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Open abdomen technique used in complications of major gynecological oncology surgery

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Abstract

Objective: To evaluate the open abdomen technique (laparostomy) used in complications of major gynecological oncology surgery.

Methods: We analyzed retrospectively the surgical database of all patients who had undergone major open surgery by the same gynecologic oncologist over a 5-year period. All patients who had had open abdomen procedure were identified; demographic data and indications of primary surgery, temporary abdominal closure procedure details, fascia closure and morbidity, mortality rates were evaluated. Intraabdominal infection and intraoperative massive hemorrhage were the major indications for all open abdomen cases. Mannheim Peritonitis Index was used perioperatively to determine open abdomen decision in intra-abdominal infections. Vacuum Assisted Abdominal Closure system and Bogota Bag were used for temporary abdominal closure techniques.

Results: Out of the total 560 patients who had undergone major oncological surgery, 19 patients (3.3%) had open abdomen procedure due to surgical complications. Eleven patients had intraabdominal infection, six patients had hemodynamic instability due to peri and postoperative hemorrhage, two patients had gross fecal contamination during posterior pelvic exenteration surgery. The fascia was closed totally in 15 (78%), partially in 3 (15%) and could not be closed in 1 patient who had died secondary to multiorgan failure. Total morbidity and mortality rates were 26% (5/19) (two intrabdominal abscess, one pulmonary embolism, one skin necrosis, one enteroatmospheric fistula) and 5.2% (1/19) respectively.

Conclusion: Open abdomen is a life-saving procedure when applied with correct indications and timing. Gynecological oncologic surgeries are candidates to serious complications and gynecologic oncologists dealing with such surgery should be as experienced as general surgeons in this regard.

Key words: gynecological oncology, laparostomy, open abdomen.

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Introduction

As the most gynecological oncology patients already have several surgical risk factors, they are candidates for severe surgical complications. Surgical morbidity and mortality rate are 13%–86% and 0.97%–3%, respectively during and after extensive surgery.[1,2] Open abdomen is a surgical procedure in which abdominal cavity is left open intentionally for the management of surgical complications.[3] Temporary abdominal closure (TAC) techniques are used to protect and block direct contact of the intraabdominal organs with the outside environment during open abdomen procedure. Open abdomen and TAC techniques were initially defined by Rotondo et al., during damage control surgery of trauma patients.[4] Later these proved to be life-saving procedures for mortal complications such as intrabdominal bleeding, mesenteric ischemia, intraabdominal infection, and abdominal compartment syndrome (ACS).

In literature, we found a few previous publications pointing to open abdomen applications in gynecological oncology.[5] Hence, we aimed to provide a general awareness to gynecologic oncologists by presenting our open abdomen cases and its applications in complication management in detail.

Methods

The medical records of patients who had undergone gynecological oncology surgery between January 2013 and January 2018 at Istanbul Kanuni Sultan Suleyman Education and Research Hospital were reviewed. Institutional review board approval (48670771-514.10) has been obtained for this study.

All patients having had open abdomen procedure were identified. The demographic data of the patients, tumor types and stages, primary operation details, indications for open abdomen, type of TAC equipment, number of TAC, total or partial fascia closure rates, morbidity, and mortality rates were evaluated. Decision of open abdomen was either taken perioperatively during the primary surgery or during relaparotomy.

Open abdomen procedures were performed in patients who had postoperative peritonitis, mesenteric ischemia and also deteriorated vital signs accompanied with intraoperative massive bleeding.

The diagnosis of intraabdominal infection was based primarily on clinical (abdominal rigidity, ileus, and abdominal distension), laboratory (abnormal value of white blood cell (WBC), C-reactive protein (CRP), and Procalcitonin) and radiological (pathological images suggested the presence of peritonitis in oral and/or iv contrast Computerized tomography (CT)) findings. We performed relaparotomy to the patients who had diagnosis or high suspicion of postoperative peritonitis, usually within 24 h. During the relaparotomy, Mannheim Peritonitis index (MPI) scoring system was used for objective criteria in performing open abdomen in postoperative infections. Patient's age, sex, presence of malignancy, organ failure, preoperative duration of peritonitis, origin of sepsis, type of peritonitis, and type of exudate were evaluated and scored according to MPI index score perioperatively and open abdomen procedures were applied for the cases totaling higher than 21 MPI score (Table 1).[6]

VAC and Bogota Bag were used for the temporary closure of the abdominal wall in our patients. VAC is preferred in the presence of intraabdominal infection to facilitate clearance of infection by using negative pressure, Bogota Bag is preferred in the presence of intraabdominal bleeding and in the presence of intestinal anastomosis which is passive TAC method without negative pressure. Sterile serum bag is used to

TABLE 1 Mannheim peritonitis index scoring system[6]

Risk factor	Weighting if present
Age > 50	5
Female sex	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Fecal	12
Definition of organ failure	
Kidney	Creatinine level >177 μmol/L Urea level >167 mmol/L Oliguria <20 mL/h
Lung	PO_2 <50 mmHg PCO_2 >50 mmHg
Shock	Hypodynamic or hyperdynamic
Intestinal obstruction	Paralysis >24 h or complete mechanical obstruction

FIGURE 1 Temporary abdominal closure with Bogota Bag application

cover the abdominal cavity and is sutured to the incision temporarily (Figure 1). As an advantage, Bogota Bag is a cheap technique, however, should not be preferred in the presence of intraabdominal infections as it does not have any clearance function. VAC can be used following Bogota Bag when the intraabdominal bleeding is under control for the clearance or prevention of abdominal infection. If packing process was necessary, abdominal compresses were wrapped with sterile drapes (Figure 2). TAC implementations were reapplied within 1 to 2 days intervals and during these process, abdominal cavities were irrigated with 3000 cc warm saline under general anesthesia through the previous incisions till closure. Areas of anastomosis, sutures, abscess locations, and bleeding sites were reevaluated to decide whether to close the abdomen or not. Closure decisions were taken as early as possible depending on infection source control and clearance of the abdomen. At each VAC application, approximation sutures were placed at the caudal and cranial ends of the incision as a part of dynamic abdominal fascia closure process. If total closure failed, a partial closure was applied and if partial closure failed, only skin was closed. Peritoneal fluid was sent for bacterial culture and antibiogram at each VAC procedure on a routine basis. In cases with

FIGURE 2 Packing application and channeling urine out of the pelvis

FIGURE 3 Mobilization of open abdomen patient with corset after VAC application

intraabdominal infections, the VAC pressure was set at 125 mmHg and in cases with anastomosis or bleeding we made sure that maximum negative pressure did not exceed 50 mmHg. Continuous negative pressure was preferred rather than intermittent negative

TABLE 2 Demographic data of patients

Patient no	Age	Comorbidity	BMI	Diagnosis	Stage	Preoperative chemo/ radiotherapy	Primary operation details
1	90	0	32	Ovarian Ca	3c	0	Primary CS
2	52	COPD	27,3	Ovarian Ca	3c	0	Primary CS
3	48	0	27	Ovarian Ca	1c	0	Primary CS
4	58	DM, HTN	26	Endometrial Ca/rectal Ca	1b/4a	Chemoradiotherapy	Posterior pelvic exenteration with end colostomy
5	60	DM, HTN	31	Ovarian Ca	3c	0	Primary CS with right hemicolectomy, ileotransversostomy
6	61	DM, HTN	35	Ovarian Ca	4a	Chemotherapy	İnterval CS with total colectomy, ileoproctostomy
7	62	DM, COPD	31	Ovarian Ca	Recurrence	0	Secondary CS with right hemicolectomy, ileotransversostomy
8	55	0	30	Endometrial Ca	4a	0	Posterior pelvic exenteration with end colostomy
9	72	0	25	Ovarian Ca	1	0	Primary CS
10	52	COPD	29	Ovarian Ca	Recurrence	Chemotherapy	Tertiary CS with total colectomy, splenectomy, distal jejunum, ileum resection
11	53	COPD, arrhythmia	23	Ovarian Ca	Recurrence	0	Secondary CS with low anterior resection, end colostomy
12	73	0	32	Ovarian Ca	Recurrence	Chemotherapy	Secondary CS with total colectomy, end ileostomy
13	30	0	27	Cervical Ca	4a	Chemoradiotherapy	Posterior pelvic exenteration with end colostomy
14	74	HTN	30	Ovarian Ca	3	0	Primary CS with right hemicolectomy
15	61	0	19	Cervical Ca	Recurrence	Chemoradiotherapy	Supralevator total pelvic exentration, end colostomi, uretherocutaneous anastomosis
16	50	0	22	Endometrial stromal sarcoma	4a	Chemotherapy	Supralevator total pelvic exentration, end colostomi+uretherocutaneous anastomosis, right internal iliac artery/vein resection
17	59	DM, HTN	29	Cervical Ca	Recurrence	Chemoradiotherapy	Infralevator total pelvic exentration, end colostomy, uretherocutaneous anastomosis
18	55	0	21	Cervical Ca	Recurrence	Chemoradiotherapy	Supralevator total pelvic exentration, end colostomi, uretherocutaneous anastomosis
19	60	DM, HTN	31	Endometrial Ca	Recurrence	Chemoradiotherapy	Secondary CS with low anterior resection, end colostomy

Abbreviations: CS, cytoreductive surgery; COPD, chronic obstructive pulmonary diseases; DM, diabetes mellitus; HTN, hypertension.

TABLE 3 Details of the open abdomen procedures

Patient number	Laparostomy day	Indication/(etiology)	Procedure details	Bogata bag	MPI	VAC (N)	VAC P (mmHg)	Fascia closure day	Fascia closure type	Complications
1	10	PP	AL	N	27	2	125	7	Total	N
2	8	PP	AL	N	22	2	125	7	Partial	Skin necrosis
3	12	PP	AL	N	33	4	125	12	Total	Intraabdominal abscess
4	Perioperative	Perioperative fecal contamination	AL	N		2	125	6	Total	N
5	7	PP/(Anastomotic leakage)	AL, ileostomy and mucous fistula	N	37	3	125	7	Partial	N
6	6	PP/(Anastomotic leakage)	AL, primary anastomosis repairing	N	37	8	50	25	Partial	Enteroatmospheric fistula
7	7	PP/(Ileum injury)	AL, ileum rxn and anastomosis	N	37	3	50	10	Total	N
8	10	PP	AL	N	37	4	125	Not closed	Not closed	Multiorgan failure (died)
9	30	PP	AL	N	34	3	125	9	Total	N
10	Perioperative	Perioperative mesenteric ischemia	Damage control, delayed anastomosis, AL	N		2	50	5	Total	Pulmonary embolism
11	Perioperative	Perioperative bleeding	Damage control packing, AL	1		1	50	3	Total	N
12	1	Postoperative bleeding, and mesenteric ischemia	Damage control, packing, AL	1		1	50	3	Total	N
13	Perioperative	Perioperative gross fecal contamination	AL	N		2	125	5	Total	N
14	Perioperative	Perioperative hypotension and mesenteric ischemia	Damage control, delayed anastomosis, AL	N		1	50	3	Total	N
15	6	PP	AL	N	27	3	125	10	Total	Intraabdominal abscess
16	Perioperative	Perioperative massive hemorrhage	Damage control, packing, AL	1		2	50	7	Total	N
17	7	PP	AL	N	27	1	125	3	Total	N

(*Continues*)

TABLE 3 Continued

Patient number	Laparostomy day	Indication/(etiology)	Procedure details	Bogata bag	MPI	VAC (N)	VAC P (mmHg)	Fascia closure day	Fascia closure type	Complications
18	Perioperative	Perioperative massive hemorrhage	Damage control, packing, AL	1				1	Total	N
19	8	PP	AL	N	33	1	125	3	Total	N

Abbreviations: AL, abdominal lavage; MPI, Mannheim Peritonitis Index; PP, postoperative peritonitis; VAC, vacuum-assisted abdominal closure.

pressure. With the usage of a corset, mobilization was achieved during the VAC usage period (Figure 3). Also, abdominal corsets were subscribed for 4–6 months following abdominal closure.

Simple descriptive statistical analyses were used. Descriptive statistics were used to calculate the frequency, central tendency (mean, median), and dispersion (range, variance, maximum and minimum) for each variable where appropriate.

Results

Of the 560 midline laparotomy cases, 19 patients (3.3%) had open abdomen procedures. Eleven patients had ovarian (4 recurrent), 4 patients had cervical (3 recurrent), 3 patients had endometrial cancer (1 recurrent), and 1 patient had double primary (endometrial and rectal cancer) tumor (Table 2). Open abdomen decisions of seven cases were made perioperatively and the rest of the cases were decided postoperatively in emergency conditions.

The mean age of these patients was 59 years (range 30–90 years). VAC procedure was used in 15 patients; Bogota Bag was used in 1 patient and in 3 patients both procedures were applied consecutively. The mean fascia closure time was 7 days. The fascia was totally closed in 15 (78%), partially in 3 (%15) and fascia was left open in 1 (5.2%) patient (as the patient died) (Table 3).

In our series, postoperative peritonitis and intraoperative massive hemorrhage were the most common indications for open abdomen. Eleven patients were diagnosed with intraabdominal infection with a mean 31.9 MPI score (range 22–37). For seven of these patients, MPI scores were above 30 (mean 35.4). Three of the 11 patients were presented with liquid leakage between the skin sutures as a sign of eventration which is secondary to the intra-abdominal infection. The remaining eight cases were presented with the sign of ileus and/or abdominal rigidity. Patients presented with eventration underwent relaparotomy on postoperative 8–10 days (patients 1, 2, and 8). VAC with 125 mmHg negative pressure was applied 2 to 4 times. Fascia was closed totally in patient 1, partially closed in patient 2 who had skin necrosis as a complication. Skin necrosis was treated with debridement and secondary wound healing. Patient 8 had multiorgan failure and died without fascial closure within 30 days of open abdomen procedure (Table 3).

Eight cases were presented with ileus, abdominal rigidity, and fever underwent relaparotomy at postoperative 6–30th days. During the evaluation of the abdominal cavities, anastomotic leakage was observed in two patients and ileum injury in one patient. We were unable to find the source of infection for the remainder of the patients. We performed an ileostomy in one of the patients with anastomotic leakage and the fascia was partially closed after applying the VAC procedure three times. The other patient underwent reanastomosis and eight VAC procedures, and the fascia was partially closed. Unfortunately, this patient developed an enteroatmospheric fistula on the 29th day. And it was again treated with the VAC procedure and total parenteral nutrition and finally the fistula tract was closed after 3 months. We performed partial resection of the ileum with delayed intestinal anastomosis and three VAC procedures in the patient with ileum injury, and the fascia was closed completely without complications. All the other patients in this group had VAC applications 1–4 times and all fascias were closed totally. Intraabdominal abscess was observed in two patients following abdominal closure and both were treated by percutaneous drainage. Total mortality rate was 9% (1 patient died from 11 patients) in postoperative peritonitis group.

Six cases having had unstable hemodynamic vital signs or mesenteric ischemia due to the long-lasting major surgery with per or postoperative hemorrhages were decided to be performed open abdomen for damage control and packing (Table 3). VAC procedure was applied in 2 patients, Bogota bag was applied in 1 patient, and Bogota Bag followed with VAC procedure were applied consequently in 3 patients. Fascias were closed totally on first or by third day in all patients. Only one patient subsequently developed a pulmonary embolism and recovered as a result of medical treatment.

We performed open abdomen to the two more patients having gross fecal contamination during posterior pelvic exenteration surgery to clear the abdomen and to reduce the risk of possible surgical infection before reconstructive surgery. VAC was applied two times with 125 mmHg pressure and fascia was closed totally without complication on fifth and sixth day of operation.

Discussion

Postoperative peritonitis and massive hemorrhage might be seen in all major gynecological oncologic surgery cases with serious outcomes. Open abdomen is a life-saving strategy when applied with correct indications and timing in the management of these complications. Bogota bag, mesh, and patch closure techniques are the option for nonnegative TAC. VAC is a negative pressure dressing system which includes a sponge dressing covered with a protective, nonadherent layer, a tube, box, and a computerized pressure pump draining abdominal fluid and debris (Figure 4).

FIGURE 4 Temporary abdominal closure with VAC application

Three main indications suggested by Demetriades who is the one of the masters in open abdomen management, are: (i) damage control for life-threatening intrabdominal bleeding, (ii) treatment and prevention of ACS, and (iii) management of severe intra-abdominal infections.[7]

Damage control surgery should be planned for unstable patients before development of death triad (severe acidosis, hypothermia, and coagulopathy). In our study, we decided to perform open abdomen for damage control on six patients. TAC procedures give surgeons valuable time frame for a second look, to see if there is any ischemic damage developing in the intestines or not, by delaying the bowel anastomosis to a later session (delayed anastomosis technique).[8] We performed delayed anastomosis in two patients with preoperative mesenteric ischemia without performing ileostomy and colostomy. There is no mortality in these damage control patients.

Intrabdominal pressure exceeding 25 mmHg may cause potentially lethal ACS, which is characterized by renal, cardiorespiratory failure, and bacterial intestinal translocations.[9] The patients having risk of intra-abdominal hypertension after fascia closure are candidates for open abdomen. Apart from the chosen TAC method, the right timing also plays an important role in reducing mortality. As seen in our study, we did not have any patient with ACS which is one of the best indicators of our good timing.

Complicated intraabdominal infections, the third main indication of Demetriades, are one of the most important causes of mortality, especially if they are poorly managed.[10] Particularly intraabdominal sepsis after abdominal surgery is associated with a more higher mortality rate of 50%–80%.[11,12] Management of intraabdominal infections by means of open abdomen is a controversial issue. Temporary closure of open abdomen by using the passive dressing does not provide sufficient traction to the fascia edges which result in laterally retraction of the fascia and low fascia closure rate resulting in serious morbidity.[13,14] Therefore, negative pressure wound therapy with continuous fascial traction is suggested as the preferred technique for temporary abdominal closure in septic patients.[15] Also, VAC technique is superior to the Bogota Bag due to active drainage of exudates and also giving the chance of early mobilization of patients by means of coursed worn with VAC device. From that point, it should be clear that intubation of the patient during the time period between two VAC applications is not necessary.

We used strict MPI scoring system for objective criteria in performing open abdomen in intra-abdominal infections. According to the validated study of the MPI, there was no mortality below an index score of 20 and mortality was 29% between 21 and 29 and increased up to 100% in MPI equal to index 30 or greater.[16,17] Gynecological oncology patients already have a 14 point basal risk score, as all patients were female (5 point), having malignancy (4 point), and usually old (being ≥50 years old, 5 point). A single accompanying parameter like organ failure, generalize peritonitis, or purulent exudate is enough to reach 21 MPI (Table 1). We performed open abdomen with VAC applications to 11 patients with 21 or higher MPI score due to intraabdominal infection. Seven of these patients had MPI scores higher than 30 (mean 35.4). One patient died out of the seven which is very low in comparison to the literature (14% vs. 100%). As a result, If the MPI score is over 20, we recommend VAC, and above 30, we strongly recommend it.

Recent meta-analysis concluded that early fascia closure before 1 week has great clinical advantages in reducing the mortality and incidence of complications as compared with delayed abdominal closure.[18] By using the VAC technique, the fascia closure rates have been reported to be as high as 70% and the mortality rate as low as 22% in septic cases.[19] In our study, by using the VAC and dynamic fascia closure, the total closure rate was 6/6 (100%) for the nonseptic patients and 8/11 (72%) for the septic patient group.

We found only one similar study presented by Kaushik et al. They reported 14 open abdomen cases from 1592 gynecological oncology patients (0.88% incidence) and used VAC in one case, Bogota Bag in others.[5] In this study, the mortality rate was 14.3% (two patients) within 30 days of open abdomen procedure. We present 19 cases with open abdomen from 560 patients (3.3% incidence). We used VAC in all of them except one case (with Bogota Bag or not) the total mortality being 5.2%. We consider that this low mortality rate results from performing open abdomen with right indication, correct timing, preferring VAC as a TAC application and early mobilization with VAC.

Enteroatmospheric fistula, which is the most serious TAC complication, is reported at a rate of 1.5%–75% and the mortality rate is within 36%–75%.[20,21] Number of TAC sessions exceeding 4–5 has been reported as a risk factor for enteroatmospheric fistula in the literature.[7] In our series, only one patient who had eight VAC applications had enteroatmospheric fistula (5.2%). We treated it with VAC application combined with a surgical intervention without morbidity.

All open abdomen decisions and each step of TAC procedures were performed by the same surgical core team, in the same referral center. These are factors which increase the validity of the results and are the strength of this study. On the other hand, its retrospective nature is our limitation.

In conclusion, open abdomen procedure reduces mortality and morbidity rates not only in trauma patients but also in critically ill, such as oncologic patients when complications are encountered, or high risks are present. It is fundamental that the gynecologic oncologists to be aware of the details and benefits of the methods mentioned here within to lead the management of these complications. Open abdomen applications deserve to receive the merit for being life-saving interventions available to gynecological oncology patients.

Author contributions

Study conception and design: Ozgur Akbayir, Suat C. Ulukent. Acquisition of data: Niyazi A. Seyhan, Basak Cingillioglu, Osman S. Gunkaya, Ilkbal T. Yuksel. Formal analysis and investigation: Niyazi A. Seyhan, Basak Cingillioglu, Osman S. Gunkaya, Ilkbal T. Yuksel. Writing-original draft preparation: Ozgur Akbayir, Hakan Guraslan, Ilkbal T. Yuksel, Osman S. Gunkaya. Writing-review and editing: Ozgur Akbayir, Suat C. Ulukent, Hakan Guraslan.

Conflict of interest

The authors declare no potential conflict of interests for this work.

Data availability statement

Data available on request due to privacy/ethical restrictions.

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