

Closure of Intractable Enterocutaneous Fistula with a Rectus Abdominis Musculocutaneous Flap

Shin-ichiro Hashiguchi, MD,*
 Hideaki Rikimaru, MD, PhD,*
 Yukiko Rikimaru-Nishi, MD,*†
 Youkou Ohmaru, MD, PhD,*
 Hisashi Migita, MD,*
 Youichiro Morihisa, MD,*‡
 Keigo Morinaga, MD, PhD,*
 Kensuke Kiyokawa, MD, PhD*

Summary: Large enterocutaneous fistulas of the small intestine are rare and difficult to close, particularly if the fistula is associated with massive leakage of digestive juice and the residual intestinal tract is too short for anastomosis. We present a patient who underwent small bowel resection and secondary anastomosis following massive necrosis of the small intestine due to superior mesenteric artery thrombosis. After resection of an enterocutaneous fistula and reanastomosis, the residual small bowel was only 70 cm long with a persistent fistula. We successfully closed the fistula by employing a hinged rectus abdominis musculocutaneous flap. Here, we report our procedure for treating a large enterocutaneous fistula without performing laparotomy and bowel resection. (*Plast Reconstr Surg Glob Open* 2019;7:e2258; doi: 10.1097/GOX.0000000000002258; Published online 5 June 2019.)

Enterocutaneous fistula (ECF) is a difficult problem for surgeons to manage.^{1,2} Up to 80% of ECFs occur postoperatively after an anastomotic leak or unrecognized bowel injury. An ECF delays wound healing following gastrointestinal surgery and exposes the surrounding skin to digestive juices including bile and pancreatic secretions. Accordingly, it is difficult to achieve closure of the fistula by simple suturing. In addition, painful erosions and ulcers can affect the surrounding skin due to leakage of digestive juice. Other negative consequences include a longer hospital stay and a significant impact on the patient's quality of life. We describe a patient with a large ECF of the small intestine in whom closure was achieved by using a hinged musculocutaneous flap.

CASE REPORT

A 72-year-old man presented with sudden onset of abdominal pain. Emergency open laparotomy revealed small intestinal necrosis due to mesenteric artery thrombosis.

Necrosis extended from 1 m distal to the ligament of Treitz to just proximal to the ileocecal valve, and wide re-

section of the bowel was performed together with jejunostomy. Two months later, reanastomosis was done to close a postoperative jejunal fistula, but a large ECF persisted and the residual small bowel was only 70 cm long. On referral to our department, the fistula was approximately 4 cm in diameter and occupied almost the entire anterior wall of the small bowel. Due to discharge of a large volume of digestive juice (2000–3000 mL/day), conservative treatment was deemed impossible. However, laparotomy was not indicated because of the strong adhesion of the residual intestinal tract and the patient's poor general condition and nutritional status. In addition, the remaining intestinal tract was too short to allow resection of the fistula and direct reanastomosis, because of the possibility of short bowel syndrome.³ Therefore, it was decided to perform reconstruction of the anterior wall of intestinal tract with a flap. First, a skin incision was made around the fistula, approximately 1.5 cm from its border. This incision was perpendicular to the subcutaneous fat, and undermining was not done (Fig. 1A). Next, a rectus abdominis musculocutaneous flap was designed contralateral abdomen to the fistula and raised with the left deep inferior epigastric artery and vein as the vascular pedicle (Fig. 1B). The skin island was designed to be approximately 20% larger than the diameter of the incision around the fistula and included some muscle perforators. This was confirmed by a doppler ultrasonic flow meter. Before suturing the flap, a balloon urethral catheter was inserted into the intestine proximal to the fistula for drainage of digestive juice. Subsequently, the skin island was sutured to the inner margin of the incision around the fistula. The muscular body of the flap was also sutured to the outer margin of the incision, completely covering the fistula site. A split skin graft was placed over the reversed musculocutaneous flap to finish the procedure (Fig. 1C). At the donor

From the *Department of Plastic and Reconstructive Surgery and Maxillofacial Surgery, Kurume University School of Medicine, Kurume, Fukuoka, Japan; †Division of Microscopic and Developmental Anatomy, Department of Anatomy, Kurume University School of Medicine, Kurume, Fukuoka, Japan; and ‡Department of Plastic and Reconstructive Surgery, National Kyushu Medical Center, Fukuoka-shi, Fukuoka, Japan.

Received for publication September 5, 2018; accepted March 18, 2019.

Copyright © 2019 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000002258

Disclosure: The authors have no financial interest to declare in relation to the content of this article.

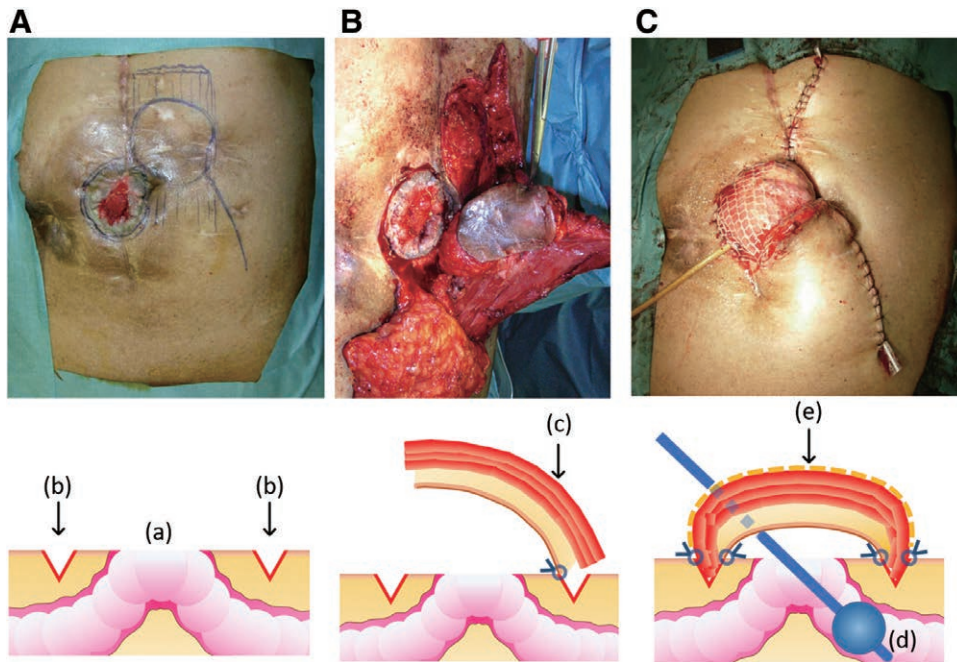


Fig. 1. Intraoperative findings and diagram. A, The small intestinal fistula in the center of the abdomen. A skin incision was made around the fistula and a corresponding rectus abdominis muscle flap was designed. The skin incision around the fistula was deepened into the fat layer. (a) Intestinal fistula opening to the skin. (b) Skin incision into adipose tissue. B, The musculocutaneous flap was elevated. (c) Reversed rectus abdominis musculocutaneous flap. C, A balloon catheter was inserted into the proximal intestine, after which the suture line was completely covered by the muscular body of the flap. A split skin graft was placed over the reversed musculocutaneous flap. (d) Proximal intestine. (e) Split skin graft.

site, the anterior layer of rectus sheath was closed so as not to compress the rectus abdominis muscle. The flap showed complete engraftment. Oral intake of water was commenced 2 weeks after surgery, and the balloon catheter was removed at 1 month postoperatively. Subsequently, minor leakage of digestive juice occurred from the catheter removal site, but this gradually decreased and complete closure was achieved at 8 months after surgery. Food intake commenced 3 months postoperatively. Intravenous hyperalimentation ceased at 9 months postoperatively and the patient was discharged from hospital. There was no recurrence of the fistula and the patient lived at home until death from pneumonia 4 years later (Fig. 2).

DISCUSSION

To close an ECF, the intestinal wall should be reconstructed with the original intestinal mucosa if reanastomosis is possible. If reanastomosis is impossible, other methods can be used.^{1,2,4} Some reports note the closure of the small intestine skin fistula using the muscle flaps, including the rectus abdominis muscle.⁵⁻⁷ However, in our patient, laparotomy could not be indicated because of the strong adhesion of the residual intestinal tract and the patient's poor general condition and nutritional status. Therefore, intestinal wall reconstruction was performed using a hinged musculocutaneous flap.^{4,8}

However, this method has 2 issues that must be overcome. First, the suture line between the border of the fistula and the skin island of the flap is inside the intes-

tinal lumen and exposed to digestive juice. Second, the intraluminal pressure of the digestive tract is elevated by peristaltic movements, placing additional stress on the suture line. We employed 4 methods to achieve successful closure. First, a vertical incision was made in the ab-



Fig. 2. Findings at 1 year and 2 months after surgery. No recurrence of the fistula was noted. The patient could ingest food orally and live at home.

dominal skin surrounding the fistula, and subcutaneous undermining was not performed to preserve marginal circulation. Then, the skin island flap with a good blood supply was sutured to the inner and margin of the incision, thus preventing the occurrence of ischemia and suture failure at the borders of the fistula. Second, the suture line around the fistula was completely covered by the muscular body of the musculocutaneous flap from backing of the suture line, promoting wound healing.⁵⁻⁷ Although minor leakage of digestive juice was observed from the small hole left after removing the balloon catheter from the intestine, complete closure was eventually achieved. Third, the skin island of the flap was designed to be 20% larger than the defect in the intestinal wall. This enlarged the lumen of the reconstructed intestinal tract so that severe stenosis would be unlikely to occur even if there was contracture at the anastomosis after surgery.⁹ Fourth, a balloon catheter was inserted into the proximal intestine from the fistula to prevent digestive juice from coming into contact with the suture line.¹⁰ As a result, it was possible to minimize exposure of the skin island flap to digestive juice and to prevent sudden elevation of the intraluminal pressure due to intestinal peristalsis.

CONCLUSIONS

A large, intractable enterocutaneous fistula of the small intestine was treated successfully with a hinged rectus abdominis musculocutaneous flap. This method can be effective in managing a fistula without resection, if resection of the affected bowel and anastomosis is impossible.

Hideaki Rikimaru, MD, PhD

Department of Plastic and Reconstructive Surgery
and Maxillofacial Surgery
Kurume University School of Medicine
67 Asahi-machi, Kurume
Fukuoka 830-0011, Japan
E-mail: Hi_rikimaru@yahoo.co.jp

ACKNOWLEDGMENT

The authors are grateful to Dr. Yamauchi Toshihiko for providing the topic treated in this article.

PATIENT CONSENT

A family member provided written consent for use of the patient's image.

REFERENCES

1. Scala M, Spagnolo F, Strada P, et al. Regenerative surgery for the definitive surgical repair of enterocutaneous fistula. *Plast Reconstr Surg*. 2012;129:391e-392e.
2. Hollington P, Mawdsley J, Lim W, et al. An 11-year experience of enterocutaneous fistula. *Br J Surg*. 2004;91:1646-1651.
3. Jeppesen PB. Spectrum of short bowel syndrome in adults: intestinal insufficiency to intestinal failure. *JPEN J Parenter Enteral Nutr*. 2014;38(1 Suppl):8S-13S.
4. Draus JM, Jr, Huss SA, Harty NJ, et al. Enterocutaneous fistula: are treatments improving? *Surgery*. 2006;140:570-576.
5. Carey JN, Sheckter CC, Watt AJ, et al. Intra-abdominal pedicled rectus abdominis muscle flap for treatment of high-output enterocutaneous fistulae: case reports and review of literature. *J Plast Reconstr Aesthet Surg*. 2013;66:1145-1148.
6. Mauldin JM, Ciraulo DL, Guest DP, et al. Contralateral rectus abdominis myofascial transposition flap closure of an anterior abdominal wall lateral duodenal cutaneous fistula after shotgun injury to the abdomen. *J Trauma Inj Infect Crit Care*. 2006;60:1353-1357.
7. Chander J, Lal P, Ramteke VK. Rectus abdominis muscle flap for high-output duodenal fistula: novel technique. *World J Surg*. 2004;28:179-182.
8. Burke MS, Kaplan SE, Kaplowitz LJ, et al. Pectoralis major myocutaneous flap for reconstruction of circumferential pharyngeal defects. *Ann Plast Surg*. 2013;71:649-651.
9. Takahashi N, Kiyokawa K, Rikimaru H, et al. Surgical treatment of pharyngeal atresia. *J Craniofac Surg*. 2007;18:208-211.
10. Klapdor R, Humke R. About the efficiency of the duodenal drainage with the double balloon tube technique using polyethylene glycol as duodenal marker. *Acta Hepatogastroenterol (Stuttg)*. 1976;23:250-254.