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## International Journal of Surgery Case Reports

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# Intrarectal negative pressure system in the management of open abdomen with colorectal fistula: A case report



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## ARTICLE INFO

### Article history:

Received 12 November 2013

Received in revised form 4 January 2014

Accepted 11 January 2014

Available online 23 January 2014

### Keywords:

Negative pressure

Colorectal fistula

Dynamic closure

Open abdomen

## ABSTRACT

**INTRODUCTION:** To present the management of open abdomen with colorectal fistula by application of intrarectal negative pressure system (NPS) in addition to abdominal NPS.

**PRESENTATION OF CASE:** Twenty-year old man had a history of injuries by a close-range gunshot to the abdomen eight days ago and he had been treated by bowel repairs, resections, jejunal anastomosis and Hartman's procedure. He was referred to our center after deterioration, evisceration with open abdomen and enteric fistula in septic shock. There were edematous, fibrinous bowels and large multiple fistulas from the edematous rectal stump. APACHE II, Mannheim Peritoneal Index and Björck scores were 18, 33 and 3, respectively (expected mortality 100%). After intensive care for 5 days, he was treated by abdominal and intrarectal NPS. NPS repeated for 5 times and the fistula was recovered on day 18 completely. Fascial closure was facilitated with a dynamic abdominal closure system (ABRA) and he was discharged on day 33 uneventfully. There was no herniation and any other problem after 12 months follow-up.

**DISCUSSION:** Management of fistula in OA can be extremely challenging. Floating stoma, fistula VAC, nipple VAC, ring and silo VAC, fistula intubation systems are used for isolation of the enteric effluent from OA. Several biologic dressings such as acellular dermal matrix, pedicled flaps have been used to seal the fistula opening with various success. Resection of the involved enteric loop and a new anastomosis of the intestine is very hard and rarely possible. In all of these reports, usually patients are left to heal with a giant hernia. In contrast to this, there is no hernia in our case during one year follow up period.

**CONCLUSION:** Combination of intra and extra luminal negative pressure systems and ABRA is a safe and successful method to manage open abdomen with colorectal fistula.

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## 1. Introduction

The management of open abdomen (OA) should be life-saving in abdominal compartment syndrome, trauma, severe secondary peritonitis, postoperative abdominal wound dehiscence.<sup>1,2</sup> Various temporary abdominal closure (TAC) techniques have been described in treatment of the open abdomen. However, data confirming their role in the management of OA complicated with fistula are limited.

An enteric fistula in the middle of open abdomen (OA) is called Entero-atmospheric fistula (EAF), which is the most challenging situation for a surgeon to deal with.<sup>3</sup> It is not a true fistula since it has

no a fistula tract and it is not covered with tissue. For these reasons, spontaneous closure of EAF is almost impossible.<sup>4</sup> Correcting the nutritional depletion, severe fluid and electrolyte imbalance, controlling local infection, systemic sepsis, fistula drainage and definitive closure of abdomen may be extremely challenging.<sup>1,3,5</sup>

In the recent literature, management of EAF in open abdomen has mainly 3 different strategies which are isolation of the enteric effluent from OA, sealing of EAF with fibrin glue or skin flap and resection of intestine including EAF and anastomosis.<sup>3</sup> The mortality rates of EAF were as high as 70% in the past decades but currently are lowered to 42% due to advanced modern ICU and improved surgical techniques.<sup>6</sup>

Here we present a case report of a patient with OA and fistula whom was treated with an additional intraluminal (intrarectal) negative pressure system (NPS) with abdominal NPS and dynamic wound closure (ABRA) system.

## 2. Case report

Twenty-year old man was referred to our center with open abdomen and colorectal fistula in septic shock. He had a history of

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**Fig. 1.** The view of open abdomen with colonic leakage in the operating room after admission to our center.

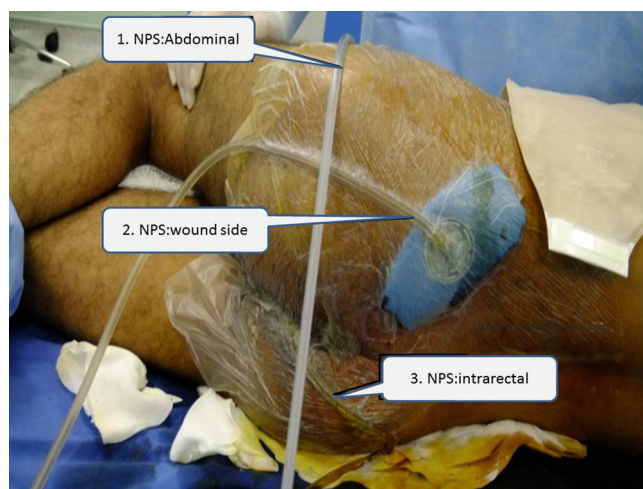
injury to the abdomen by a close-range gunshot for two times eight days ago. His previous treatment had had an emergency laparotomy which had demonstrated hemoperitoneum (1500 ml), active bleeding from lumbar veins, multiple injuries in small intestines and left colon. After hemostasis, injured part of ileum had been resected and end to end anastomosis had been made. Another perforated part of jejunum, about 10 cm to distal to Treitz ligament, had been primarily sutured. Resection of descending colon had been performed as Hartmann's procedure. The patient had been referred to our clinic with evisceration and colorectal fistula at postoperative day eight. On admission, the patient was in septic shock, hypotensive and intubated (blood pressure: 80/40 mm Hg, heart rate: 110/min body temperature: 38.0 °C, Hb: 11 g/L, WBC: 18.000 mm<sup>3</sup>, urea: 110 mg/dL, creatinine: 1.8 mg/dL, potassium: 3.1 mmol/L, sodium: 125 mmol/L, albumin: 2.4 g/dL, ALT (alanine transaminase): 293 U/L, AST (aspartate transaminase): 254 U/L, ALP (alkaline phosphatase): 231 U/L).

Hemodynamic instability was tried to improve in intensive care unit after for 2 h and later he was referred to operating room. There was 26 cm × 18 cm in-size open abdomen (Fig. 1). Small intestinal loops were dilated and covered with fibrins. There were multiple colorectal fistulas at the distal edematous Hartmann's stump. The APACHE II, Mannheim Peritoneal Index and Björck scores were 18, 33 and 3, respectively. Abdominal necrotic tissues were debrided and irrigated with normal saline. On left gluteus, there were two gunshot wounds opening to a pouch located posterior to rectum, 10 cm × 10 cm × 8 cm which were connected with the rectal fistula and abdominal cavity. When normal saline was injected through gunshot wounds, it was draining through the rectum and open abdomen. The gluteal wounds were debrided and washed with normal saline as well. First abdominal NPS was applied by a standard method (ABthera, KCI). NPS is a good alternative technique for evacuation of intra-abdominal exudates and edema and allowing control of abdominal volume.<sup>8,9</sup> A perforated polyethylene sheet was placed over the intra-abdominal organs under the fascia and a sponge was placed over the silicone sheet and covered with drapes. Approximately a 5–6 cm opening was made in the center of the drape to apply suction tubing system (Fig. 2). The second NPS was



**Fig. 2.** Application of standard abdomen negative pressure system (ABthera, KCI).

used on the gunshot wounds at the left gluteus. A part of silicone drain was inserted into wounds. A sponge was put on the drain and covered with drape. Tubing system was added to center of system (Fig. 3). An additional NPS was placed in to the rectum (Fig. 3). To prevent erosion on rectal mucosa, the tubing system of the ABthera was covered by a part of silicone sheet. The silicone cover was trimmed as in oval form and lubricated for easy application to the rectum (Fig. 4). It was placed near to fistula side (Fig. 5). These three NPS were connected each other by Y connectors. During the first four days, a continuous synchronized -50 mmHg negative pressure was used. After four days, the negative pressures were adjusted intermittently as high level (-125 mm Hg for 4–10 min) and as low level (-50 mm Hg for 1–2 min). The dressings and abdominal NPS were changed for every 2–4 days in the operating room under general anesthesia. The patient was weaned from mechanical ventilator on second day. He stayed in ICU for 5 days. Multiple fistulas were resolved completely on day 18 after a total 5 times changing the dressings and vacuum systems. After that, a dynamic abdominal closure system (ABRA; Canica Design, Almonte, Ontario, Canada) was added to management (Figs. 6 and 7). ABRA is a technique which based on using anchors and elastomers to provide muscle and fascia reapproximation.<sup>7,8</sup> The elastomers of ABRA were inserted through the full thickness (skin, subcutaneous tissue



**Fig. 3.** Three negative pressure systems were seen. 1. VAC was used on standard open abdomen. 2. VAC therapy system was used on gunshot lesions on left gluteus area. 3. Intrarectal negative pressure system was placed.



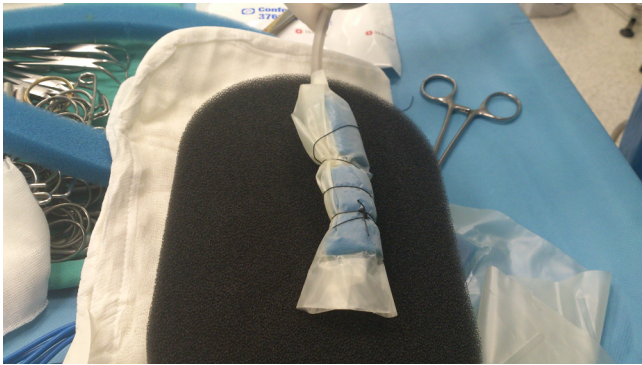


Fig. 4. The tubing system was covered by part of silicone cover of the ABthera not to harm to the rectal mucosa during negative pressure application.

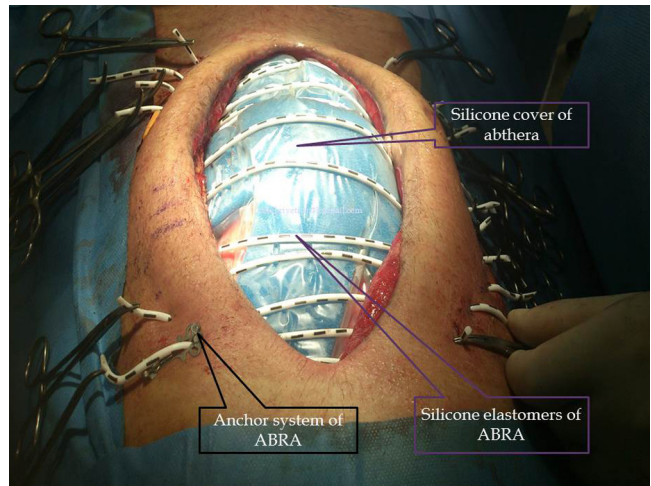


Fig. 7. Applied ABRA was seen.

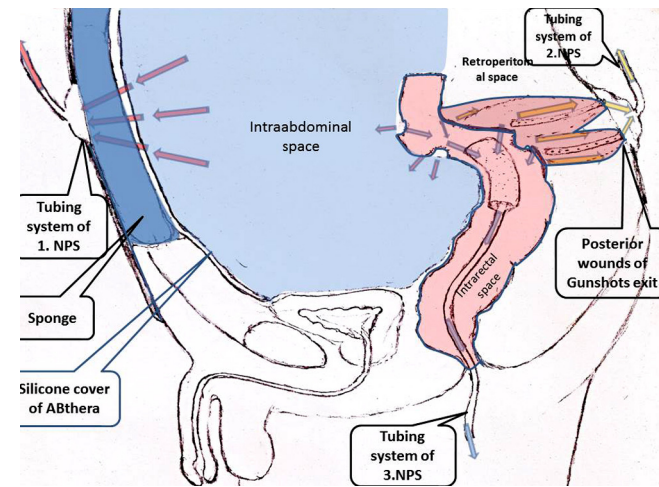


Fig. 5. Rectal pouch, fistula on it and retroperitoneal wound of two gunshots and their pathways are seen. Negative pressure effects of 3 VAC therapy systems on rectal wall and rectal fistula are showed. Illustration of neutralization of negative pressure effect of abdominal and wound side negative pressure systems on fistula at rectal pouch by using intra-rectal synchronized negative pressure system.

and fascia) of the abdominal wall at a distance of approximately 5 cm from the medial fascial margin. The elastomers were aligned about 3 cm part across the defect of open abdomen. Abdominal organs were covered with a porous silicone sheet (Fig. 7). The

optimal tension was obtained by stretching the elastomers 1.5–2 times the tension free length of black mark on elastomers. Tension of ABRA was adjusted when NPS dressings were changed.

When the wound edges came together, fascia was sutured by separated 1/0 PDS sutures without mesh application. Skin closure was performed two days after the fascial closure (Fig. 8). Anchors of ABRA were removed one week after the skin closure (Fig. 9). There was no herniation or any other problem on abdominal wall and the patient was uneventful after 12 months follow-up.

### 3. Discussion

The fistula formation in OA is the most critical complication.<sup>6</sup> Management of fistula in OA can be extremely challenging. Hemodynamic status of the patient, degree of MPI score, Björck score and condition of fascia are some of the complex factors influencing the success rate of treatment in patients with septic OA.<sup>9–11</sup> The APACHE II, MPI and Björck scores of our patient were 18, 33 and 3, respectively. According these scores, the expected mortality rate of the patient were near to 100%.<sup>11</sup>

In the recent literature, floating stoma, fistula VAC, nipple VAC, ring and silo VAC, fistula intubation systems are used for isolation of the enteric effluent from OA.<sup>3</sup> Apart from the techniques accomplishing the goal of effective diversion of enteric effluents, several



Fig. 6. Entero-atmospheric fistula was taken under control and good granulation tissue was seen on 18 day.



Fig. 8. Successfully closed abdominal wall was seen.



**Fig. 9.** After anchor of ABRA was removed. There is no herniation or other complication.

biologic dressings such as acellular dermal matrix, pedicled flaps have been used to seal the fistula opening with various success.<sup>12</sup> Although resection of the involved enteric loop is the most definite treatment option in patients with EAF, resection and a new anastomosis of the intestine is very hard and rarely possible.

Goverman et al.<sup>13</sup> reported that the enteric contents should be taken under control through a separate hole in the sponge of NPS by preparing the site around the fistula for split-thickness skin graft for the application of ostomy bags in 5 cases. Application of the fistula-VAC should be considered as a useful option in treating patients with high output intestinal fistula in open abdominal wounds. Jamshidi and Schecter<sup>12</sup> reported using human acellular dermal matrix applied via fibrin glue on the EAF opening had a 71% success rate. In all of these reports, more often patients are left to heal with a giant hernia. In contrast to this, our patient did not develop a hernia during one year follow up period.

Sriusadaporn et al. reported in eight patient case series, once the involved enteric loop was resected and re-anastomosis was performed, abdominal defect was closed with a dextron mesh and subsequently covered with bilateral bipedicled anterior abdominal skin flaps.<sup>14</sup>

Neither the methods achieving isolation of the enteric effluents, nor the techniques sealing the opening of EAF and resection of intestinal loop including EAF and re-anastomosis could not be used in our case, since EAF was multiple and very deeply located.

In this case, standard abdomen and gunshot wound side NPS were used for optimal drainage of infected materials, reduction of the edema from abdomen and wound of gunshot wound. Intrarectal position of NPS was used to neutralize effects of intra-abdominal and wound side NPS on the rectal wall at fistula side (Fig. 5). Furthermore, the rectal effluents were evacuated through the rectal way and isolation of wound of OA from rectal effluents could be provided successfully by this intrarectal NPS.

Steenborde<sup>15</sup> emphasized that single use of negative pressure treatment for OA failed because of the retraction of the abdominal muscles. Therefore, after controlling abdominal sepsis, we used dynamic wound closure system offering a dynamic and continuously adjustable traction allowing both expansion and retraction in accordance with oscillation of breathing and patient movement by preventing further lateral retraction of the abdominal muscles and fascia. Reimer et al.<sup>16</sup> reports that complete primary closure was

achieved with ABRA in patients with non-gastrointestinal pathology but OA of only 4 of 10 patients with gastrointestinal sepsis could be closed. Verdum et al.<sup>2</sup> stated that delayed closure was achieved at 88% in 16 patients within 30 days with ABRA combined with VAC dressing or Bogota beg. In our previous studies, we speculated that application of ABRA is best employed in combination with VAC therapy in septic OA.<sup>7,8</sup> We also think that application of ABRA in conjunction with intrarectal negative pressure system help the rectal effluents to be evacuated, providing the integrity of abdominal domain.

In conclusion, application of intrarectal NPS in conjunction with abdominal NPS and ABRA is safe, successful method to manage OA with colorectal fistula.

#### Conflicts of interest statement

None.

#### Funding

None.

#### Ethical approval

Patient's consent was taken.

#### Author contributions

Fahri Yetişir contributed to the study design, study analysis, writing, data collection and patient treatment and follow-up. A. Ebru Salman contributed to the writing and patient treatment and follow-up. R. Mamedov contributed to the writing and data collection. M. Aksoy and A. Yalcin contributed to the data collection. Cuneyt Kayaalp contributed to writing and editing.

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