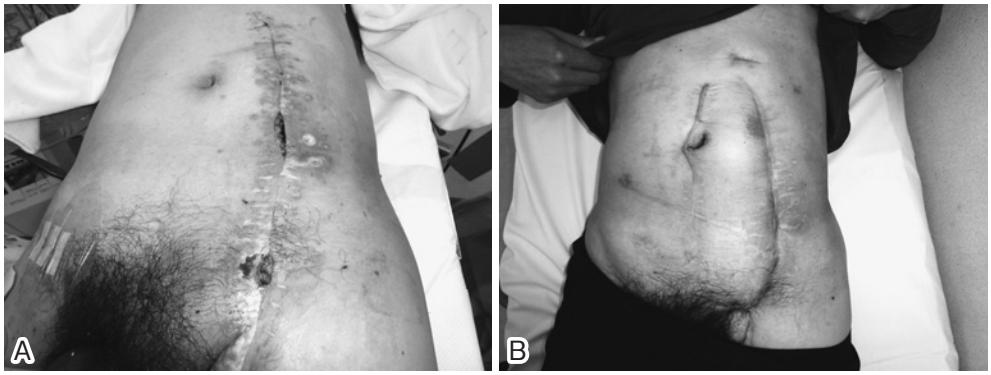

Fig. 2 **A**: The 10th days after the operation (wound infected by methicillin-resistant *Staphylococcus aureus*)
B: The wound had healed by the 45th day after the operation.

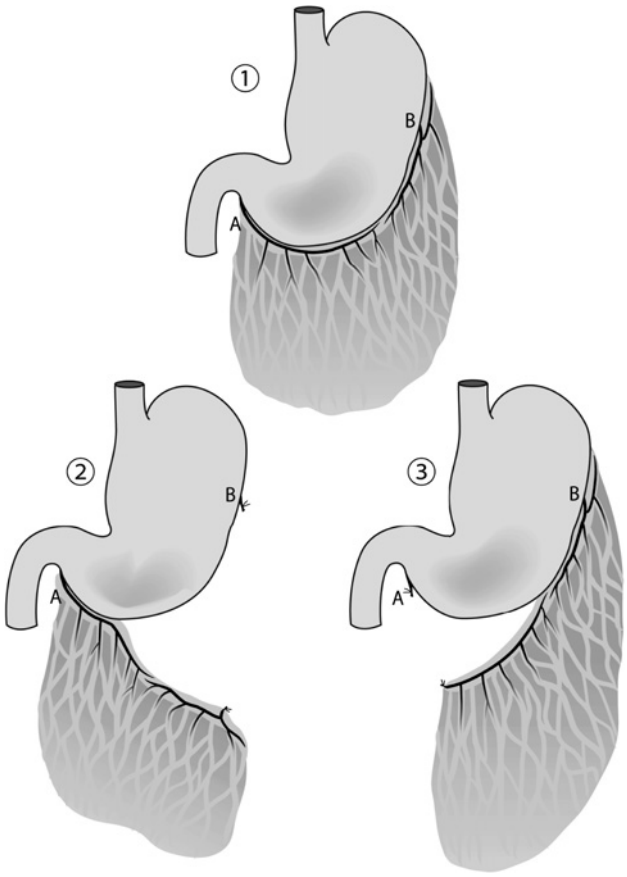

Fig. 3 The omentum hangs down in the inferior margin of the stomach like a curtain (1). Bilateral gastroepiploic arteries forms a network and is vascular rich tissue. Therefore, where the blood flow of the whole omentum is maintained, even if 1 side (A or B) of the bilateral gastroepiploic arteries is ligated (2, 3).

upper gastrointestinal tract, empyema, intrathoracic esophageal rupture[2–4], mediastinitis after open heart surgery[5,6], and liver injury[7]. In fact, the omentum has been used for reconstructive surgery for more than a century. In 1888, Senn used the omentum to protect an intestinal anastomosis[8], and in 1963, Kiricuta reported the use of omental flaps in cases of breast reconstruction surgery to treat breast cancer[9]. Furthermore, in 2010, Costa et al operated for patients with Poland's syndrome in the omental flap by using a laparoscopic technique[10]. This technique has also been used to treat wounds considered at high risk of contamination because of the antibacterial and anti-inflammatory actions of the omentum[11]. However, this technique has rarely been used to treat cases of severe trauma[12–14]. Herein, we have described the use of the pedicled omental flap technique for a case of severe trauma and a case of refractory infection for which we achieved good results.

The omentum is a tissue that is attached to the stomach and transverse colon and hangs like a curtain over the intestinal surface. Bilateral gastroepiploic arteries run across the omental superior border and approach the omentum before dividing downward into numerous branches. These small arteries extend to form a broad network of vascular-rich tissue. As a result, blood flow to the entire omentum is maintained even after ligation of one side of the gastroepiploic arteries, thus allowing a long pedicled flap to be constructed (**Fig. 3**) in a simple procedure that can be performed by a general trauma surgeon. In men, the pedicle flap has a mean size of 15× 25 cm, and its gyration radius can reach the esophagus and axillary region in the upper part of the abdomen and the buttocks and groin area in the pelvis (**Fig. 4**)[15].

The pedicled omental flap technique has been shown to support soft-tissue defects of various shapes and types. Kobayashi has reported that the pedicled omental flap promoted neovascularization and had anti-

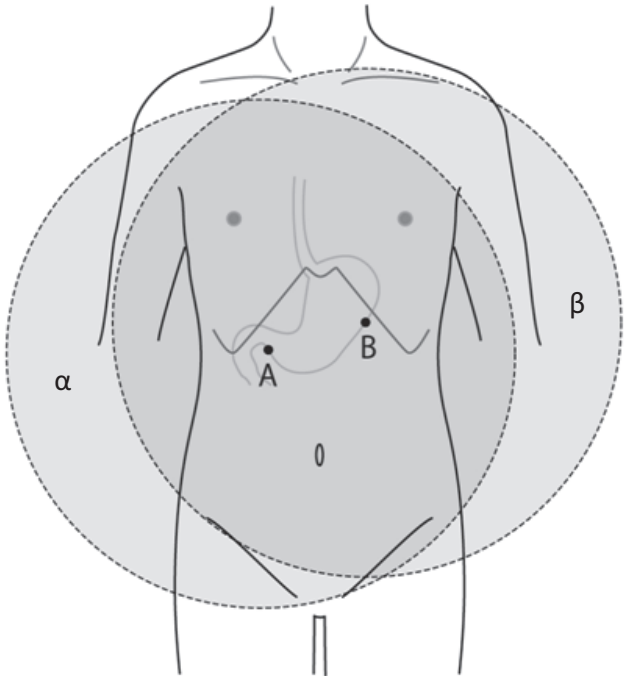

Fig. 4 Omental flap A is able to cover the area α, which is the lower half of trunk including the region of esophagus and axilla, and the omental flap B is able to cover the area β, which is the upper half of trunk including the buttocks, or the groin.

inflammatory effects on the infected wound[16]. Furthermore, van Wingerden et al have reported that for treating infected wounds the pedicled omental flap is more effective than the muscle flap[17]. Studies have not confirmed the ability of this flap technique to promote granulation; however, we speculate that granulation was promoted in our present cases because the flap effectively prevented infection and provided abundant blood flow. In case 1, because of the patient's poor general condition, if we had not used this technique we would have been unable to completely cover the extremely large defect of soft tissue without infection in only 40 days. For cases in other patients, such as those with complicated abdominal injuries or a history of abdominal operation, this technique is difficult and has limited indications. Additionally, the use of the pedicled omental flap technique as a remedial or prophylactic technique depends on when surgery is performed.

A particular technique is necessary to create and form the pedicled omental flap and transition it from the peritoneum to the exterior. The omentum receives nutrition from the bilateral gastroepiploic arteries; in many cases, the right gastroepiploic artery is dominant, and vascular supply is established via anastomosis only for the peripheral sides. We can create flaps with a long, mobile pedicle by ligating either the right or left main artery; however, care must be taken to maintain blood flow to the omentum itself when the peripheral anastomotic region is cut. Moreover, when the flap is induced to the outside of the peritoneum, hernia may develop if the anastomosis is too loose, and excessive twisting of the flap stem may result in flap ischemia. Furthermore, the combination of negative-pressure therapy and the pedicled omental flap technique may result in omental blood-flow reduction, and, therefore, an important issue in such cases is maintaining the appropriate pressure[18].

The first case we have reported is an example of a favorable course without severe infection following the use of the pedicled omental flap technique in combination with a skin graft during the acute phase. In contrast, the second case provides an example of the wound-healing properties of this technique. On the basis of these cases, we believe that the pedicled omental flap has effective prophylactic and remedial uses. In other words, we believe that this technique is an effective therapy both for cases with extensive soft tissue defects with a high risk of infection and for cases with currently infected wounds. Although the use of free omental flaps for treating infected wounds has been reported, microsurgical techniques are required but cannot be performed by all

trauma surgeons[19,20]. Thus, we conclude that the pedicled omental flap technique can be easily performed by general trauma surgeons and can be performed to treat severe infected wounds and extensive soft-tissue defects.

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Conflict of Interest: The authors declare no conflict of interest.

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