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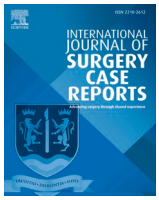

Case report

Incisional wound closure by sequential partial split-thickness skin grafting following failure of primary abdominal fascia closure after open abdomen management: A case report

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ABSTRACT

Introduction: Open abdomen (OA) is a widely used technique for managing abdominal organ injury, abdominal compartment syndrome, and abdominal sepsis. While various methods have contributed to successful primary closure of the abdominal fascia after OA, some patients still develop enteroatmospheric fistulas that impede abdominal fascia closure. We report a case of successful epithelialization of the incision by sequential partial split-thickness skin grafting (STSG) in a patient who had failure in primary abdominal fascia closure due to enteroatmospheric fistulas after OA for incisional dehiscence and anastomotic leakage.

Presentation of case: A 73-year-old male patient underwent pancreaticoduodenectomy for duodenal adenocarcinoma. The abdominal incision was then necrosed and dehisced due to anastomotic leakage on postoperative day (POD) 6, and multiple intra-abdominal lavages with OA were performed. On POD 15, the patient developed enteroatmospheric fistulas; thus, primary fascia closure was considered impossible. On PODs 72 and 106, STSG was conducted on the granulation tissue at the incisional wound, and complete epithelialization was achieved on POD 111.

Discussion: Sequential partial STSG only needed basic surgical skills and standard devices for surgery.

Conclusion: We reported the case with successful epithelialization of the incision by sequential partial STSG, in which primary abdominal fascia closure was failed due to enteroatmospheric fistulas after OA for incisional dehiscence and anastomotic leakage.

1. Introduction

Open abdomen (OA) with temporal abdominal closure is widely used to complete laparotomy without abdominal fascia closure [1]. While OA has been performed in several conditions, such as abdominal organ injury, vascular diseases with massive hemorrhage, abdominal sepsis, and abdominal compartment syndrome, it reportedly improves the clinical consequences of damage control surgery for severely injured trauma patients [2–4]. However, it should be noted that a considerable number of patients would experience difficulty in primary abdominal fascia closure, particularly when the demand for OA continues for >2 weeks [5].

To achieve the primary abdominal fascia closure following OA, several methods have been performed, such as dynamic closure technique with negative wound pressure therapy (NPWT) and/or mesh traction [6], component separation, and local or free flap [7]. The dynamic closure technique and component separation have been reported with a 50 %–80 % successful rate of primary fascia closure, although the abdominal fascia cannot be closed in some cases particularly when an enteroatmospheric fistula exists [8]. As the incisional wound is exposed to bowel contents that are spilled from the fistula, significant efforts with customized strategies are needed in such cases.

Sequential partial skin grafting is among the options to achieve epithelization of the abdominal incision with unclosed fascia [9].

Abbreviations: NPWT, negative wound pressure therapy; OA, open abdomen; POD, postoperative day; STSG, split-thickness skin grafting.

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Although this method can be chosen even in cases with multiple enteroatmospheric fistulas, protecting the graft margin from being contaminated with intestinal spillage in every skin graft procedure is always needed [10]. In this study, we report a case of successful epithelialization of the incision by sequential partial split-thickness skin grafting (STSG) in a patient who had failure in primary abdominal fascia closure due to enteroatmospheric fistulas after OA for incisional dehiscence and anastomotic leakage. The details of the partial skin grafting procedure for protecting the graft edge are also described. This work has been reported in line with the updated SCARE guideline [11].

2. Presentation of case

A 73-year-old man with a history of partial colectomy for sigmoid colon perforation underwent subtotal stomach-preserving pancreaticoduodenectomy for duodenal adenocarcinoma diagnosed by esophagogastroduodenoscopy. Due to extensive bowel adhesion and incisional hernia, small bowel resection and partial colectomy with primary anastomosis, as well as abdominoplasty, were additionally conducted.

On postoperative day (POD) 1, hemodynamical instability occurred and postoperative intra-abdominal sepsis was clinically diagnosed. Immediate administration of fluids, vasopressors, and broad-spectrum antibiotics was initiated, and the patient was resuscitated without relaparotomy. However, the abdominal incision was gradually becoming necrosed in the following days and was dehisced on POD 6. Thereafter, excision of the necrotized abdominal wall tissues and intra-abdominal lavage were conducted; subsequently, the patient was managed with OA.

Initially, temporal abdominal closure was conducted with incisional NPWT, rather than with a commercial NPWT kit. As a pancreatic fistula and anastomotic leakage from the ileum were identified in the first abdominal lavage, multiple intra-abdominal and enteric drainage tubes were placed. Intra-abdominal washout was performed every 24–72 h, and the drainage tubes were replaced frequently during OA management. On POD 15, intra-abdominal contamination was still present due to the pancreatic and enteroatmospheric fistulas (Fig. 1); therefore, primary fascia closure was considered impossible, and temporal incisional hernia formation and abdominal reconstruction at 1 year later were planned as short- and long-term endpoints, respectively. On POD 28, massive bleeding from the gastroduodenal artery due to a pancreatic fistula was found and hemostasis was obtained by emergency angiography.

Fig. 1. Incisional wound on postoperative day 15.
Pancreatic and enteroatmospheric fistulas were observed before split-thickness skin grafting (STSG).

To achieve epithelization of the abdominal incision with planned hernia formation, sequential partial STSG was conducted on POD 72. The initial 1:3 meshed STSG was performed onto the central area of the wound. An ostomy paste was placed around the edge of skin graft to separate the grafted area from the nongrafted granulated tissue and to prevent NPWT on the graft from losing negative pressure (Fig. 2A and B). Engraftment was identified on POD 84 (Fig. 3), and the second and third partial STSGs were performed on the cephalic and caudal parts of the incisional wound on POD 106 (Fig. 4). With these three partial STSGs, epithelization of the wound was identified on POD 111 (Fig. 5). OA management was completed successfully at approximately 4 months after the initial surgery.

The patient was planned to be discharged to a long-term care facility; however, multiple lung metastases were found on CT, and he eventually died on POD 210 because of multiple organ failure due to progressive cancer.

3. Discussion

In this case, primary abdominal fascia closure could not be achieved because of pancreatic and multiple enteroatmospheric fistulas following delayed intra-abdominal lavage. Therefore, temporal incisional hernia formation was planned and completed with partial STSGs with hand-made NPWT dressing. Of note, ostomy paste around the grafted wound and highly absorbable dressings on the non-grafted granulated wound effectively prevented graft contamination.

Several studies have suggested that primary fascia closure could not be achieved often in patients with intra-abdominal sepsis, pancreatitis, and obesity [12–14]. Additionally, prolonged OA management would introduce various complications, such as enteroatmospheric intestinal fistula, which also makes the fascia closure difficult [15,16]. Therefore, appropriate sepsis control, enhanced nutritional support, and deliberate local wound care should be provided to avoid additional bowel damages [17], although considerable discussion is ongoing on the optimal wound care methods.

Once primary fascia closure is considered impossible, every effort should be focused on the epithelization of incisional wounds. One of the options would include direct application of biological dressing, such as human acellular dermal matrix and cadaveric STSG, which were reported to have a successful epithelization rate of >70 % [18]. Another method would be the use of an autogenous pedicled de-mucosalized small intestinal sheet that can achieve satisfactory blood supply; it has also been reported to have promising results with low wound infection rates [19]. However, these methods largely depend on institutional resources and skills of the surgeons; therefore, there is a concern on their generalizability. Notably, although periodical wound dressing changes until the granulation tissue at the incision shows epithelization would be the simplest and safest method, it would take years to achieve this in cases with a large trauma incision.

Sequential partial STSG along with hand-made NPWT conducted in this study does not need designated skills or expensive devices. While a key technique would be the separation of granulated tissue from the grafted area, this can be easily achieved with an ostomy paste. Moreover, considering that NPWT has been a standard treatment for wound management nowadays [20], our method would be highly applicable in most institutions.

There are several limitations to this report. First, the generalizability of the methods for achieving epithelization of incisional wounds is

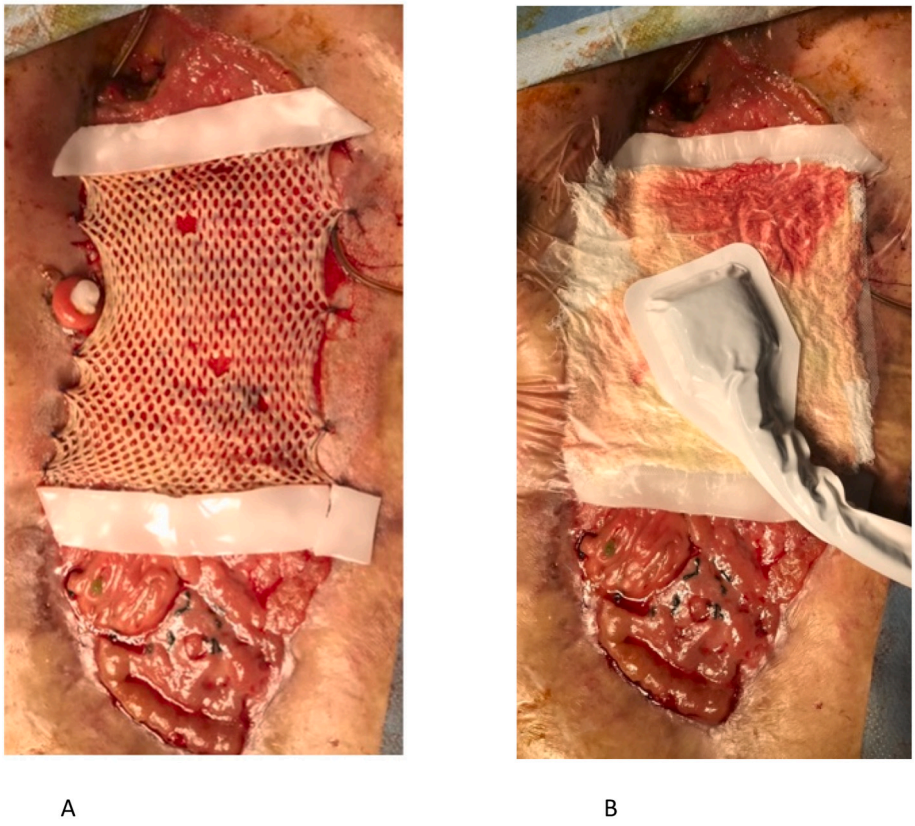

Fig. 2. Incisional wound after the initial STSG.
A. The initial 1–3 meshed STSG was performed onto the central area of the wound. An ostomy paste (Adapt: Hollister, Illinoi, USA) was placed around the edge of skin graft to separate the grafted area from non-grafted granulated tissue and to prevent negative pressure wound therapy on the graft from losing negative pressure. B. As a dressing for the skin graft, the graft was covered with a silicone-faced wound dressing mesh (SI-mesh; ALCARE, Tokyo, Japan) and then RENASYS-G Gauze Dressing (Smith & Nephew, Hull, UK) was applied. A 120 mmHg continuous negative pressure was administered using a RENASYS TOUCH device (Smith & Nephew, Hull, UK).

Fig. 3. Incisional wound on postoperative day 84.
The engraftment was identified at the initial skin graft.

Fig. 4. The second and third partial STSG.
A. The second and third partial STSG procedures were performed on the cephalic and caudal parts of the wound on POD 106. One-to-three meshed STSG was applied on both sides, covered with silicone-faced wound dressing mesh (SI-mesh; ALCARE, Tokyo, Japan) and RENASYS-G Gauze Dressing (Smith & Nephew, Hull, UK). An ostomy paste (Adapt: Hollister, Illinoi, USA) was also placed at the border between enteroatmospheric fistula and graft to prevent the skin graft from being contaminated by intestinal spillage. At the cephalic wound, 120 mmHg of continuous negative pressure was applied using a RENASYS TOUCH device (Smith & Nephew, Hull, UK).

Fig. 5. Incisional wound on postoperative day 111.
After several partial STSG procedures, epithelization of the wound was achieved.

unclear. Given that the patient's background characteristics before initiating OA is relatively unique in this study (elective surgery for duodenal adenocarcinoma and anastomotic leakage), whether the current method can be used for OA for abdominal compartment syndrome or massive intra-abdominal bleeding [21] should be validated in another study. Second, the current method would require several health care professionals to closely observe the wound until epithelization. Therefore, institutions with a limited number of health care providers would find the use of our technique difficult. Third, the current method requires healthy skin to cover the wound with STSG. Patients with chronic skin diseases or conditions, such as extremity defect, history of extensive burns, and skin infection, would not be optimal candidates for this method.

4. Conclusion

Sequential partial STSG enabled epithelization of the incisional wound whole 4 months and therefore might be a feasible option among patients in whom abdominal fascia cannot be closed following OA. However, the generalizability of this method for abdominal compartment syndrome or intra-abdominal bleeding should be further validated.

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Ethical approval

This study was approved by the Institutional Review Board of the Keio University School of Medicine (application number: 20200338).

Author contribution

SS, RY, and KM analysed the patient data and wrote the first draft of this manuscript. SW, IY, YS, MO, SH, MK, and YK helped to draft the manuscript and revised it critically for important intellectual content. JS contributed to the final approval of the version to be published. All authors read and approved the final manuscript.

Registration of research studies

N/A.

Guarantor

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Declaration of competing interest

No financial and personal relationships exist in this case report.

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