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Postoperative gynecologic oncology admissions to intensive care unit in the tertiary care center: an eight-year retrospective study

Pawel Krawczyk[1], Dominika Trojnarska[2], Rafal Baran[3], Tomasz Lonc[4], Rafal Swistek[4], Pawel Tyszecki[4,5], Robert Jach[2]

[1]*Department of Anesthesiology and Intensive Care Medicine, Jagiellonian University Medical College, Cracow, Poland*
[2]*Department of Obstetrics and Gynaecology, Jagiellonian University Medical College, Cracow, Poland*
[3]*Department of Gynecological Endocrinology and Gynecology, University Hospital, Cracow, Poland*
[4]*Department of Anesthesiology and Intensive Care Medicine, University Hospital, Cracow, Poland*
[5]*Department of Anesthesiology and Intensive Care Medicine, 5th Military Hospital with Polyclinic, Cracow, Poland*

ABSTRACT

Objectives: The purpose of the study was to analyze the cohort of gynecologic oncology patients admitted to intensive care unit (ICU).

Material and methods: We conducted a retrospective study including all ICU postoperative admissions related to adult female patients with gynecological malignancies diagnosis treated in the tertiary care center between Jan 1, 2007, and Dec 31, 2014.

Results: A total of 666 women were admitted to ICU. It accounted for 2 % of all tertiary care center gynecology admissions. The mean age was 62.4 ± 12.7 years, and the mean length of stay was 8.9 ± 9.6 days. One hundred seventeen women (17.5%) required mechanical ventilation, and 220 women (33%) vasoactive drug infusion. The most common malignancy in the observed cohort of patients was ovarian cancer 326 (48.9%), followed by endometrial cancer 206 (30.9%). The patients with respiratory or circulatory insufficiency were older (mean age 64.9 ± 11.8 vs 60.8 ± 13; $p < 0.001$) and had longer mean ICU stay (13.1 ± 13.9 vs 6.3 ± 3.5 days; $p < 0.001$). We found a decrease in ICU admissions of patients without respiratory and circulatory failure after elective major surgery (Spearman: $r = -1$, $p = 0.017$). We report 21 patients' deaths (3.1% in the cohort; 0.06% of all admissions).

Conclusions: Ovarian cancer patients were the largest group in the study, representing almost half of ICU admissions in the gynecology oncologic population. Older age was the risk factor of respiratory and circulatory insufficiency. Availability of intermediate care facilities could reduce ICU admissions after major surgery.

Key words: intensive care; gynecologic oncology; critical care; admission; risk factor

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INTRODUCTION

Surgical procedure is the primary treatment in gynecologic oncology. Major surgical procedures often require admission to an intensive care unit; however, no clear criteria or risk factors determine optimal intensive care unit admission strategy [1]. The cohort of cancer patients except for the malignancy often suffers from comorbidities that may influence the outcome. In addition, many of these patients meet either elderly or frailty criteria. There are different strategies for intensive care unit admissions after major surgery. It may be planned to provide high-quality perioperative care or unplanned required in emergencies or surgical and anesthetic complications.

Objectives

The study presents a cohort of gynecologic oncology patients admitted to the intensive care unit after major surgery in the gynecology tertiary care center.

Corresponding author:
Pawel Krawczyk
Department of Anesthesiology and Intensive Care Medicine, Jagiellonian University Medical College, 40 Kopernika St, 31–501 Cracow, Poland
tel/fax. +48 12 433 27 63, e-mail: p.krawczyk@uj.edu.pl
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MATERIAL AND METHODS

We conducted a retrospective study including all intensive care unit postoperative admissions related to adult female patients with gynecological malignancies diagnosis treated in the gynecology tertiary care center between Jan 1, 2007 to Dec 31, 2014.

The center was a 65-bed clinic covering a population of 3 410 900 inhabitants [2] with an average annual number of 4000 admissions and access to a 4-bed mixed medical and surgical intensive care unit. We obtained the following data regarding the patients admitted to the intensive care unit: demographics, oncologic history, medical intensive care unit interventions (respiratory support, vasoactive drugs use, renal replacement therapy, diuretic use, invasive pulmonary artery monitoring, total parenteral nutrition use, need for resuscitation, presence of metabolic disturbances, surgical site drainage, interventions outside intensive care unit, massive fluid loss), mortality and intensive care unit length of stay. In addition, the cohort of patients for this study was divided into six groups according to oncologic diagnosis: malignant neoplasm of the ovary, corpus uteri, cervix uteri, vulva, breast, and other (included malignant neoplasm of the uterus; part unspecified, vagina, other and unspecified female genital organs and secondary malignant neoplasm of other and unspecified sites).

We present descriptive data as means ± standard deviation (SD) and median value with interquartile range (IQR) for continuous variables and as percentages (%) for categorical variables. Correlations between quantitative variables were analyzed using the Spearman correlation coefficient. The comparison of the values of quantitative variables in two groups was performed using the Mann-Whitney test. Results with a p-value < 0.05 were considered significant. Analyses were conducted using R software (ver. 4.1.0.; R Foundation for Statistical Computing, Vienna, Austria) [3]. The study was approved by the Ethics Committee of Jagiellonian University, Cracow, Poland (approval number: 122.6120.8.2015; 29.01.2015).

RESULTS

A total of 666 women diagnosed with gynecological malignancies were admitted to the intensive care unit. It accounted for 52.7% of all intensive care unit admissions and 2% of all gynecologic oncology admissions to the tertiary care center. The mean patients' age was 62.4 ± 12.7 years, and the mean intensive care unit length of stay was 8.9 ± 9.6 days (Tab. 1).

One hundred seventeen women (17.57%) required prolonged mechanical ventilation, and 220 patients (33%) received vasoactive drug infusion. More than half of patients receiving vasoactive drugs required more than one vasopressor. Among gynecology oncologic patients admitted to ICU the most common malignancy was ovarian cancer 326 (48.9%), followed by endometrial cancer 206 (30.9%), and cervix uteri cancer 62 (9.3%) (Fig. 1).

One hundred thirty-seven women (20.4%) had metabolic disturbances, and 136 (20.4%) required total parenteral nutrition during intensive care unit stay. Renal replacement therapy was not frequent in this cohort of patients (17; 2.5%). However, diuretics use was common (67.8%). Detailed results are presented in Table 2.

The patients admitted with respiratory of circulatory insufficiency were older (mean age 64.98 ± 11.83 vs 60.89 ± 13; p < 0,001) and had longer mean intensive care unit length of stay (days; 13.1 ± 13.96 vs 6.31 ± 3.53; p < 0.001) (Tab. 3).

In the following years, there was a decrease in intensive care unit planned admissions of patients without respiratory and circulatory failure after major surgery (Spearman (r) correlation coefficient in time for all patients in years 2010–2014 r = –1, p = 0.017). The correlation was strongest for endometrial cancer patients (r = –0.881, p = 0.007 for years 2007–2014 and r = –1, p = 0.017 for years 2010–2014) (Tab. 4).

We report 21 patients' deaths (3.15% of the cohort; 0.06% of all tertiary care center admissions).

Table 1. Age and length of intensive care unit stay in a different group of patients

Parameter		ICD-10						
		Breast cancer (n = 15)	Vulvar Cancer (n = 34)	Cancer colli uteri (n = 62)	Endomatrial cancer (n = 206)	Ovarian cancer (n = 326)	Other (n = 23)	Total (n = 666)
Age	Mean ± SD	60.73 ± 11.55	75.41 ± 9.57	62.42 ± 10.96	66.53 ± 10.36	58.94 ± 13.05	58.3 ± 13.94	62.48 ± 12.71
	Median	60	76	61.5	68	59	59	63
	IQR	51–71.5	72.25–83,25	55–71	59.25–74	51–69	50–64	54–72
Length of stay	Mean ± SD	12.93 ± 16.06	10.26 ± 8.38	6.4 ± 3.74	8.28 ± 10.13	9.35 ± 9.65	11.35 ± 12.42	8.94 ± 9.69
	Median	6	7.5	5	5	7	6	6
	IQR	4.5–12	5–11.5	4–7	5–7	5–10	5–9.5	5–9

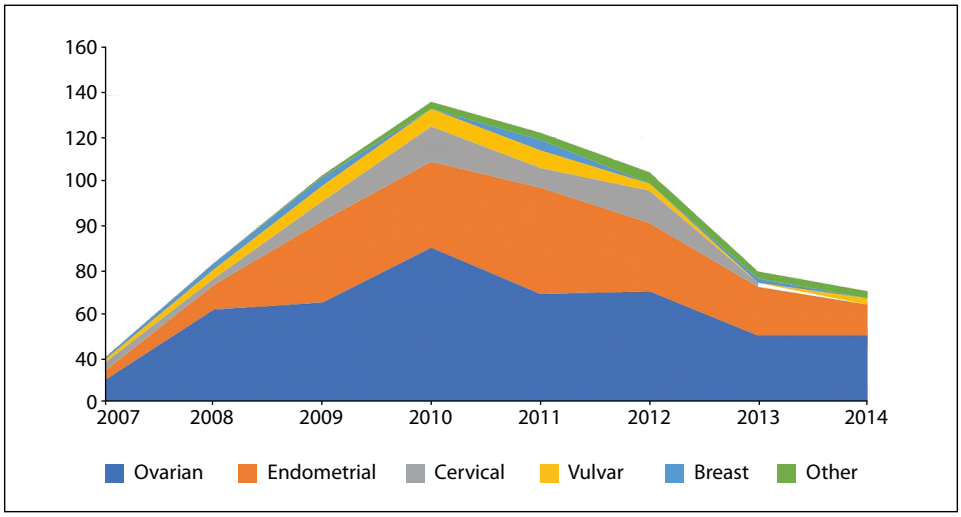

Figure 1. Intensive care unit admissions in a cohort of gynaecologic oncology patients

Table 2. Intensive care unit interventions in a different group of oncologic patients

	Breast cancer (n = 15)	Vulvar cancer (n = 34)	Cancer colli uteri (n = 62)	Endometrial cancer (n = 206)	Ovarian cancer (n = 326)	Other malignancies (n = 23)	Total (n = 666)
Mechanical ventilation	3 (20.00%)	5 (14.71%)	9 (14.52%)	28 (13.59%)	62 (19.02%)	10 (43.48%)	117 (17.57%)
Single vasoactive	9 (60.00%)	10 (29.41%)	19 (30.65%)	72 (34.95%)	101 (30.98%)	9 (39.13%)	220 (33.03%)
Multi vasoactive	4 (26.67%)	3 (8.82%)	9 (14.52%)	34 (16.50%)	54 (16.56%)	8 (34.78%)	112 (16.82%)
Massive fluid loss	1 (6.67%)	2 (5.88%)	4 (6.45%)	6 (2.91%)	28 (8.59%)	2 (8.70%)	43 (6.46%)
Arterial line	15 (100.00%)	34 (100.00%)	62 (100.00%)	205 (99.51%)	325 (99.69%)	22 (95.65%)	663 (99.55%)
Central line	15 (100.00%)	34 (100.00%)	61 (98.39%)	206 (100.00%)	326 (100.00%)	23 (100.00%)	665 (99.85%)
Cardiac output monitoring	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (0.97%)	3 (0.92%)	2 (8.70%)	7 (1.05%)
Diuretic use	8 (53.33%)	24 (70.59%)	39 (62.90%)	145 (70.39%)	217 (66.56%)	19 (82.61%)	452 (67.87%)
RRT	0 (0.00%)	0 (0.00%)	4 (6.45%)	8 (3.88%)	4 (1.23%)	1 (4.35%)	17 (2.55%)
Metabolic disorders acidosis/alkalosis	4 (26.67%)	3 (8.82%)	13 (20.97%)	35 (16.99%)	73 (22.39%)	9 (39.13%)	137 (20.57%)
CPR	0 (0.00%)	0 (0.00%)	1 (1.61%)	9 (4.37%)	9 (2.76%)	2 (8.70%)	21 (3.15%)
TPN	6 (40.00%)	3 (8.82%)	5 (8.06%)	24 (11.65%)	92 (28.22%)	6 (26.09%)	136 (20.42%)
Surgical site drainage	15 (100.00%)	29 (85.29%)	57 (91.94%)	193 (93.69%)	305 (93.56%)	21 (91.30%)	620 (93.09%)
Interventions outside ICU(CT/surgery)	5 (33.33%)	8 (23.53%)	8 (12.90%)	28 (13.59%)	53 (16.26%)	8 (34.78%)	110 (16.52%)

CPR — cardiopulmonary resuscitation; CT — computed tomography; ICU — intensive care unit; RRT — renal replacement therapy; TPN — total parenteral nutrition

Table 3. Comparison of age and length of intensive care unit stay between patients with and without respiratory and circulatory insufficiency

Parameter		Group		p value
		No respiratory and circulatory insufficiency (n = 408)	Respiratory and circulatory insufficiency (n = 258)	
Age [years]	Mean ± SD	60,89 ± 13	64.98 ± 11.83	p < 0.001
	Median	61	66	
	IQR	53–71	56–74	
Length of stay [days]	Mean ± SD	6.31 ± 3.53	13.1 ± 13.96	p < 0.001
	Median	5	8	
	IQR	4–7	6–13	

Table 4. Results of Spearman (r) correlation coefficient of the number of intensive care unit admitted patients without respiratory and circulatory insufficiency in the following years, including subanalyses for different malignancies

ICD-10	% Patients without respiratory and circulatory insufficiency								Spearman (r) correlation coefficient in time	
	2007	2008	2009	2010	2011	2012	2013	2014	2007–2014	2010–2014
Cancer colli uteri	75	66.67	77.78	75	77.78	46.67	100	0	r = –0.133, p = 0.754	r = –0.3, p = 0.683
Vulvar cancer	0	100	57.14	62.5	62.5	100	0	0	r = 0.055, p = 0.907	r = –0.316, p = 0.684
Endometrial cancer	75	72.73	64.86	74.36	70.83	61.29	36.36	14.29	r = –0.881, p = 0.007 *	r = –1, p = 0.017
Ovarian cancer	60	78.57	75.56	80	67.35	56	46.67	3.33	r = –0.69, p = 0.069	r = –1, p = 0.017
Other	0	25	80	100	45.45	33.33	0	0	r = –0.22, p = 0.601	r = –0.975, p = 0.005
Total	60	75	70.87	77.21	67.2	56.19	40.68	5.56	r = –0.69, p = 0.069	r = –1, p = 0.017

DISCUSSION

This study presents the cohort of 666 postoperative oncologic patients admitted to the intensive care unit in an eight-year review, representing 2% of all tertiary care center admissions. Admissions accounted for 52.7% of all intensive care unit admissions.

Ovarian cancer patients were the largest group in the study, representing almost half of the cohort (48.9%). Ovarian cancer is the most lethal gynecologic malignancy [4] and follows breast and cervical cancer as the third most common gynecologic cancer cause of death [5]. The late diagnosis is usually associated with grade III or IV of the disease and the need for aggressive surgical cytoreduction. It significantly increases perioperative risk, corresponding with the risk of unplanned intensive care unit admissions [6]. Malignant neoplasm of corpus uteri was the second largest group in the study. Endometrial cancer risk increases with age [7]. This malignancy requires performing a radical hysterectomy. Which at an advanced age, may influence the postoperative outcome. The third most common malignancy was cancer of the cervix uteri. Despite performing a radical operation, this group characterized the shortest length of intensive care unit stay, which can be explained by the overall younger age of cervical cancer patients. The vulvar cancer diagnosis was not very common, relating to 34 older patients (5.1%) with a mean age of 75 and prolonged ICU stay. This group of ICU patients is relatively more prone to worse outcomes due to their frailty [8].

One-fifth of the studied population demonstrated signs of metabolic disorders, mainly acidosis, a common finding in intensive care unit patients. Nutritional treatment is essential when treating oncologic patients. Many oncologic patients demonstrate malnutrition which is a risk factor for worse outcomes. Early pre-operative identification and active treatment of these patients are beneficial. If not solved pre-operatively, it may require the involvement of total parenteral nutrition during intensive care unit stay [9]. Twenty percent of the studied cohort received total parenteral nutrition during their intensive care unit stay. Cardiac output monitoring devices use was not commonly reported in the studied population. This point of care assessment facilitates the proper assessment of fluid responsiveness in critically ill patients, limiting the excessive perioperative volume of fluids [10, 11]. The study by Díaz-Montes et al. [12] demonstrated longer intensive care unit stays in 57% of ovarian cancer intensive care unit patients. The risk factors included age over 63 years, poor nutritional status, and excessive perioperative fluid load.

Many studies report elective ICU admissions after major surgery. Ovarian cancer patients are the leading group in studies analyzing intensive care unit admissions of gynecologic oncology patients. In this group, respiratory failure was reported in 3–35% of patients [6, 13–15]. 17.5% of patients in our cohort required mechanical ventilation. In our study, vasopressors were required in one-third of patients. The need for hemodynamic support was the leading reason for intensive care unit admission in other studies, including gynecologic oncology patients ranging between 44–84% of admissions [6, 13,15]. Surgical stress, blood loss, infections, decreased sympathetic tone due to anesthesia increase the need for vasopressors' uses. Perioperative hypotension is directly related to adverse postoperative outcomes associated with increased mortality [16, 17]. Early identification and management of hypotension and hemodynamic instability are paramount, justifying planned, pre-emptive intensive care unit admissions. Numerous studies suggest

better patient outcomes resulting from intensive care unit admission following major surgery. Patients do worse in postoperative complications outside ICU [18–20]. It may be an argument for the low trigger for early intensive care unit admission after major surgery; however, we must be aware of the shortage of intensive care unit beds and limited resources [21].

A recently published review identified age, anemia, American Society of Anesthesiologists physical high status, body mass index, significant comorbidity, emergency surgery, high-risk surgery, male sex, obstructive sleep apnea, increased blood loss, and duration of surgery as risk factors for unplanned critical care admissions [22]. In the following years analyzed in the study, the number of intensive care unit admissions of cancer patients without respiratory and circulatory insufficiency decreased with the strongest correlation in the endometrial cancer group. It may result from relatively less extended surgery in this group of patients and gaining experience of the center. Establishing a center is related to an initially higher risk of complications. It may increase patients' morbidity, generating perioperative intensive care unit admissions. The outcome also improves with gaining experience, improving staff learning curves, and involving novel perioperative care strategies [23–25]. In our study, respiratory and circulatory insufficiency was defined by the need for invasive mechanical ventilation and vasoactive drug use. However, there may be many different reasons for more extended ICU stay, like the prolonged need for oxygen therapy (passive or non-invasive ventilatory support), respiratory rehabilitation, the need to optimize fluid balance, the problem with postoperative oral feeding, total parenteral nutrition involvement, infection and metabolic complications. Despite the ERAS strategy being described first at the end of the twentieth century, it took several years to generate a formal ERAS protocol [26], and the enhanced recovery after surgery guidance for gynecologic oncologic was introduced only in 2016 [27, 28], allowing to improve the patient's outcome.

One sensible approach to establishing the center is the preventable, pre-emptive approach assuming scheduled intensive care unit admission of patients after major surgery. However, there is no evidence supporting either this or the opposite approach reacting for perioperative patient deterioration. Unfortunately, the opposite approach may relate to increased morbidity and mortality [1]. During the study period, there was a significant reduction in scheduled ICU admissions for patients not requiring mechanical ventilation or vasopressors. It has, in our opinion, a multifactorial origin resulting from improvement in perioperative care also related to the ERAS approach, gaining experience in the center, a modified approach to oncologic treatment, the increasing shortage of ICU beds, and the creation of a pool of high-dependency beds. The role and access to the high-dependency unit cannot be underestimated, allowing to reduce intensive care unit admission rate for patients not requiring multi-organ support therapy.

In our cohort, intensive care unit mortality rate was low (3.1%). It results from the patients' characteristics scheduled mainly for elective surgery for gynecological malignancy. Other studies analyzing similar ICU patient populations report similar mortality rates; however, overall cancer intensive care unit mortality is much higher, reaching 47–58% [29–31]. However, the high mortality in critically- ill patients represented a group of all intensive care unit oncologic admissions, including hematological patients for medical and surgical reasons of admissions.

Several factors are usually considered for planned ICU admission, like major surgery including with a long duration and risk of hypothermia and hypovolemia, numerous comorbidities, and the older age of the patient. Our data suggest that cancer patients benefit from intensive care unit admissions; however, there is an ongoing debate regarding the benefit from planned intensive care unit admissions after major surgery. This approach is based mainly on expert opinions, which raises a need for a systematic approach that allows healthcare providers to select the best strategy for oncologic patients utilizing correctly limited critical care resources [32].

This study had several limitations. It was a retrospective single-center study. We analyzed data and intensive care unit interventions without long-term outcomes, not including the stage of the neoplastic disease, which was out of the manuscript scope. We did not differentiate between scheduled and emergency ICU admissions. The database we were using for this study does not provide data regarding the course of the oncologic disease, patients' characteristics like BMI, ASA, comorbidities including sepsis, and the total number of gynecology oncologic surgeries performed in our institution. Further studies should focus on identifying risk factors of intensive care unit admission in gynecologic oncology patients.

CONCLUSIONS

Ovarian cancer was the leading cause of intensive care unit admissions in gynecologic oncology patients. Older age was the risk factor of respiratory and circulatory insufficiency. Availability of intermediate care facilities could reduce intensive care unit admissions after major surgery.

Article information and declarations

Conflict of interest

All authors declare no conflict of interest.

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