Operative Management of Enteroatmospheric Fistula in Björck 4 Open Abdomen Patients by the Help of Laparoscopic Lateral Approach

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Abstract As the open abdomen (OA) management increases, the number of fistula formation has also been increasing during the last two decades. These fistulas in OA have been defined as enteroatmospheric fistula (EAF). EAF occurring in a frozen OA is classified as Björck 4 OA. Management of Björck 4 OA patient is not easy and mortality of these patients is very high in spite of the presence of modern treatment modalities. There are a few surgical approaches for treatment of Björck 4 OA patients. One of them is excising the hostile segment by lateral abdominal approach from the healthy side or entering from lateral border of OA wound after enough time intervals for subsiding of the edematous intestine in acute inflammatory reaction in the hostile environment. In this case, we present a newly developed surgical technique, called laparoscopic lateral approach which was applied to Björck 4 OA patient for excising hostile intestinal segment and management of the abdominal wall defect.

Keywords Management of enteroatmospheric fistula · Open abdomen · Negative pressure therapy · Laparoscopic open abdomen management · Laparoscopic enteroatmospheric fistula treatment

Introduction

The open abdomen (OA) is one that requires a temporary abdominal closure due to the skin and fascia not being closed after laparotomy. OA management has become increasingly common during the last two decades [1, 2]. The fistula formation in OA is one of the most devastating complications. These fistulas have been defined as enteroatmospheric fistula (EAF). If EAF occurs in frozen OA, this is classified as Björck 4 OA. The mortality rates of Björck 4 OA patients were as high as 70% in the past decades, but currently are lowered to 42% due to advanced intensive care unit (ICU) modalities and improved surgical techniques [3]. Unlike enterocutaneous fistula, EAF cannot be closed without proper surgical treatment [1].

Most important problems during surgical management of Björck 4 OA are massive adhesions of the abdominal viscera and a large abdominal wall defect. Operative management of Björck 4 OA comes into consideration after hemodynamic stabilization and EAF controlling. There are a few alternative approaches for surgical management of Björck 4 OA patients. The most popular one of them is excising the hostile segment by lateral abdominal approach from the healthy side [4] or entering from lateral border of OA wound after enough time interval for subsiding of the edematous small and large bowel in acute inflammatory reaction in the hostile intraabdominal environment [1, 5].

In this case, we present a newly developed surgical technique, called laparoscopic lateral approach which was applied to Björck 4 OA patients for excising hostile intestinal segment and management of the abdominal wall defect.

Preoperative Management

Sepsis, malnutrition, and fluid and electrolyte imbalances of OA patients had been corrected before operation. This

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operation was performed 75 days later from the skin grafting, at the same hospitalization period.

Surgical Techniques

All operations were performed in supine position under general anesthesia after prophylactic antibiotherapy application. The surgical procedure may be divided into four steps:

- 1) Exploratory laparoscopy and separating healthy intestinal structures from hostile intestinal structure which has EAFs by gentle dissection (Fig. 1)
- 2) Excision of the hostile intestinal segment (Figs. 1 and 2)
- 3) Making double-barrel stoma with the remaining healthy intestinal structure (Fig. 2)
- 4) Closure of the abdominal wall defect by skin flaps (Fig. 3)

Step 1: Exploratory Laparoscopy and Separating Healthy Intestinal Structures from Hostile Intestinal Structure

First of all, a 12-mm incision was made at the right mid-axillary line between the lower border of the rib and anterior superior iliac spine (ASIS) far away from the granulating tissue of OA wound. The peritoneal cavity was carefully entered and the intraabdominal adhesions cautiously dissected and a 10-mm trocar was inserted from there with the open technique. The abdomen was insufflated with CO₂ and extensively adhered abdomen was explored. Gentle dissection by finger with the help of camera was made. One 5-mm trocar was also inserted to this created space, 7 cm anteromedial

from the first trocar in the abdomen. Gentle dissection was continued toward the superior side. After creating some more space inside the abdominal cavity, one more 5-mm trocar was also inserted 7 cm superomedial from the first trocar (Fig. 1a). Lysis of adhesions could not be too difficult, by starting the dissection in healthy intestine so far from hostile intraabdominal environment firstly (Fig. 1b). All healthy small and large intestines were dissected and separated from anterior abdominal wall and hostile intestinal segment. One more 5-mm trocar was also inserted into the abdomen from the newly created space. Dissection was continued all around the hostile segment. The most difficult part of this step is to dissect the small and large bowel that densely adhered to the overlying granulation tissue formed in the bed of OA. Care must be taken to avoid inadvertent injury to the bowel. The entire anterior abdominal wall was separated from visceral tissue, other than hostile intestinal segment. Light illumination was seen on the OA wound all around the EAFs.

Step 2: Excision of the Hostile Intestinal Segment After laparoscopic dissection was completed, an open surgery was started. The first incision was made by enlarging the 5-mm trocar entrance over the skin grafting of the OA wound (Fig. 1c). Since grafted part had just been emptied under the skin, entry to the peritoneal cavity was performed easily. The entrance was enlarged carefully (Fig. 1d). Under vision, incision was continued all around the OA wound and hostile segment was made free entirely. Careful exploration was made and isolation of hostile segment was continued by separating healthy intestinal segment from hostile intestinal on and its meso (Fig. 2a). The intraabdominal adhesions were cautiously dissected. The dissections were considered to be complete,

Fig. 1 Exploratory laparoscopy and separating healthy intestinal structures from hostile intestinal structure. **a** Trocars insertion sides are seen. **b** Inner view of LLA. **c** Enlarged 5-mm trocar entrance over the skin grafting of the OA wound is seen. **d** The entrance was enlarged carefully. Under vision, incision was continued all around the OA wound

Fig. 2 Resection of the hostile segment and double-barrel stoma formation. **a** Hostile segment is made free from surrounding tissue entirely. **b** After resecting the entire hostile intestinal segment, two intestinal ends are seen. **c** Ostomy opening is created on the left side of the patient. **d** Maturation of double-barrel ostomy is seen

when segments of the small bowel in which the fistulae arose from have all been identified and isolated. Lyses of adhered part of the small intestine were continued up to Treitz ligament proximally and up to the ileocecal valve distally. Subsequently, an approximately 60-cm intestinal segment with six orifices of EAF was resected. There was no iatrogenic injury during dissection. At the end of this step, there were two intestinal ends (one proximal intestinal end was coming from Treitz ligament and the length of it was 120 cm, one distal end was going to ileocecal valve and the length of it was 70 cm) (Fig. 2b). There were so many fecaloid stone impactions all throughout the colon.

Step 3: Making Double-Barrel Stoma Formation with the Remaining Healthy Intestinal Structure Because of the colonic fecaloid impaction, it was decided to make the double-barrel stoma. It was checked where the intestinal ends could be reached to make a stoma. Double-barrel stoma was made on the left side of the patient and matured with 3/0 Vicryl suture (Fig. 2c, d).

Step 4: Closure of the Abdominal Wall Defect by Skin Flaps Direct fascial closure of the abdominal wall could not be achieved due to extreme tension. Bilateral skin flaps were prepared by dissecting from the rectus muscle (Fig. 3a).

Fig. 3 Preparation of the skin flap and abdominal closure. **a** Skin flap preparation by dissecting from rectus muscle is seen. **b** Tripping the granulation tissue is seen at the end of the skin flap. **c** Suturing the skin flaps was seen at the midline. **d** At the end of the operation, closed abdomen and matured double-barrel stoma are seen

Granulation tissue at the end of the skin flap was tripped (Fig. 3b). One drain was placed to the recto-vesical space and the other drain was placed to subhepatic space. Abdominal closure was performed in the midline by suturing the skin flap with 2/0 interrupted polypropylene (Fig. 3c, d).

Postoperative Care

For pain control, intravenous paracetamol 1 g was given if VAS >3, maximally four times a day at 6-h intervals. As a rescue analgesic, morphine IV 0.05 mg/kg was applied to patients if their VAS score was >3 and paracetamol had been administered less than 6 h before. Morphine injection was repeated up to 15 mg in 4 h. At any time, if pain relief was inadequate, an alternative opioid (tramadol) IV at a dose of 1 mg/kg was used. Patient was mobilized during the first postoperative day. Oral intake and enteral nutrition was started after the stoma working on the second postoperative day. Jejunostomy output was 900–1500 cm³ and 4 * 1 lomotil pill per day was started. Jejunostomy output decreased to 600–1200 cm³ but patient needed additional 1000 cm³ IV fluid replacement per day. All drains were removed on the fifth postoperative day.

Patient was discharged on the 11th postoperative day with lomotil 4 * 1 and IV 1000 cm³ Ringer's lactate per day. Patient was controlled for postoperative 30th days and he had no extra problem. Operation for stoma closure was planned 1 month later.

Discussion

LLA as a technique has some advantages and disadvantages. Firstly, hostile intestinal segment can be separated without large lateral incision in a Björck 4 OA patient, by this LLA intraabdominal dissection. Therefore, blood supply and continuity of lateral abdominal wall is not destroyed so much. Secondly, dissection especially at remote and deep side is

easier in LLA. By entering the peritoneal cavity from healthy space, dissection of the intestinal segments can be performed easily. Thirdly, during the laparoscopic operation, visceral edema does not develop because the entire intestinal segments stay inside the abdomen without heat loss with minimal tissue trauma. As a result, less edema formation in visceral tissue makes abdominal closure easier.

On the other hand, besides all these advantages, the LLA technique requires so much experienced surgeon in laparoscopy and OA management. Surgeon has to be so patient during gentle dissection, since dissection may take several hours.

Conclusion

LLA may be used for excising hostile intestinal segment and management of the abdominal wall defect without additional large lateral incision in Björck 4 OA patients.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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