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ORIGINAL RESEARCH / *ÖZGÜN ARAŞTIRMA*

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# Reasons for Intensive Care Unit Admission and Prognosis After Surgery for Gynaecologic Malignancies

## Jinekolojik Malignite Cerrahisi Sonrası Yoğun Bakım Ünitesine Başvuru Nedenleri ve Prognoz

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**ABSTRACT** *Objective:* The aims of this study was to investigate factors associated with intensive care unit (ICU) admission and prognosis following surgical treatment of gynaecological malignancy.
*Materials and Methods:* This study was designed as a retrospective cohort analysis, which encompasses patients who were subjected to gynecologic oncological surgery and subsequently monitored in the ICU from December 1st, 2022, to December 1st, 2023.
*Results:* Data of 57 patients who underwent gynaecological oncological surgery and were admitted to ICU during the study period were analysed. Median age was 61.47 years, median body mass index 27 kg/m$^2$, American Society of Anaesthesiologists score 3±2.5. The most common indication for ICU admission was haemodynamic instability with 73.6% (n=42), followed by respiratory failure with 15.7% (n=9) and other reasons. Charlson comorbidity index, lactate and base deficit levels were higher and albumin values were lower in patients with ICU stay of 3 days or more (p=0.04, p=0.004, p=0.034, p=0.025). Only 2 patients (3.5%) developed mortality during the study period.
*Conclusion:* The most common indication for ICU follow-up after elective gynaecological oncology surgery is hemodynamic instability with low ICU mortality and short length of stay in general.
**Keywords:** Comorbidities, gynecologic oncology surgery, intensive care unit

**ÖZ** *Amaç:* Bu çalışmanın amacı jinekolojik malignitelerin cerrahi tedavisi sonrası yoğun bakım ünitesine (YBÜ) yatış ve prognoz ile ilişkili faktörleri araştırmaktır.
*Gereç ve Yöntem:* Bu çalışma, 1 Aralık 2022 ile 1 Aralık 2023 tarihleri arasında jinekolojik onkolojik cerrahi uygulanan ve sonrasında YBÜ izlenen hastaları kapsayan retrospektif bir kohort analizi olarak tasarlanmıştır.
*Bulgular:* Çalışma döneminde jinekolojik onkolojik cerrahi geçiren ve YBÜ kabul edilen 57 hastanın verileri analiz edildi. Medyan yaş 61,47, medyan vücut kitle indeksi 27 kg/m$^2$, Amerikan Anesteziyoloji Derneği skoru 3±2,5 idi. YBÜ kabul için en yaygın endikasyon %73,6 (n=42) ile hemodinamik instabilite iken, bunu %15,7 (n=9) ile solunum yetmezliği, %10,5 (n=6) yerine solunum yetmezliği ve diğer nedenler izlendi. Charlson komorbidite indeksi, laktat ve baz açığı düzeyleri 3 gün ve üzeri YBÜ'de kalan hastalarda daha yüksek, albümin değerleri ise daha düşüktü (p=0,04, p=0,004, p=0,034, p=0,025). Çalışma süresi boyunca sadece 2 hastada (%3,5) mortalite gelişti.
*Sonuç:* Elektif jinekolojik onkoloji cerrahisi sonrası YBÜ takibi için en yaygın endikasyon hemodinamik instabilite olup, genel olarak YBÜ mortalitesi düşük ve YBÜ yatış süresi kısadır.
**Anahtar Kelimeler:** Komorbiditeler, jinekolojik onkoloji cerrahisi, yoğun bakım ünitesi

## Introduction

Gynaecological cancers are cancers of the female reproductive system and are the most common cancers among women worldwide. According to GLOBOCAN cancer data, gynaecological cancers account for approximately 40% of all cancer incidence in women worldwide. The estimated annual number of new cases worldwide is 604,127 for cervical cancer, 417,367 for endometrial cancer, 313,959 for ovarian cancer and 45,240 for vulvar cancer. Furthermore, gynecological cancers account for more than 30% of all cancer deaths among women. Surgical intervention is usually the preferred primary treatment modality for these cancers (1,2).

Gynaecological oncology surgery involves resection of tissues in both the lower and upper abdomen, especially in ovarian cancer. To ensure complete cytoreduction, surgery often goes beyond the removal of the uterus and ovaries (hysterectomy and adnexectomy). It may also involve removal of the bowel, bladder or liver, as well as the spleen (splenectomy), parts of the peritoneum (peritonectomy) or lymph nodes (lymphadenectomy) (3). These radical operations for gynaecological cancers can take a long time to complete and often result in a lot of blood loss. In the light of this information, these patients are at risk for serious complications that may result in postoperative morbidity and mortality (4). Therefore, postoperative intensive care unit (ICU) follow-up may be frequently required in this group of patients undergoing major surgical procedures. Optimising postoperative ICU management is crucial to improve patient outcomes. However, there are no clear criteria or risk factors that determine the optimal ICU admission strategy in this patient group. Furthermore, limited information is available on the epidemiology and prognosis of critical gynaecological oncology patients requiring postoperative ICU management (5-7).

The aim of this study was to evaluate the clinical characteristics, prognosis, ICU length of stay and associated factors in patients admitted to the ICU after gynaecological oncological surgery.

## Materials and Methods

The current study was carried our in accordance with the Declaration of Helsinki and approved by the Clinical Researches Ethics Commitee of University of Health Sciences Turkey, Antalya Training and Research Hospital, Antalya, Turkey (decision no: 18/3 date: 28.12.2023).

It was designed as a retrospective cohort study and included patients who were followed up in the ICU after gynaecological oncology surgery between 01 December 2022 and 01 December 2023. The data of the patients were obtained from patient file database and the observation results noted to the patient ICU charts. Patient informed consent was waived due to the retrospective study design. Researchers analyzed only anonymized data.

Patients over 18 years of age who underwent surgery for gynaecological malignancies in our clinic and were admitted from the operating room to the ICU were included in the study. Patients younger than 18 years of age, patients who were not operated for gynaecological malignancy and patients who did not require postoperative ICU follow-up were excluded from the study.

Demographic and clinical data including age, body mass index, comorbidities, diagnosis of gynaecological malignancy, surgical resections performed, operative time (the time between the onset of anaesthesia and the completion of the surgical procedure), need for blood and blood product replacement, indication for ICU admission (haemodynamic instability, respiratory failure, heart failure), need for mechanical ventilation, need for inotropes, length of ICU stay and prognosis (exitus/survival) were obtained and analysed. Laboratory parameters (haemoglobin, base deficit, lactate, albumin) and arterial blood gas analysis (base deficit, lactate) were recorded.

Patients with one or more of the following criteria were considered haemodynamically unstable: Hypertension (20% increase in mean arterial pressure at baseline), hypotension (20% decrease in mean arterial pressure at baseline), tachycardia (heart rate ≥100), bradycardia (heart rate ≤60) (8,9). Respiratory failure was defined as arterial oxygen pressure ($PaO_2$) below 60 mmHg or arterial carbon dioxide pressure above 50 mmHg in room air or $PaO_2$ to inspired oxygen fraction ratio ($PaO_2/FiO_2$) below 300 (10,11).

Comorbidities were measured using the Charlson comorbidity index (CCI), a measure specifically designed to categorise the impact of comorbidities and their prognostic impact on mortality, which has been extensively validated in cohorts of patients with malignancies (12).

The acute physiology and chronic health evaluation-II (APACHE-II) and sequential organ failure assessment (SOFA) was used to measure the severity of a patient's

condition on admission to the ICU (13). The preoperative assessment of surgical risk, expressed by the American Society of Anaesthesiologists (ASA) score, was based on the physical status classification of the American Society of Anaesthesiology.

### Statistical Analysis

In our study, analyses were performed using Statistical Package for the Social Sciences software version 21.0 (IBM Inc, Chicago, IL, USA). Descriptive statistics of numerical and qualitative (categorical) variables obtained in the study were analysed and numerical parameters were expressed as interquartile range (median, minimum and maximum) and categorical variables were expressed as frequency. Shapiro-Wilk test, histogram analyses and Q-Q plot graphs were used for the compatibility of numerical variables with normal distribution. For multiple group comparisons, One-Way analysis of variance (ANOVA) or Kruskal-Wallis H tests were performed. Distributional relationships between categorical parameters were evaluated by Pearson chi-square analysis or Fisher's Exact test. Pearson or Spearman's correlation analyses were used for correlation between numerical parameters. In the whole study, type-I error rate was taken as 5% and $p<0.05$ was accepted as significant.

## Results

During the study period, there were 233 patients undergoing gynaecological cancer surgery and 59 patients were admitted to the ICU. Data from 57 patients who met the inclusion criteria were analysed (Figure 1).

Clinical and demographic characteristics of patients are presented in Table 1. The mean age was 61.47±12.13 years and 34 (59.65%) patients had comorbidities. The mean ASA score of the patients was III. Surgery was performed for ovarian cancer in 61.4%, endometrial cancer in 36.8% and colorectal cancer with isolated vaginal metastasis in 1 patient. Total hysterectomy and bilateral salpingo-oophorectomy were performed in 47 patients and systematic pelvic lymphadenectomy in 31 patients. Primary debulking was performed in 21 patients with ovarian cancer, interval debulking in 9 patients and secondary cytoreduction surgery in 5 patients. Splenectomy was performed in 8 patients with ovarian cancer, ureteroneocystostomy in 2 patients, peritonectomy in 12 patients and anastamosis of colorectal resection in 9 patients. Laparoscopic surgery was performed in 6 patients and all patients had endometrial cancer. Sentinel lymph node dissection was performed in 2 of these patients. The mean operative time was 300 (90-620) minutes and this time was longer in ovarian cancer surgery than in other surgeries ($p<0.001$). Blood product transfusion was required in 26 patients (45.6%) in the perioperative period, 24 patients required vasoactive drugs intraoperatively, and 2 of these patients continued to require vasoactive drugs postoperatively. Operative time was higher in this patient group ($p<0.001$).

The most common indication for ICU admission was haemodynamic instability (hypotension in 18 patients, hypotension with bradycardia in 2 patients, tachycardia with hypotension in 4 patients, hypertension in 6 patients, tachycardia with hypertension in 2 patients, tachycardia in 6 patients, bradycardia in 4 patients) with 73.6% (n=42), followed by respiratory failure with 15.7% (n=9) and other reasons. The mean APACHE-II and SOFA scores at ICU admission were 18.8±7.2 and 5±5.8, respectively. The mean $PaO_2/FiO_2$ at ICU admission was 320±55.6 mmHg and 36 (63.1%) patients required mechanical ventilation. Operative time was higher in this patient group ($p<0.001$). The mean length of stay on mechanical ventilation was 1 day (0-15). The median values of haemoglobin 11.83 g/dL (11.83±1.72), albumin 25.2 g/L (25.2±3.6), lactate 1.70 mmol/L (0.7-5.9) and base deficit 1.70 mmol/L (-10.2-19.4) are shown in Table 2. Patients who underwent ovarian cancer surgery had a longer operation time and a higher need for mechanical ventilator and blood product transfusion than patients who underwent endometrial cancer surgery ($p=0.007$, $p=0.026$, $p=0.024$).

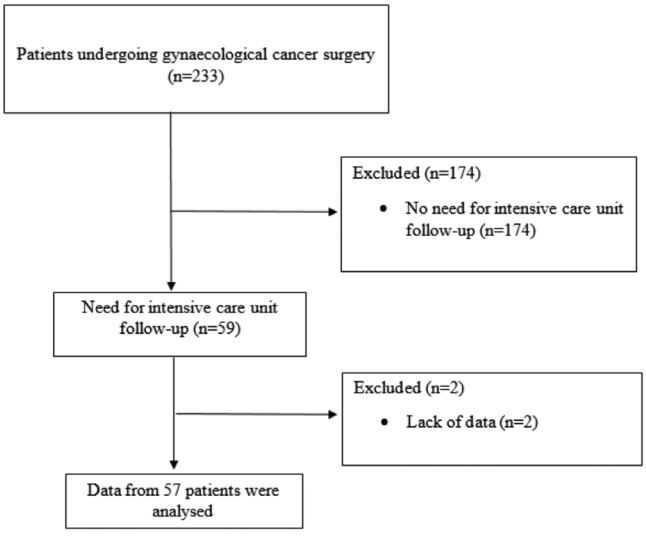


**Figure 1.** Study flow diagram

| Table 1. Distribution summary of general descriptive data | | |
|---|---|---|
| **Parameters** | **Frequency (n)** | **%** |
| **Diagnosis** | | |
| Endometrium CA | 21 | 36.84% |
| Over CA-periton CA | 35 | 61.4% |
| Isolated vaginal metastasis of colon cancer | 1 | 1.75% |
| **Intraoperative replacements** | | |
| No | 31 | 54.39% |
| Yes (ES and/or FFP) | 26 | 45.61% |
| **Mechanical ventilation** | | |
| No | 21 | 36.84% |
| Yes | 36 | 63.16% |
| **Inotrope use*** | | |
| No | 55 | 96.49% |
| Yes | 2 | 3.51% |
| **Presence of comorbidities** | | |
| No | 23 | 40.35% |
| Yes | 34 | 59.65% |
| **Comorbidities$^{\Phi}$** | | |
| HT | 12 | 21.1% |
| DM | 8 | 14.0% |
| Asthma | 2 | 3.5% |
| Hyperthyroidism | 1 | 1.8% |
| CAD | 4 | 7.0% |
| Epilepsy | 2 | 3.5% |
| Elephantiazis | 1 | 1.7% |
| CRF | 1 | 1.8% |
| COPD | 2 | 3.5% |
| **Prognosis** | | |
| Alive | 55 | 96.5% |
| Exitus† | 2 | 3.5% |
| **Operation$^{\Phi}$** | | |
| TAH-BSO | 47 | 82.5% |
| Systematic pelvic, paraortic LN dissection | 31 | 54.4% |
| Colorectal resection anastomosis | 9 | 15.8% |
| Laparoscopy | 6 | 10.5% |
| Splenectomy | 8 | 14.0% |
| Interval debulking | 9 | 15.8% |
| Secondary cytoreduction | 5 | 8.8% |
| Primer debulking | 21 | 36.8% |
| Peritonectomy | 12 | 21.1% |
| Sentinal LN dissection | 2 | 3.5% |
| Ureteroneocystostomy | 2 | 3.5% |

*Noradrenaline, †Causes of mortality: sepsis, ARF, ARDS and pulmonary embolism. $^{\Phi}$Some patients have more than one characteristic (comorbidity or type of operation performed). DM: Diabetes mellitus, HT: hypertension, CAD: coronary artery disease, CRF: chronic renal failure, HL: hyperlipidaemia, COPD: chronic obstructive pulmonary disease, CA: cancer (malignancy), ES: erythrocyte suspension, FFP: fresh frozen platelet, LN: lymph node, TAH-BSO: total abdominal hysterectomy bilateral salphingoopherectomy, ARDS: acute respiratory distress syndrome, ARF: acute respiratory failure

The median length of stay in the ICU was 2 (1-20) days. CCI, lactate and base deficit levels were higher and albumin values were lower in patients with ICU stay of 3 days or more (Table 3) (p=0.04, p=0.004, p=0.034, p=0.025). Only 2 patients (3.5%) developed mortality during the study period. Mortality was due to massive pulmonary embolism in 1 patient undergoing ovarian cancer surgery and intraobdominal sepsis/disseminated intravascular coagulation in 1 patient undergoing endometrial cancer surgery.

## Discussion

The results of our study revealed that the most common indication for ICU follow-up after gynaecological oncology surgery was haemodynamic instability (73.6%) and ICU mortality was 3.5%. ICU length of stay was longer in patients with low albumin level, comorbidity, high lactate and base deficit.

Patients undergoing major gynaecological oncology surgery often require postoperative management in the ICU. In our study, 25.3% of patients who underwent gynaecological oncological surgery required ICU follow-up after surgery. Previous studies have also reported that 6% to 56% of patients require ICU follow-up after gynaecological cancer surgery (14-18). In a systematic review including 7 studies evaluating the factors affecting ICU admission after gynecologic oncology surgery, haemodynamic instability was reported to be the most common indication for ICU admission. Similar to the findings of this systematic review, the most common indication for ICU admission in our study was haemodynamic instability (19). In our study, the majority of patients had comorbidities and the mean CCI was 5 (2-10). Some studies evaluating the determinants of ICU admission in patients undergoing gynaecological oncology surgery have reported a significant association between high CCI scores and ICU admission (14,17). In parallel with these studies, the findings of our study reflect the fact that pre-existing comorbidities predispose to ICU admission in patients undergoing gynaecological oncology surgery.

In our study, the majority (61.4%) of the patients admitted to the ICU were patients who underwent surgery for ovarian cancer. Leath et al. (16) reported that the majority (39%) of 185 gynaecological oncology patients admitted to the ICU after surgery were patients who underwent surgery for ovarian cancer. Similarly, in a recent study in which the data of 666 patients admitted to the ICU after gynaecological

| Table 2. General distribution characteristics of quantitative parameters | | | |
|---|---|---|---|
| **Parameters** | **Minimum** | **Maximum** | **Distribution†** |
| Age (years) | 20 | 83 | 61.47±12.13 |
| BMI (kg/m$^2$) | 23 | 34 | 27±7.7 |
| ASA (score) | 1 | 4 | 3±2.5 |
| Hb (g/dL) | 6.7 | 16.4 | 11.83±1.72 |
| Albumin (g/L) | 18.3 | 37.1 | 25.2±3.6 |
| APACHE-II (score) | 5 | 34 | 18.8±7.2 |
| SOFA (score) | 0 | 11 | 5±5.8 |
| $PaO_2/FiO_2$ (mmHg) | 170 | 470 | 320±55.6 |
| **Parameters** | **Q1** | **Q3** | **Median** |
| Base deficit (mmol/L) | -10.2 | 19.4 | 1.70 (-10.2-19.4) |
| Lactat (mmol/L) | 0.70 | 5.90 | 1.70 (0.7-5.9) |
| Operation time (min) | 90 | 620 | 300 (90-620) |
| ICU length of stay (days) | 1 | 20 | 2 (1-20) |
| CCI (score) | 2 | 10 | 5 (2-10) |

†Age, Hb, BMI, ASA score, albumin, APACHE-II, $PaO_2/FiO_2$ (mmHg) and SOFA (score) parameters were expressed as mean ± standard devination. and other parameters were expressed as interquartile range. BMI: Body mass index (kg/cm$^2$), ASA: American Society of Anaesthesiologists, APACHE-II: acute physiological and chronic assessment-II, SOFA: sequential organ failure assessment, ICU: intensive care unit, CCI: Charlson comorbidity index, Hb: hemoglobin, $PaO_2/FiO_2$: Inspired oxygen fraction ratio

| Table 3. Comparison of quantitative parameters according to intensive care unit length of stay | | | | |
|---|---|---|---|---|
| | **ICU length of stay** | | | |
| | **1 day (n=23, 40.4%)** | **2 day (n=24, 42.1%)** | **≥3 day (n=9, 15.8%)** | **p-value** |
| **Median (IQR)** | | | | |
| CCI (score) | 4 (2-6) | 5 (4-7) | 7 (5-10) | **0.04** |
| Base deficit (mmol/L) | -2 (-7.5-3.5) | -3.05 (-10.2-2.4) | -4.9 (-8-19.4) | **0.034** |
| Lactate (mmol/L) | 1.3 (0.8-3.6) | 2 (0.7-4.6) | 3.8 (1.5-5.9) | **0.004** |
| Operation time (min) | 270 (90-450) | 350 (100-620) | 260 (120-420) | 0.282 |
| **Mean ± standard devination†** | | | | |
| Age (years) | 58.74±13.33 | 63.54±11.87 | 63.33±9.87 | 0.367 |
| Hb (g/dL) | 12.29±1.02 | 11.31±1.67 | 11.72±2.74 | 0.143 |
| Albumin (g/L) | 27.4±2.2 | 24.4±2.7 | 21.4±3.4 | **0.025** |
| APACHE-II (score) | 18.22±6.13 | 18.47±7.21 | 20.2±10.5 | 0.860 |
| SOFA (score) | 4.3±2.5 | 4±3.5 | 5±4.5 | 0.734 |
| ASA (score) | 2±1.7 | 2.3±1.7 | 2.8±1.2 | 0.687 |
| BMI (kg/m$^2$) | 26±4.3 | 26.5±5.1 | 26.9±3.3 | 0.610 |
| $PaO_2/FiO_2$ (mmHg) | 380±90.1 | 374±71 | 350±80.4 | 0.480 |

Parameters showing normal distribution characteristics were expressed as mean ± standard devination. Those not showing normal distribution characteristics were expressed as median (IQR). †One-Way analysis of variance (ANOVA), ‡Kruskal-Wallis H test, $p<0.05$ means statistical significance between all days. CCI: Charlson comorbidity index, APACHE-II: acute physiological and chronic assessment II, SOFA: sequential organ failure assessment, ASA: American Society of Anaesthesiologists, BMI: body mass index (kg/cm$^2$), IQR: interquartile range, Hb: hemoglobin, $PaO_2/FiO_2$: Inspired oxygen fraction ratio, ICU: intensive care unit

oncology surgery were included in the analysis, it was reported that approximately half of the patients were patients who underwent surgery for ovarian cancer (7). Ovarian cancer has the worst prognosis among gynaecological malignancies and is usualy diagnosed at late stage (stage III or IV) (20). Therefore, aggressive surgical procedures are often required in this patient group. As a result, prolonged operative time, the need for continuous volume resuscitation and the need for blood product transfusion may be frequent, and it is essential to perform the necessary replacements without causing haemodynamic instability.

In our study, ICU mortality was 3.5% and the mean APACHE-II score of the patients was 18.8±7.2. ICU mortality after gynaecological oncology surgery has been reported in a wide range (0-28%) in previous studies (5,14,16,21). Our study included patients who underwent elective surgery for gynaecological malignancy, and the mortality rate (3.1%) was similar to that reported by Krawczyk et al. (7). Van Le et al. (22) reported that the mortality rate in gynaecological oncology patients was 78% when the APACHE-II score was higher than 20 and 3% when it was lower than 20. Considering the mean APACHE-II score of our patient population in our study, our results confirm the analysis of Van Le et al. (22) The causes of mortality in our study were massive pulmonary embolism, sepsis and disseminated intravascular coagulation. Although the mortality rate was low, it should be kept in mind that this patient group is vulnerable to serious complications that may result in mortality and patients should be closely monitored in this respect.

In this patient group, dehydration, hypotension due to large intraoperative blood loss and the need for vasopressor agents may develop. Perioperative hypotension is known to be associated with unfavourable postoperative outcomes and increased mortality (23). Therefore, careful monitoring of the need for fluid resuscitation and blood product replacement to prevent hypotension is very important to prevent mortality. In our study, 45.6% of the patients received blood transfusion and vasopressor agents were needed in only 2 patients during postoperative period. In our clinic, we administer fluid and blood product transfusion to our patients in the peroperative period, including the preoperative period, taking into account haemodynamic parameters and clinical findings. One of the reasons for the low mortality rate may be the careful fluid and blood resuscitation to prevent hypotension in our clinic.

In our study, the length of ICU stay was generally short (median 2 days). The ICU length of stay reported by Heinonen et al. (5) was 5 days in both benign and malignant cases. Leath et al. (16) reported a median ICU length of stay of 2.2 days, which is similar to the results of our study. In a systematic review of patients undergoing gynecological oncology surgery, Thomakos et al. (19) reported that age, high CCI and blood loss levels and long operation time were associated with prolonged ICU stay. In a study of 95 patients to determine perioperative variables associated with length of stay in the surgical ICU and total cost of hospitalisation to optimise resource utilisation in patients operated for ovarian cancer, patient age ≥63 years was significantly associated with ICU stay ≥48 hours. In a multivariate analysis, Díaz-Montes et al. (24) showed that an albumin level <3.5 g/dL was significantly associated with prolonged ICU stay. In these studies, patients with ovarian cancer were evaluated in general. In our study, there were 9 patients with ICU length of stay of 3 days or more, and CCI, lactate and base deficit levels were higher and albumin values were lower in this patient group. In our study, the majority of our patient population consisted of patients with ovarian cancer, but there were also patients who underwent surgery for other gynecological cancers. Therefore, there may have been differences between the results of our study and the reported data in terms of factors that may cause prolonged hospitalisation.

This study has several limitations. It was a retrospective single centre study. We analysed data and ICU interventions without long-term outcomes and did not include the stage of neoplastic disease, which was outside the scope of the article. We are aware that the sample was not large enough to make a definitive conclusion about the outcomes of patients admitted to the ICU after gynaecological cancer surgery.

## Conclusion

The most common indication for ICU follow-up after elective gynaecological oncology surgery is hemodynamic instability with low ICU mortality and short length of stay in general. However, ICU length of stay is longer in patients with low albumin level, comorbidity, high lactate and base deficit. Prospective studies with larger patient cohorts are needed to identify factors associated with ICU length of stay and to improve patient management and outcomes.

### Ethics

**Ethics Committee Approval:** The current study was carried our in accordance with the Declaration of Helsinki and approved by the Clinical Researches Ethics Commitee of University of Health Sciences Turkey, Antalya Training and Research Hospital, Antalya, Turkey (decision no: 18/3 date: 28.12.2023).

**Informed Consent:** Since our study was retrospective, informed consent was not obtained from the patients.

### Authorship Contributions

Surgical and Medical Practices: A.A., G.E.S., M.G., N.Y., I.Ü., T.T., Concept: N.K.Ö., T.T., Design: A.A., M.G., Data Collection and Process: T.T., Analysis or Interpretation: N.K.Ö., N.Y., Literature Search: A.A., Writing: A.A., I.Ü.

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