Risk factors for evisceration in gynecological oncology surgeries

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Background/aim: To investigate the risk factors for evisceration in a gynecological oncology population. The secondary aim was to evaluate the impact of evisceration on survival.

Materials and methods: Inclusion criteria consisted of having had an elective surgery performed through a xiphoidopubic incision in our institution and having a gynecological malignancy based on pathology. A total of 198 patients were evaluated, 54 with evisceration and 144 without evisceration. Due to the widely varied prognosis of female genital cancers, the survival was analyzed on a homogenized group, including only 62 patients with primary advanced stage epithelial ovarian-tubal-peritoneal cancer.

Results: The preoperative factors associated with evisceration in the univariate analysis were old age, high body mass index (BMI), hypertension, smoking, comorbidities, high American Society of Anesthesiologist (ASA) score (3 and 4), and low preoperative albumin level. The associated intraoperative factors were bleeding volume, receiving more than two units of erythrocyte suspension or fresh frozen plasma, and having had a major operation. The associated postoperative factors were the albumin transfusion and the antibiotic use in the early postoperative period. In the multivariate analysis, smoking, low levels of preoperative albumin, high BMIs, and high ASA scores (3 and 4) were independent prognostic factors for evisceration. Evisceration was not associated with recurrence and survival in the patients with primary advanced stage epithelial ovarian-tubal-peritoneal cancer.

Conclusion: Smoking, preoperative hypoalbuminemia, obesity, and high ASA scores (3 and 4) were the prognostic factors for evisceration. Short-term modifiable factors such as smoking cessation and improved nutritional status should be considered in elective gynecological oncology surgeries. Evisceration had no impact on survival and recurrence in the patients with primary advanced stage epithelial ovarian-tubal-peritoneal cancer.

Key words: Evisceration, hypoalbuminemia, obesity, smoking, survival, wound dehiscence

1. Introduction
Laparotomy continues to be a vital procedure for emergency and elective surgeries despite the trend toward an increase in minimally invasive techniques to avoid the surgical site complications. Although laparotomy techniques have been improving, abdominal wound dehiscence is still a common postoperative surgical site complication with an incidence of up to 3.5% [1,2]. Furthermore, evisceration can cause serious morbidities in up to 45% of the cases [1,3–5].

Wound healing is a complicated process affected by several factors, such as patient characteristics, comorbidities, closure techniques, and materials [1,2,5]. The primary purpose of this study was to investigate the risk factors for evisceration in the patients undergoing gynecological oncology surgeries. The secondary aim was to evaluate the impact of evisceration on the survival of the patients with primary advanced stage epithelial ovarian-tubal-peritoneal cancer.

2. Materials and methods
2.1. Study design and patient selection
We reviewed the electronic data and files of the patients who underwent elective primary or recurrent surgeries due to the malignant gynecological diseases between January 1, 2005 and May 1, 2017, in the gynecological oncology clinic of our hospital. The institutional review board approved the study protocol (04.2017/07). Wound dehiscence was considered evisceration, which was defined as the loss of the integrity of the fascial closure in the abdominal area and did not include those with cutaneous separation. A total of 84 patients had evisceration. Those with incomplete...
data (n = 5), those with initial surgery performed in another center (n = 2), those with an incision that was not xiphoidopubic (n = 14), those without a gynecological malignancy in the final pathology report (n = 4), and those who underwent an emergency operation because of the surgical complications such as ileus, anastomotic leakage, and abscess (n = 5) were excluded. The study included those who had an elective surgery performed by vertical incision from the xiphoid process to the pubic bone in our institution and who had a gynecological malignancy such as cervical, endometrial, tubal, ovarian, or peritoneal carcinoma based on pathology. The final study group was formed with 54 patients with evisceration and 144 patients without evisceration who were operated on in the same period and had similar characteristics.

2.2. Data collection
The data related to the demographics, medical history, blood laboratory values, and the pre-, intra-, and postoperative clinical features were reviewed. The patients who smoked until the day before the operation were considered smokers. Chronic diseases (diabetes mellitus, hypertension, asthma, or other chronic diseases), smoking, and obesity (body mass index > 30 kg/m²) were defined as comorbidities. Complete blood counts and biochemical analyses were obtained in the last 7 days before the operation and on the day after the operation. The laboratory parameters were presented as median values along with the reference levels used by our laboratory. American Society of Anesthesiologist (ASA) scores were evaluated by the anesthesiologists. For antibiotic prophylaxis, cefazolin was given to all patients 60 min before the incision. The additional doses of antibiotics were administered when the operation time exceeded 2 h or when there was an excessive blood loss during the surgery (> 1500 mL).

The type of the operation was categorized as follows: 'simple' for total abdominal hysterectomy with or without bilateral salpingo-oophorectomy; 'complex' for the surgeries with additional lymphadenectomy, appendectomy, or omental resection; and 'major' for the surgeries with the addition of any type of gastrointestinal resection, splenectomy, peritoneectomy, diaphragm stripping, partial pancreatectomy, or liver resection. An antibiotic therapy in the first 24 h after the operation was defined as the initiation of antibiotic therapy in the early postoperative period. In the postoperative period, routine antibiotic administration is not used for the patients who undergo surgery in our clinic, except for intraoperative surgical prophylaxis. However, antibiotics can be administered in the early postoperative period (within the first 24 h after the operation), depending on the patient's symptoms, infection markers, surgical procedure (gastrointestinal resection, anastomosis), and surgeon's decision.

In all patients, abdominal fascial closures were performed by experienced gynecological oncology specialists. Synthetic nonabsorbable monofilament sutures were used for all fascial closures. The incisions were closed with continuous suture technique, placed at 2 cm lateral to the fascial edge with 1.5 cm bites.

2.3. Statistical analysis
Data were analyzed using SPSS version 20.0 for Windows (SPSS Inc., Chicago, United States). Categorical variables were compared using Pearson's chi-square or Fisher's exact test as appropriate. The factors with a possible effect on evisceration were evaluated using logistic regression analysis. Variables with a P-value < 0.25 in the univariate analysis were used to develop a multivariate model for predicting the relationship between significant factors and evisceration. Variables that were correlated by more than 50% were excluded in a multivariate analysis using a Cox proportional hazards model. Hazard ratios (HR) and 95% confidence interval (CI) were also calculated for each independent variable.

2.4. Survival analysis
The time from the surgery to the recurrence or the last follow-up visit was defined as the disease-free survival (DFS). The time from the surgery to death, which resulted from the disease or the last follow-up visit, was defined as the disease-specific survival (DSS). The time from the surgery to death because of the disease, surgery, surgical complications, or the last follow-up visit was defined as overall survival (OS). Survival analysis was performed using the Kaplan–Meier method. Survival curves were compared using the log-rank test. In the survival analysis, the patients who had cancers other than ovary-tubal-peritoneal cancer, had early-stage (1 and 2) ovary-tubal-peritoneal cancer, received neoadjuvant therapy, or did not receive adjuvant chemotherapy, were excluded. Due to the widely varied prognosis of female genital cancers, the survival analysis group was homogenized to evaluate the effect of evisceration on the survival analysis more accurately. Therefore, the survival analysis was performed for the patients only with primary advanced stage (3 and 4) epithelial ovarian-tubal-peritoneal cancer. The level of statistical significance was set at P < 0.05.

3. Results
The median age of the entire cohort was 55.1 years (range: 27–78). The histopathological origins of the tumors were in the ovaries, fallopian tube, or peritoneum in 114 (57.6%) patients, uterus in 75 (37.9%) patients, and cervix in 9 (4.5%) patients. Twenty-six (13%) patients underwent surgery due to the recurrence of gynecological malignancies. Comorbidly was present in 154 (77.8%) patients. Twenty-four (12%) patients were smokers. Eighty-four (42.4%) patients had a history of previous
abdominal surgery. The median time from the most recent operation to the current operation was 90.7 months (range: 1–600 months). The most recent operation was within the previous 6 months for 30 out of 84 (35.8%) patients. Thirty-six (18.2%) patients had a history of chemotherapy or radiotherapy. The ASA score was 3 and 4 in 85 (43%) patients. The current operation was due to recurrent disease in 26 (13%) patients. The median operation time was 317.6 min (range: 105–660 min). Forty-one (20.7%) patients had ascites. The operation type was simple or complex in 100 (50.5%) patients and major in 98 (49.5%) patients. Antibiotic treatment was given to 68 (34.3%) patients in the early postoperative period. The incidence of evisceration was 3.2% of the 2106 patients who underwent laparotomy with vertical midline incision during the period covered by this study. Preoperative, intraoperative, and postoperative findings are shown in Tables 1–4.

### 3.1. Preoperative factors
The median time from the current operation to the emergence of evisceration was 11 days (range: 1–44 days). The evisceration was associated with the following preoperative factors: old age, high body mass index (BMI), hypertension, smoking, any comorbidity, high ASA scores (ASA 3 and 4), and low preoperative albumin level. The odds ratios (OR) for evisceration were 1.98 (CI: 1.048–3.737; P = 0.034) for older age, 2.19 (CI: 1.149–4.158; P = 0.016) for high BMI, 2.74 (CI: 1.439–5.197; P = 0.002) for hypertension, 3.83 (CI: 1.597–9.205; P = 0.002) for smoking, 2.87 (CI: 1.136–7.240; P = 0.021) for the presence of any comorbidity, 3.1 (CI: 1.619–5.934; P < 0.0001) for high ASA scores, and 7.32 (CI: 2.223–24.094; P < 0.0001) for the presence of low albumin level at the preoperative period (Table 2).

### 3.2. Intraoperative factors
The intraoperative parameters related to the evisceration were bleeding volume, receiving more than two units of erythrocyte suspension (ES) or fresh frozen plasma (FFP), and having had a major surgery (Table 3). The evisceration rate was 20.2% in the patients with intraoperative bleeding <750 mL while 34.3% in those with >750 mL bleeding volume (OR: 2.07, CI: 1.087–3.928; P = 0.025). The evisceration was not related to receiving ES during the operation. However, receiving more than two units of ES or FFP was related to an OR of 4.6 (CI: 1.738–12.178; P = 0.001) or 3.84 (CI: 1.138–12.987; P = 0.025) for evisceration, respectively. The evisceration rate was 20% for the patients with a simple or complex surgery compared to 34.7% for those with a major surgery (OR: 2.13, CI: 1.117–4.041; P = 0.020). Moreover, gastrointestinal system resection, colon resection alone, splenectomy, appendectomy, and diaphragm stripping were significantly associated with evisceration (Table 3).

### 3.3. Postoperative factors
In the univariate analysis, albumin transfusion and antibiotic usage in the early postoperative period were associated with a higher rate of evisceration (Table 4). The rate of evisceration was 44.4% in the patients who received postoperative albumin transfusion and 19.3% in those who did not (OR: 3.35, CI: 1.741–6.461; P < 0.0001). Antibiotic usage in the early postoperative period was also associated with evisceration (OR: 4.36; CI: 2.253–8.451; P < 0.0001). In the Cox proportional hazards model, smoking, a low level of preoperative albumin, high BMI, and high ASA scores (3 and 4) were independent prognostic factors for evisceration (Table 5).

### 3.4. Evisceration and survival
The survival was analyzed for 62 patients with primary advanced stage (3 and 4) epithelial ovarian-tubal-peritoneal cancer. Evisceration occurred in 24 patients. The median follow-up time was 21 months (range: 1–108 months). Twenty-four (38.7%) patients had recurrence; 20 (32.3%) patients died. Two- and five-year survival rates were 55% and 25% for DFS, 95% and 62% for DSS, and 85% and 55% for OS, respectively.

The mean time from surgery to adjuvant chemotherapy was 28.6 ± 14.1 days (range: 10–65 days) for the patients with evisceration and 17.4 ± 5.7 days (range: 9–34 days) for those without (P < 0.0001). However, evisceration was not associated with recurrence and survival. The DFS was related to the stage of cancer only. The DSS was related to the type of tumor, the stage of cancer, and the recurrence time. The OS was related to the recurrence time alone (Table 6).

### 4. Discussion
The major finding of our study was that smoking, preoperative hypoalbuminemia, obesity, and high ASA scores were the independent prognostic factors associated with evisceration. Although the presence of evisceration caused a delay in initiation of the chemotherapy, it had no impact on survival. This is one of the few studies to evaluate risk factors for evisceration, as well as any association between evisceration and survival, in gynecologic-oncologic patients.

Wound healing is a complex phenomenon that includes cellular, inflammatory, and proliferative processes [6]. A defect in this healing cascade may cause abdominal wound dehiscence. Various intrinsic and extrinsic factors can have an impact on dehiscence. However, these factors are still not clear. Studies have reported a diverse set of risk factors for wound dehiscence, including old age [3,4,7], male sex [3,7], emergency surgery [3,4,8], malignancy [4,6], wound infection [6,8], hypoproteinemia [3,4,6–9], obesity [4,7], intraabdominal sepsis [4], hemodynamic instability [4], ascites [4], anemia [7], long operation time [8], and high ASA scores [8].
The toxins in tobacco can delay and interrupt the wound healing process [10–12]. The underlying mechanisms are related to tissue hypoxia and reduced tissue perfusion since these toxins decrease the immune function and induce vasoconstriction, thrombogenesis, atherosclerosis, and a reduction in the oxygen-carrying capacity of the blood [12]. Therefore, the rate of the composite of wound-related complications including both wound dehiscence and surgical site infection is higher in smokers [10,11]. Goltsman et al. found that smoking was an independent risk factor for wound dehiscence.

Nutrition has a vital role in tissue repair due to the anabolic nature of healing [13]. Proteins are among the essential elements in nutrition as well as in wound healing [13]. Hypoalbuminemia is a significant indicator

**Table 1. Features of the entire cohort.**

| Parameters                                      | n    | Median (range)     |
|-------------------------------------------------|------|--------------------|
| **Preoperative parameters**                     |      |                    |
| Body mass index (kg/m²)                         | 198  | 30.7 (18.3–51.1)   |
| The time from main operation to the next operation but one | 84   | 24 (1–600)         |
| Preoperative given erythrocyte suspension (unit) | 8    | 2 (1–3)            |
| Preoperative given fresh frozen plasma (unit)    | 1    | 2                  |
| The time when the erythrocyte suspension was performed preoperatively (day) | 8    | 1 (1–3)            |
| Hemoglobin level (g/dL)                         | 198  | 12.4 (8.2–16.8)    |
| Leukocyte count (/µL)                           | 198  | 7575 (1450–21.800) |
| Neutrophil count (/µL)                          | 198  | 5000 (960–19.910)  |
| Platelet count (10³/mm³)                        | 198  | 309.5 (34–951)     |
| Albumin level (g/dL)                            | 118  | 4.2 (2.2–5.3)      |
| Glucose level (mg/dL)                           | 198  | 99.5 (69–274)      |
| **Intraoperative parameters**                   |      |                    |
| The duration of operation (minute)              | 198  | 300 (105–660)      |
| Ascites volume (mL)                             | 41   | 2500 (200–10.500)  |
| Bleeding volume (mL)                            | 198  | 750 (100–5000)     |
| Given colloid fluid quantity (mL)               | 198  | 5500 (1500–14.700) |
| Given crystalloid fluid quantity (mL)           | 198  | 4500 (1000–12.000) |
| Given colloid fluid quantity (mL)               | 193  | 1000 (500–3300)    |
| Intraoperative given erythrocyte suspension (unit) | 88  | 2 (1–6)            |
| Intraoperative given fresh frozen plasma (unit)  | 63   | 2 (1–4)            |
| **Postoperative parameters**                    |      |                    |
| Postoperative given erythrocyte suspension (unit) | 61  | 2 (1–3)            |
| Postoperative given fresh plasma (unit)         | 12   | 2 (1–2)            |
| The time when the erythrocyte suspension was performed postoperatively (day) | 61  | 3 (1–30)           |
| Hemoglobin level (postoperative 1st day) (g/dL)  | 198  | 10.65 (7–15.8)     |
| Leukocyte count (postoperative 1st day) (/µL)    | 198  | 12600 (1330–33500) |
| Neutrophil count (postoperative 1st day) (/µL)   | 198  | 10445 (1130–28000) |
| Platelet count (postoperative 1st day) (10³/mm³) | 198  | 266.5 (51–721)     |
| Albumin (postoperative 1st day) (g/dL)           | 59   | 2.4 (1.2–3.2)      |
### Table 2. Relation between preoperative parameters and evisceration in the entire cohort.

| Parameters                              | Evisceration | OR         | 95% CI       | P-value |
|-----------------------------------------|--------------|------------|--------------|---------|
|                                         | Present | Absent | OR  | 95% CI |          |         |       |
| Age (year)                              | n     | %     | n     | %     | 1 (ref) | 1.048–3.737 | 0.034 |
| ≤56                                     | 22    | 21    | 83    | 79    |          |          |       |
| >56                                     | 32    | 34.4  | 61    | 65.6  | 1.979   |          |       |
| Body mass index (kg/m²)                 | n     | %     | n     | %     | 1 (ref) | 1.149–4.158 | 0.016 |
| ≤30.7                                   | 20    | 19.8  | 81    | 80.2  |          |          |       |
| >30.7                                   | 34    | 35.1  | 63    | 64.9  | 2.186   |          |       |
| Diabetes mellitus                       | n     | %     | n     | %     | 0.695–3.025 | 0.320 |
| Absent                                 | 40    | 25.6  | 116   | 74.4  | 1 (ref) |          |       |
| Present                                | 14    | 33.3  | 28    | 66.7  | 1.450   |          |       |
| Hypertension                            | n     | %     | n     | %     | 1.439–5.197 | 0.002 |
| Absent                                 | 22    | 19    | 94    | 81    | 1 (ref) |          |       |
| Present                                | 32    | 34.4  | 50    | 61    | 2.735   |          |       |
| Asthma                                  | n     | %     | n     | %     | 0.287–4.623 | 0.842 |
| Absent                                 | 51    | 27.1  | 137   | 72.9  | 1 (ref) |          |       |
| Present                                | 3     | 30    | 7     | 70    | 1.151   |          |       |
| Smoking                                 | n     | %     | n     | %     | 1.597–9.205 | 0.002 |
| Absent                                 | 41    | 23.6  | 133   | 76.4  | 1 (ref) |          |       |
| Present                                | 13    | 54.2  | 11    | 45.8  | 3.834   |          |       |
| Comorbidity                             | n     | %     | n     | %     | 1.136–7.240 | 0.021 |
| Absent                                 | 6     | 13.6  | 38    | 86.4  | 1 (ref) |          |       |
| Present                                | 48    | 31.2  | 106   | 68.8  | 2.868   |          |       |
| History of the abdominal operation     | n     | %     | n     | %     | 1.482–1.716 | 0.769 |
| Absent                                 | 32    | 28.1  | 82    | 71.9  | 1 (ref) |          |       |
| Present                                | 22    | 26.2  | 62    | 73.8  | 0.909   |          |       |
| The time of the most recent previous operation | n     | %     | n     | %     | 0.311–2.181 | 0.696 |
| >24                                     | 11    | 28.2  | 28    | 71.8  | 1 (ref) |          |       |
| ≤24                                     | 11    | 24.4  | 34    | 75.6  | 0.824   |          |       |
| The time of the most recent previous operation (month) | n     | %     | n     | %     | 0.377–2.860 | 0.941 |
| >6                                      | 14    | 25.9  | 40    | 74.1  | 1 (ref) |          |       |
| ≤6                                      | 8     | 26.7  | 22    | 73.3  | 1.039   |          |       |
| Presence of surgery within preoperative 6 months | n     | %     | n     | %     | 0.401–2.319 | 0.936 |
| No                                      | 46    | 27.4  | 122   | 72.6  | 1 (ref) |          |       |
| Yes                                     | 8     | 26.7  | 22    | 73.3  | 0.964   |          |       |
| History of chemotherapy or radiotherapy | n     | %     | n     | %     | 0.378–1.986 | 0.735 |
| No                                      | 45    | 27.8  | 117   | 72.2  | 1 (ref) |          |       |
| Yes                                     | 9     | 25    | 27    | 75    | 0.867   |          |       |
| Surgery type                            | n     | %     | n     | %     | 0.213–1.674 | 0.323 |
| Primary                                 | 49    | 28.5  | 123   | 71.5  | 1 (ref) |          |       |
| Recurrent                               | 5     | 19.2  | 21    | 80.8  | 0.598   |          |       |
| ASA score                               | n     | %     | n     | %     | 1.619–5.934 | <0.0001 |
| 1 and 2                                 | 20    | 17.7  | 93    | 82.3  | 1 (ref) |          |       |
| 3 and 4                                 | 34    | 40    | 51    | 49    | 3.100   |          |       |
| History of preoperative transfusion of erythrocyte suspension | n     | %     | n     | %     | 0.377–7.090 | 0.507 |
| No                                      | 51    | 26.8  | 139   | 73.2  | 1 (ref) |          |       |
| Yes                                     | 3     | 37.5  | 5     | 62.5  | 1.635   |          |       |
| Amount of the erythrocyte suspension (unit) | n     | %     | n     | %     | NC     | NC       |       |
| ≤2                                      | 3     | 42.9  | 4     | 57.1  | 1 (ref) |          |       |
| >2                                      | 2     | 0     | 1     | 100   | NC      | NC       |       |
| Amount of the fresh frozen plasma (unit) | n     | %     | n     | %     | NC     | NC       |       |
| ≤2                                      | 1     | 100   | 0     | 0     | 1 (ref) |          |       |
| >2                                      | 0     | 0     | 0     | 0     | NC      | NC       |       |
| Hemoglobin level (g/dL)                  | n     | %     | n     | %     | 0.705–2.477 | 0.384 |
| >12.4                                   | 24    | 24.5  | 74    | 75.5  | 1 (ref) |          |       |
| ≤12.4                                   | 30    | 30    | 70    | 70    | 1.321   |          |       |
| Hemoglobin level (g/dL)                  | n     | %     | n     | %     | 0.769–2.701 | 0.254 |
| >12                                     | 27    | 24.1  | 85    | 75.9  | 1 (ref) |          |       |
| ≤12                                     | 27    | 31.4  | 59    | 68.6  | 1.441   |          |       |
of malnutrition in the patients with gynecological cancers [14,15]. Although some studies have shown no association between wound dehiscence and hypoalbuminemia [1,16], several studies have shown hypoalbuminemia to be an independent prognostic factor for wound dehiscence [4,17–20]. Besides being a prognostic for morbidity, preoperative hypoalbuminemia is an adverse prognostic factor for survival in the patients with ovarian cancer [17,21]. Kenig et al. found no association between obesity (>30 kg/m²) and wound dehiscence [1]. Walming et al. and Nugent et al. determined that increasing BMI was associated with higher rates of evisceration [2,18]. Nugent et al. found that obesity, hypoalbuminemia, prior surgery, and pulmonary disease were major risk factors on a nomogram for wound dehiscence in a gynecological oncologic cohort [18]. The present study showed that preoperative hypoalbuminemia was a negative prognostic factor for evisceration. However, no association was found between hypoalbuminemia and survival in the present study. Our study supported both obesity and hypoalbuminemia as independent risk factors for evisceration.

A high ASA score reflects several risk factors, such as old age, cardiovascular diseases, pulmonary diseases, obesity, and other chronic conditions. Additionally, a high ASA score may imply hypoxia, a suppressed immune system, and malnutrition. Nugent et al. and Novetsky et al. found increased incidences of wound dehiscence for the patients with ASA scores of 3 and above [18,22]. The present study supports the relationship between high ASA scores and increased wound dehiscence.

Wound dehiscence has long-term outcomes. The rate of incisional hernia was extremely high in the patients with a history of wound dehiscence [5]. The long-term quality of life scores indicated that physical and mental health were affected negatively in the patients with wound dehiscence [5,23]. Furthermore, besides high morbidity, wound dehiscence was associated with a high mortality rate ranging from 10% to 35% [1,5,7]. In the present study, no relationship was found between evisceration and survival or recurrence, although evisceration caused a delay in the initiation of chemotherapy.

A significant limitation of the study was the retrospective design. Another possible limitation is that the data were obtained from a single center, although this might have minimized the impact of technical and physician-related factors. Other limitations were the inclusion of the recurrence patients, the diverse types of cancers (ovarian, cervix, uterine), and the patients with a history of abdominal operation or ascites, as they may impair wound healing. A major strength of the study was the exclusion of emergency operations. Additionally, the inclusion of patients with a single incision type (xiphoidopubic incision) and the large sample size that was sufficient for evaluating several parameters were among the other strengths of the study.

Table 2. (Continued).

| Parameter                  | Reference Level | 1≤7575 | 24 | 24.2 | 75 | 75.8 | 1 (ref) | 0.725–2.547 | 0.338 |
|----------------------------|-----------------|-------|----|------|----|------|---------|-------------|-------|
| Leukocyte count (/µL)      |                 |       |    |      |    |      |         |             |       |
| ≤10.000                   | 43              | 26.4  | 120 | 73.6 | 1 (ref) | 0.578–2.830 | 0.543 |
| >10.000                   | 11              | 31.4  | 24  | 68.6 | 1.279 |           |        |         |
| Neutrophil count (/µL)     |                 |       |    |      |    |      |         |             |       |
| ≤5000                     | 27              | 27.3  | 72  | 72.7 | 1 (ref) | 0.535–1.869 | 1.000 |
| >5000                     | 27              | 27.3  | 72  | 72.7 | 1.000 |           |        |         |
| Platelet count (10³/mm³)   |                 |       |    |      |    |      |         |             |       |
| ≤100.5                    | 27              | 27.3  | 72  | 72.7 | 1 (ref) | 0.535–1.869 | 1.000 |
| >100.5                    | 27              | 27.3  | 72  | 72.7 | 1.000 |           |        |         |
| Albumin level (g/dL)       |                 |       |    |      |    |      |         |             |       |
| >3.5                      | 11              | 10.7  | 92  | 89.3 | 1 (ref) | 0.669–5.521 | 0.220 |
| ≤3.5                      | 12              | 19    | 51  | 81   | 1.922 |           |        |         |
| Glucose (mg/dL)            |                 |       |    |      |    |      |         |             |       |
| ≤115                      | 26              | 26.3  | 73  | 73.7 | 1 (ref) | 0.592–2.070 | 0.750 |

1: Median value; 2: among the 84 patients with history of abdominal operation; 3: Among the entire cohort (n: 198); 4: Reference level of our institution.

OR: odds ratio, CI: confidence interval, NC: not calculated.
Table 3. Relation between intraoperative parameters and evisceration in the entire cohort.

| Parameters                                                                 | Evisceration | OR    | 95% CI     | P-value |
|----------------------------------------------------------------------------|--------------|-------|------------|---------|
|                                                                            | Present (n: 54) | Absent (n: 144) |          |         |
|                                                                            | n           | %     | n          | %       |          |         |
| The duration of the operation (minutes)                                   | ≤300        | 33    | 30.3       | 76      | 69.7     | 1 (ref) | 0.376–1.345 | 0.294 |
|                                                                            | >300        | 21    | 23.6       | 68      | 76.4     | 0.711   |          |       |
| Ascites                                                                    | No          | 38    | 24.2       | 119     | 75.8     | 1 (ref) | 0.970–4.142 | 0.058 |
|                                                                            | Yes         | 16    | 39         | 25      | 61       | 2.004   |          |       |
| The amount of the ascites (mL)                                            | ≤2500       | 11    | 44         | 14      | 56       | 1 (ref) | 0.155–2.165 | 0.414 |
|                                                                            | >2500       | 5     | 31.2       | 11      | 68.8     | 0.579   |          |       |
| Groups of the operation                                                    | Simple and Complex | 20    | 20         | 80      | 80       | 1 (ref) | 1.117–4.041 | 0.020 |
|                                                                            | Major       | 34    | 34.7       | 64      | 65.3     | 2.125   |          |       |
| Hysterectomy                                                               | Absent      | 10    | 27         | 27      | 73       | 1 (ref) | 0.454–2.269 | 0.970 |
|                                                                            | Present     | 44    | 27.3       | 117     | 72.7     | 1.015   |          |       |
| Type of hysterectomy                                                       | Type 1      | 17    | 22.1       | 60      | 77.9     | 1 (ref) | 0.825–3.390 | 0.152 |
|                                                                            | Type 2 and 3| 27    | 32.1       | 57      | 67.9     | 1.672   |          |       |
| Oophorectomy (unilateral or bilateral)                                     | Absent      | 9     | 25.7       | 26      | 74.3     | 1 (ref) | 0.479–2.532 | 0.820 |
|                                                                            | Present     | 45    | 27.6       | 118     | 72.4     | 1.102   |          |       |
| Lymphadenectomy                                                            | Absent      | 7     | 25.9       | 20      | 74.1     | 1 (ref) | 0.430–2.728 | 0.866 |
|                                                                            | Present     | 47    | 27.5       | 124     | 72.5     | 1.083   |          |       |
| Omentectomy                                                                | Absent      | 8     | 21.6       | 29      | 78.4     | 1 (ref) | 0.617–3.407 | 0.392 |
|                                                                            | Present     | 46    | 28.6       | 115     | 71.4     | 1.450   |          |       |
| Appendectomy                                                               | Absent      | 32    | 22.7       | 109     | 77.3     | 1 (ref) | 1.103–4.155 | 0.023 |
|                                                                            | Present     | 22    | 38.6       | 35      | 61.4     | 2.141   |          |       |
| Peritoneectomy                                                             | Absent      | 49    | 28.5       | 123     | 71.5     | 1 (ref) | 0.213–1.674 | 0.323 |
|                                                                            | Present     | 5     | 19.2       | 21      | 80.8     | 0.598   |          |       |
| Colon resection                                                            | Absent      | 35    | 23.2       | 116     | 76.8     | 1 (ref) | 1.123–4.504 | 0.020 |
|                                                                            | Present     | 19    | 40.4       | 28      | 59.6     | 2.249   |          |       |
| Intestinal resection                                                       | Absent      | 52    | 27.5       | 137     | 72.5     | 1 (ref) | 0.151–3.742 | 0.728 |
|                                                                            | Present     | 2     | 22.2       | 7       | 77.8     | 0.753   |          |       |
| Gastrointestinal system resection                                          | Absent      | 33    | 22.4       | 114     | 77.6     | 1 (ref) | 1.226–4.769 | 0.010 |
|                                                                            | Present     | 21    | 41.2       | 30      | 58.8     | 2.418   |          |       |
| Diaphragm stripping                                                        | Absent      | 36    | 23.7       | 116     | 76.3     | 1 (ref) | 1.028–4.173 | 0.039 |
|                                                                            | Present     | 18    | 39.1       | 28      | 60.9     | 2.071   |          |       |
| Splenectomy                                                                | Absent      | 43    | 24.9       | 130     | 75.1     | 1 (ref) | 1.003–5.623 | 0.045 |
|                                                                            | Present     | 11    | 44         | 14      | 56       | 2.375   |          |       |
| Cholecystectomy                                                            | Absent      | 51    | 28.3       | 129     | 71.7     | 1 (ref) | 0.140–1.822 | 0.289 |
|                                                                            | Present     | 3     | 16.7       | 15      | 83.3     | 0.506   |          |       |
| Hepatic resection                                                          | Absent      | 51    | 27.1       | 137     | 72.9     | 1 (ref) | 0.287–4.623 | 0.842 |
|                                                                            | Present     | 3     | 30         | 7       | 70       | 1.151   |          |       |
| Amount of the bleeding (mL)                                               | ≤750        | 20    | 20.2       | 79      | 79.8     | 1 (ref) | 1.087–3.928 | 0.025 |
|                                                                            | >750        | 34    | 34.3       | 65      | 65.7     | 2.066   |          |       |
| Amount of the total fluid applied (mL)                                     | ≤5500       | 31    | 29         | 76      | 71       | 1 (ref) | 0.441–1.558 | 0.560 |
|                                                                            | >5500       | 23    | 25.3       | 68      | 74.7     | 0.829   |          |       |
| Amount of the crystalloid fluid applied (mL)                               | ≤4500       | 35    | 28.9       | 86      | 71.1     | 1 (ref) | 0.420–1.542 | 0.513 |
|                                                                            | >4500       | 19    | 24.7       | 58      | 75.3     | 0.805   |          |       |
Table 3. (Continued).

| Parameters                                                                 | Evisceration | OR   | 95% CI       | P-value |
|----------------------------------------------------------------------------|--------------|------|--------------|---------|
|                                                                            | Present      | Absent |              |         |
| History of postoperative transfusion of erythrocyte suspension¹             | Absent       | 37   | 26.1        | 105     | 73.9 | 1 (ref) | 0.626–2.446 | 0.541 |
|                                                                            | Present      | 28   | 25.5        | 82      | 74.5 | 1 (ref) | 1.305 |
| Amount of the erythrocyte suspension (unit) ²                              | ≤2           | 16   | 10          | 46      | 82.1 | 1 (ref) | 1.738–12.178 | 0.001 |
|                                                                            | >2           | 26   | 17.9        | 39      | 62   | 70.5 | 1.228 |
| Amount of the fresh frozen plasma (unit) ³                                | ≤2           | 12   | 7.8         | 37      | 84.1 | 1 (ref) | 1.138–12987 | 0.025 |
|                                                                            | >2           | 5    | 21.7        | 18      | 78.3 | 0.486 |
| Albumin transfusion                                                       | Absent       | 26   | 19.3        | 109     | 80.7 | 1 (ref) | 1.741–6.461 | <0.0001 |
|                                                                            | Present      | 28   | 44.4        | 35      | 55.6 | 3.354 |
| Hemoglobin, postoperative 1st day (g/dL) ²                                | >10.65       | 27   | 27.3        | 72      | 72.7 | 1 (ref) | 0.535–1.869 | 1.000 |
|                                                                            | ≤10.65       | 27   | 27.3        | 72      | 72.7 | 1.000 |
| Hemoglobin, postoperative 1st day (g/dL) ³                                | >12          | 12   | 24.5        | 37      | 75.5 | 1 (ref) | 0.576–2.543 | 0.614 |
|                                                                            | ≤12          | 42   | 28.2        | 107     | 71.8 | 1.210 |
| Leukocyte count, postoperative 1st day (/µL) ²                           | ≤12.600      | 26   | 26.3        | 73      | 73.7 | 1 (ref) | 0.592–2.070 | 0.750 |
|                                                                            | >12.600      | 28   | 28.3        | 71      | 71.7 | 1.107 |
| Neutrophil count, postoperative 1st day (/µL) ³                          | ≤10.445      | 29   | 29.3        | 70      | 70.7 | 1 (ref) | 0.436–1.526 | 0.523 |
|                                                                            | >10.445      | 25   | 25.3        | 74      | 74.7 | 0.815 |
| Platelet count, postoperative 1st day (10³/mm³) ³                        | ≤266.5       | 28   | 28.3        | 71      | 71.7 | 1 (ref) | 0.483–1.689 | 0.750 |
|                                                                            | >266.5       | 26   | 26.3        | 73      | 73.7 | 0.903 |
| Albumin level, postoperative 1st day (g/dL) ²                           | >2.4         | 6    | 21.4        | 22      | 78.6 | 1 (ref) | 0.838–8.368 | 0.092 |
|                                                                            | ≤2.4         | 13   | 41.9        | 18      | 58.1 | 2.648 |
| The history of the early period antibiotic usage                          | Absent       | 22   | 16.9        | 108     | 83.1 | 1 (ref) | 2.253–8.451 | <0.0001 |
|                                                                            | Present      | 32   | 47.1        | 36      | 52.9 | 4.364 |

¹: The erythrocyte suspension performed in the period between postoperative 1st day and occurrence of evisceration, ²: median value, ³: reference value of laboratory in our institution. NC: not calculated, OR: odds ratio, CI: confidence interval.

Table 4. Relation between postoperative parameters and evisceration in the entire cohort.

| Parameters                                                                 | Evisceration | OR   | 95% CI       | P-value |
|----------------------------------------------------------------------------|--------------|------|--------------|---------|
|                                                                            | Present      | Absent |              |         |
| History of postoperative transfusion of erythrocyte suspension¹             | Absent       | 37   | 26.1        | 105     | 73.9 | 1 (ref) | 0.626–2.446 | 0.541 |
|                                                                            | Present      | 28   | 25.5        | 82      | 74.5 | 1 (ref) | 1.305 |
| Amount of the erythrocyte suspension (unit) ²                              | ≤2           | 16   | 10          | 46      | 82.1 | 1 (ref) | 1.738–12.178 | 0.001 |
|                                                                            | >2           | 26   | 17.9        | 39      | 62   | 70.5 | 1.228 |
| Amount of the fresh frozen plasma (unit) ³                                | ≤2           | 7    | 15.9        | 37      | 84.1 | 1 (ref) | 1.138–12987 | 0.025 |
|                                                                            | >2           | 8    | 42.1        | 11      | 57.9 | 3.844 |

¹: The erythrocyte suspension performed in the period between postoperative 1st day and occurrence of evisceration, ²: median value, ³: reference value of laboratory in our institution. NC: not calculated, OR: odds ratio, CI: confidence interval.
In conclusion, smoking, preoperative hypoalbuminemia, obesity, and high ASA scores were independent prognostic factors for evisceration. The minimization of these modifiable factors can decrease the risk of evisceration in elective gynecological surgeries. Furthermore, precautions such as the cessation of smoking and the rehabilitation of nutritional status should be considered, in the short term, for better outcome in these surgeries. Evisceration had no impact on survival and recurrence in the patients who underwent gynecological oncology surgeries.

**Informed consent**
All participants were informed in the format requested by the relevant authorities and/or boards. The institutional review board approved the study protocol (04.2017/07).

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### Table 5. Multivariate analysis of parameters.

| Parameters                                         | Hazard Ratio | 95% CI         | P-value |
|----------------------------------------------------|--------------|----------------|---------|
| Age (>56 vs. ≤56 years)                            | 1.838        | 0.369–9.152    | 0.458   |
| Smoking (present vs. absent)                       | 22.129       | 2.494–196.329  | 0.005   |
| Preoperative albumin level (≤3.5 g/dL vs. >3.5 g/dL) | 11.798       | 1.938–71.829   | 0.007   |
| Body mass index (≥30.7 kg/m² vs. ≤30.7 kg/m²)      | 6.062        | 1.301–28.260   | 0.022   |
| Presence of hypertension (present vs. absent)      | 2.386        | 0.553–10.301   | 0.244   |
| ASA score (3 and 4 vs. 1 and 2)                    | 5.120        | 1.184–22.142   | 0.029   |
| Presence ascites (positive vs. negative)           | 1.833        | 0.258–13.043   | 0.545   |
| Groups of the operation (major vs. simple and complex) | 3.843        | 0.866–17.056   | 0.077   |

1: Median value, 2: reference level of laboratory in our institution. ASA: American Society of Anesthesiologists, CI: confidence interval.

### Table 6. The association between factors and survival, and recurrence among the 62 patients with primary advanced stage (3 and 4) epithelial ovarian-tubal-peritoneal cancer.

| Parameters                  | n | 2-year DFS (%) | P value | 2-year CCS (%) | P-value | 2 year OS (%) | P-value |
|-----------------------------|---|----------------|---------|----------------|---------|---------------|---------|
| Age (years)                 |   |                |         |                |         |               |         |
| ≤58                         | 31| 53             | 0.995   | 92             | 0.579   | 86            | 0.192   |
| >58                         | 31| 58             |         | 75             |         | 84            |         |
| Histologic type of cancer   |   |                |         |                |         |               |         |
| Serous                      | 50| 54             | 0.960   | 96             | 0.023   | 86            | 0.145   |
| Non-serous                  | 12| 60             |         | 88             |         | 78            |         |
| Stage                       |   |                |         |                |         |               |         |
| 3                           | 49| 62             | 0.026   | 96             | 0.040   | 89            | 0.133   |
| 4                           | 13| 31             |         | 77             |         | 71            |         |
| Evisceration                |   |                |         |                |         |               |         |
| Not occurred                | 38| 59             | 0.761   | 92             | 0.986   | 87            | 0.321   |
| Occurred                    | 24| 50             |         | 91             |         | 81            |         |
| The time given chemotherapy (days) |   |                |         |                |         |               |         |
| ≤18                         | 28| 60             | 0.902   | 92             | 0.762   | 96            | 0.947   |
| >18                         | 27| 55             |         | 95             |         | 87            |         |
| The time given chemotherapy (days) |   |                |         |                |         |               |         |
| ≤30                         | 48| 58             | 0.981   | 97             | 0.941   | 94            | 0.256   |
| >30                         | 7 | 50             |         | 75             |         | 54            |         |
| Recurrence time (months)    |   |                |         |                |         |               |         |
| ≤18                         | 12| -              |         | 82             | 0.010   | 82            | 0.010   |
| >18                         | 12| -              |         | 88             |         | 88            |         |
| Recurrence time (months)    |   |                |         |                |         |               |         |
| ≤12                         | 6 | -              |         | 83             | 0.010   | 83            | 0.010   |
| >12                         | 18| -              |         | 94             |         | 94            |         |

1: Median value among the 62 patients, 2: Median value among the 55 patients. DFS: disease-free survival, OS: overall survival.
References

1. Kenig J, Richter P, Zurawska S, Lasek A, Zbierska K. Risk factors for wound dehiscence after laparotomy - clinical control trial. Polski Przegląd Chirurgiczny 2012; 84 (11): 565-573. doi: 10.2478/v10035-012-0094-0

2. Walming S, Angenete E, Block M, Bock D, Gessler B et al. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. BMC Surgery 2017; 17 (1): 19. doi: 10.1186/s12893-017-0207-0

3. Van Ramshorst GH, Nieuwenhuizen J, Hop WC, Arends P, Boom J et al. Abdominal wound dehiscence in adults: development and validation of a risk model. World Journal of Surgery 2010; 34 (1): 20-27. doi: 10.1007/s00268-009-0277-y

4. Pavlidis TE, Galatianos IN, Papaziogas BT, Lazaridis CN, Atmatzidis KS et al. Complete dehiscence of the abdominal wound and incriminating factors. The European Journal of Surgery 2001; 167 (5): 351-354. doi: 10.1080/110241501750215221

5. Van Ramshorst GH, Eker HH, Van Der Voet JA, Jeekel J, Lange JE. Long-term outcome study in patients with abdominal wound dehiscence: a comparative study on quality of life, body image, and incisional hernia. Journal of Gastrointestinal Surgery 2013; 17 (8): 1477-1484. doi: 10.1007/s11605-013-2233-2

6. Aksamija G, Mulabdic A, Rasíc I, Aksamija L. Evaluation of risk factors of surgical wound dehiscence in adults after laparotomy. Medical Archives 2016; 70 (5): 369-372. doi: 10.5455/medarh.2016.70.369-372

7. Shanmugam VK, Fernandez SJ, Evans KK, McNish S, Banerjee AN et al. Postoperative wound dehiscence: Predictors and associations. Wound Repair and Regeneration 2015; 23 (2): 184-190. doi: 10.1111/wrr.12268

8. Webster C, Neumayer L, Smout R, Horn S, Daley J et al. Prognostic models of abdominal wound dehiscence after laparotomy. The Journal of Surgical Research 2003; 109 (2): 130-137. doi: 10.1016/s0022-4804(02)00097-5

9. Rodriguez-Hermosa JL, Codina-Cazador A, Ruiz B, Roig J, Girones J et al. Risk factors for acute abdominal wall dehiscence after laparotomy in adults. Cirugía Española 2005; 77 (5): 280-286. doi: 10.1016/s0009-739x(05)70854-x

10. Goltsman D, Munabi NC, Ascherman JA. The association between smoking and plastic surgery outcomes in 40,465 patients: An analysis of the American College of Surgeons National Surgical Quality Improvement Program Data Sets. Plastic and Reconstructive Surgery 2017; 139 (2): 503-511. doi: 10.1097/PRS.0000000000002958

11. Dahl RM, Weterslev J, Jorgensen LN, Rasmussen LS, Moller AM et al. The association of perioperative dexamethasone, smoking and alcohol abuse with wound complications after laparotomy. Acta Anaesthesiologica Scandinavica 2014; 58 (3): 352-361. doi: 10.1111/aas.12270

12. Khullar D, Maa J. The impact of smoking on surgical outcomes. Journal of the American College of Surgeons 2012; 215 (3): 418-426. doi: 10.1016/j.jamcollsurg.2012.05.023

13. Dubay DA, Franz MG. Acute wound healing: the biology of acute wound failure. The Surgical Clinics of North America 2003; 83 (3): 463-481. doi: 10.1016/s0039-6109(02)00196-2

14. Laky B, Janda M, Clehorn G, Obermair A. Comparison of different nutritional assessments and body-composition measurements in detecting malnutrition among gynecologic cancer patients. The American Journal of Clinical Nutrition 2008; 87 (6): 1678-1685. doi: 10.1093/ajcn/87.6.1678

15. Braga M, Ljungqvist O, Soeters P, Fearon K, Weimann A et al. ESPEN guidelines on parenteral nutrition: surgery. Clinical Nutrition 2009; 28 (4): 378-386. doi: 10.1016/j.clnu.2009.04.002

16. Kenig J, Richter P, Lasek A, Zbierska K, Zurawska S. The efficacy of risk scores for predicting abdominal wound dehiscence: a case-controlled validation study. BMC Surgery 2014; 14 (1): 65. doi: 10.1186/1471-2482-14-65

17. Ataseven B, Du Bois A, Reinhaller A, Traut A, Heitz F et al. Pre-operative serum albumin is associated with post-operative complication rate and overall survival in patients with epithelial ovarian cancer undergoing cytoreductive surgery. Gynecologic Oncology 2015; 138 (3): 560-565. doi: 10.1016/j.ygyno.2015.07.005

18. Nugent EK, Hoff JT, Gao F, Massad LS, Case A et al. Wound complications after gynecologic cancer surgery. Gynecologic Oncology 2011; 121 (2): 347-352. doi: 10.1016/j.ygyno.2011.01.026

19. Bohl DD, Shen MR, Mayo BC, Massel DH, Long WW et al. Malnutrition predicts infectious and wound complications following posterior lumbar spinal fusion. Spine 2016; 41 (21): 1693-1699. doi: 10.1097/BRS.0000000000001591

20. Obermair A, Hagenauser S, Tammind D, Clayton RD, Nicklin JL et al. Safety and efficacy of low anterior en bloc resection as part of cytoreductive surgery for patients with ovarian cancer. Gynecologic Oncology 2001; 83 (1): 115-120. doi: 10.1006/gygno.2001.6353

21. Asher V, Lee J, Bali A. Preoperative serum albumin is an independent prognostic predictor of survival in ovarian cancer. Medical Oncology 2012; 29 (3): 2005-2009. doi: 10.1007/s12324-011-0019-5

22. Novetsky AP, Zighelboim I, Guntupalli SR, Ioffe YJ, Kizer NT et al. A phase II trial of a surgical protocol to decrease the incidence of wound complications in obese gynecologic oncology patients. Gynecologic Oncology 2014; 134 (2): 233-237. doi: 10.1016/j.gyngon.2014.06.012

23. Correa NF, de Brito MJ, de Carvalho Resende MM, Duarte MF, Santos FS et al. Impact of surgical wound dehiscence on health-related quality of life and mental health. Journal of Wound Care 2016; 25 (10): 561-570. doi: 10.12968/jowc.2016.25.10.561