



The NEWS2 score predicts prolonged hospitalization in the intensive care unit in major surgery patients

NEWS2 skoru, majör cerrahi hastalarında uzun süreli yoğun bakım yatışını öngörür

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Abstract

Objective: Gynecological malignancies are significant causes of mortality and morbidity in women worldwide. Although surgery is an important treatment method, both the extent of the surgery and the factors related to the patient affect postoperative processes. The National Early Warning Score 2 (NEWS2) is a simple, inexpensive, and safe early warning score developed in 2012 and updated in 2017. Although it is not commonly used in surgical patients, its use in patients who will undergo major surgery may provide insights about the postoperative process. This study investigates the importance of NEWS2 and its relationship in patients with for major gynecologic oncology surgery.

Materials and Methods: Forty-four patients with gynecologic malignancies scheduled for major abdominal surgery were included in this study. Patients with a NEWS-2 score of <3 were included in group 1, and patients with a NEWS-2 score of more than 3 were included in groups 2. NEWS2 Score, Sequential Organ Failure Assessment (SOFA), and Acute Physiology and Chronic Health Evaluation 2 scores (APACHE 2) were calculated. In addition, postoperative routine clinical and laboratory parameters were evaluated. Operation time, duration of intubation in the intensive care unit (ICU), the length of the intensive care stay, and length of hospitalization were recorded.

Results: Duration of intubation in the ICU in group 1 with a NEWS2 <3 [8.2 (0-18) vs 16.2 (3-39), respectively; $p<0.01$], ICU length of stay [21.6 (4-27) vs 47.3 (4-113), respectively; $p<0.01$], length of hospitalization [11.6 (5-56) vs 18.6 (8-67), respectively; $p<0.01$]. NEWS2 >3 was significantly higher compared to group 2. The SOFA score was significantly higher in group 2 compared with group 1 [1.2±0.5 vs 4.1±1.9; respectively; $p<0.01$]. In the correlation analysis, the NEWS2 score level was positively correlated with the SOFA score ($p<0.001$, $r=0.81$) and hospitalization time ($p<0.001$, $r=0.60$) and neutrophil lymphocyte ratio (NLR) ($p<0.001$, $r=0.47$).

Conclusion: These findings suggest that the NEWS2 score may be correlated with the length of intensive care intubation, length of intensive care stay, and length of hospitalization. NEWS2 is an effective and simple scoring system that provides information about postoperative outcomes in gynecologic oncology patients scheduled for major surgery.

Keywords: NEWS2 score, gynecologic oncology, major surgery

Öz

Amaç: Jinekolojik maligniteler tüm dünyada kadınlarda mortalite ve morbiditenin önemli nedenleridir. Cerrahi tedavi önemli bir tedavi yöntemi olsa da gerek cerrahinin büyüklüğü, gerek hastaya bağlı faktörler postoperatif süreçleri etkilemektedir. The National Early Warning Score 2 (NEWS2), basit, ucuz ve güvenli bir erken uyarı skorudur. Cerrahi hastalarda kullanımı çok yaygın olmasa da majör cerrahi geçirecek hastalarda kullanımı postoperatif süreç hakkında fikir verebilir. Bu çalışmada jinekolojik onkolojik majör cerrahi geçiren hastalarda NEWS2 skorunun önemi ve ilişkisi araştırılmıştır.

Gereç ve Yöntemler: Bu çalışmaya majör cerrahi planlanan 44 jinekoloji hastası dahil edilmiştir. Grup 1'e NEWS2 <3 olan hastalar, grup 2'ye ise NEWS2 >3 olan hastalar kabul edildi. NEWS2, Sequential Organ Failure Assessment (SOFA) and Acute Physiology and Chronic Health Evaluation 2 skoru

PRECIS: We found that in gynecologic oncology patients undergoing major abdominal surgery, the duration of ICU stay, intubation time, and hospitalization were significantly shorter in patients with a NEWS2 <3 than in patients with a NEWS2 >3.

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hesaplandı. Ayrıca ameliyat sonrası rutin klinik ve laboratuvar parametreleri kaydedildi. Operasyon süresi, yoğun bakımda entübasyon süresi, yoğun bakım kalış süresi ve hastane kalış süresi kaydedildi.

Bulgular: NEWS2 <3 olan Grup 1'de yoğun bakımda entübasyon süresi [8,2 (0-18) vs 16,2 (3-39), sırasıyla; $p<0,01$], yoğun bakımda kalış süresi [21,6 (4-27) vs 47,3 (4-113), sırasıyla; $p<0,01$], hastane kalış süresi [11,6 (5-56) vs 18,6 (8-67), sırasıyla; $p<0,01$], NEWS2 >3 olan grup 2 ile karşılaştırıldığında anlamlı olarak daha yüksekti. SOFA Grup 1 ile karşılaştırıldığında anlamlı olarak Grup 2'de daha yüksekti [1,2±0,5 vs 4,1±1,9; sırasıyla; $p<0,01$]. Spearman korelasyon analizinde, NEWS2, SOFA skoru ($p<0,001$, $r=0,81$) ve hastane kalış süresi ($p<0,001$, $r=0,60$) ve nötrofil lenfosit oranı ($p<0,001$, $r=0,47$) ile pozitif korele idi.

Sonuç: Bu bulgular NEWS2 skorunun yoğun bakım entübasyon süresi, yoğun bakım kalış süresi ve hastane kalış süresi ile korele olabileceğini göstermektedir. Majör cerrahi geçirmesi planlanan jinekolojik onkoloji hastalarında NEWS2 postoperatif sonuçlar hakkında bilgi veren etkin ve basit bir skorlama sistemidir.

Anahtar Kelimeler: NEWS2 skor, jinekolojik onkoloji, majör cerrahi

Introduction

Gynecological cancers are the fourth most common type of cancer among women worldwide. Survival has increased with effective treatment. While there is ongoing interest in developing new treatments, surgical procedures remain the most popular option^(1,2). Complications resulting from major surgeries can impact both morbidity and survival. For this reason, it is crucial to identify these patients beforehand and take preventive measures against potential complications⁽²⁾.

Early warning scores are typically scoring systems that are calculated based on patient's vital signs. These systems, first described in 1997, are now commonly used to predict unfavorable patient outcomes, such as intensive care unit (ICU) stays⁽³⁾. The National Early Warning Score (NEWS), associated with clinical outcomes in surgical patients, including hospital mortality and admission to the ICU, was developed by the Royal College of Physicians^(4,5). In this scoring system, clinical patient data such as respiratory rate, saturation, systolic blood pressure, heart rate, consciousness, and temperature are recorded preoperatively. This system, which does not require a laboratory parameter, is also considered to be very cost effective. Gynecological cancer surgery is a complex procedure associated with several prognostic complications such as prolonged hospitalization and delay in treatment⁽⁶⁾.

Materials and Methods

This study was conducted prospectively at the Süleyman Demirel University Faculty of Medicine Hospital. Necessary permissions for the study and ethics committee approval were obtained from the Süleyman Demirel University Ethics Committee (date: 11.02.2023, approval number: 58). Informed consent was obtained from all patients or their relatives. The study included 44 patients scheduled for major abdominal surgery (44 females). In addition to standard preoperative evaluation, the NEWS2 score was calculated on the day of the operation, and patients with a NEWS2 Score of <3 were defined as group 1 (n=19) and patients with a NEWS2 score of >3 as group 2 (n=25) (Table 1). The preoperative hemogram and biochemistry parameters of the patients were recorded (Table 2). Twenty-six patients were operated on for ovarian cancer, 5 for cervical cancer, and 13 for

endometrial cancer. All patients were operated under general anesthesia. A combined epidural spinal catheter was applied for postoperative analgesia. Catheterization was not performed in 3 patients because they rejected the procedure. All catheterized patients (n=41) received intrathecal morphine before surgery. Surgical time, complication time, and intubation time were recorded. Postoperative intubation time, ICU length of stay, hospitalization, and complications were recorded for patients whose postoperative follow-up continued in the ICU. The first 24-hour Sequential Organ Failure Assessment (SOFA) and Acute Physiology and Chronic Health Evaluation (APACHE) 2 scores were calculated and recorded (Table 1). Patients with an operation duration of 2 h, no malignancy, and patients who were not admitted to the postoperative ICU were excluded from the study.

Statistical Analysis

Statistical analysis was performed using SPSS software version 26 (SPSS, Chicago, IL). The distribution of continuous variables was tested by the Kolmogorov-Smirnov test. Continuous variables were expressed as mean ± standard deviation or median and 25th-75th percentile values (interquartile range) (normally and not normally distributed, respectively). Categorical variables were expressed as percentages. Statistical differences among groups were tested by Mann-Whitney U. Spearman correlation coefficients were calculated to evaluate the relationships between variables. Thereafter, binary logistic regression analyzes were performed stepwise to identify the possible association of NEWS2 levels as a dependent variable with potential confounding factors. These independent confounders were ICU and hospitalization time, operation time, neutrophil to lymphocyte ratio (NLR), and white blood cell. P value less than 0.05 was considered.

Results

Demographic and clinic data for the groups are presented in Table 1. The mean age of patients was 61±10 years in Group 1, and 65±9 years in Group 2. No significant difference was found between the groups. The presence of diabetes mellitus was similar between the groups ($p=0,50$). However, the presence of hypertension was significantly higher in group 2 ($p=0,02$).

The operation time was comparable between the two groups (p= 0.89). At the end of the operation, 20 patients (80%) were transferred to the ICU as intubated in group 1 and 19 patients (100%) were transferred as intubated in group 2 (Table 1). Statistical differences among groups were tested by Mann-Whitney U.

In group 2, the duration of a mechanical ventilator in the ICU [8.2 (0-18) vs 16.2 (3-39) days, respectively, p<0.01], the total duration of the ICU stay [21.6 (4-27) vs 47.3 (4-113) hours, respectively, p<0.01], and the duration of hospitalization [11.6 (5-56) vs 18.6 (8-67) days, respectively, p<0.01] were significantly higher than group 1. Similarly, the SOFA Score (1.2±0.5 vs 4.1±1.9, respectively, p<0.01) was also higher in groups 2. However, the APACHE 2 score was similar between the groups (p=0.77, Table 1).

The neutrophil count [4.8 (1.8-13.6) vs 7.2 (3.4-20.8) x10³/mL, respectively, p<0.01] and NLR [4.4 (1.4-42.5) vs 5.6 (1.4-20.6), respectively; p<0.01] were significantly higher in group 2. Similarly, the glucose (131±52 vs 177±62 mg/dL, respectively; p<0.01) and the aspartate transaminase level [13 (8-23) vs 38 (8-148) U/L, respectively; p<0.01] were also prominently higher in group 2 than in group 1 (Table 2).

Table III shows the results of binary logistic regression. High values of the NEWS2 score (>3) were significantly associated with the length of stay in the ICU (p=0.042). The final model was found to fit the data adequately (Hoshmer-Lemeshow χ^2 = 14.65, sig = 0.01). In the Spearman correlation analysis, the NEWS2 score was positively correlated with the SOFA score (p<0.001, r=0.81) and the hospitalization time (p<0.001, r=0.60) and NLR (p<0.001, r=0.47) (Table 3).

Table 1. Comparison of demographic and clinical parameters between the groups

NEWS2 score	<3 n=25	>3 n=19	P
Mean age, year	61±10	65±9	0.18
Diabetes Mellitus, n (%)	9 (36)	6 (31)	0.50
Hypertension, n (%)	7 (28)	12 (63)	0.02
Mechanical Ventilator, n (%)	20 (80%)	19 (100%)	0.06
Mechanical Ventilator duration, day	8.2 (0-18)	16.2 (3-39)	<0.01
Hospitalized time, day	11.6 (5-56)	18.6 (8-67)	<0.01
ICU time, hour	21.6 (4-27)	47.3 (4-113)	<0.01
Operation time, hour	515±90	534±120	0.89
SOFA score, n	1.2±0.5	4.1±1.9	<0.01
APACHE score, n	14.7±3.9	15.1±4.4	0.77

APACHE: Acute Physiology and Chronic Health Evaluation, ICU: Intensive Care Unit, NEWS2: The National Early Warning Score 2, SOFA: Sequential Organ Failure Assessment Score

Table 2. Change in laboratory characteristics

NEWS2 score	<3 n=25	>3 n=19	P
Glucose, mg/dL	131±52	177±62	<0.01
Creatinine, mg/dL	0.64 (0.4-1.7)	0.75 (0.3-1.6)	0.09
GFR	95±16	85±24	0.06
Sodium, mg/dL	141±20	135±22	0.18
Potassium, mg/dL	4.5±0.6	4.4±1.1	0.12
Calcium, mg/dL	9.1±0.9	8.6±1.3	0.19
Magnesium, mg/dL	1.9±0.3	1.8±0.2	0.79
AST, U/L	23 (11-50)	58 (12-282)	0.10
ALT, U/L	13 (8-23)	38 (8-148)	<0.01
Hemoglobin, g/dL	12.2±1.2	11.8±1.8	0.44
Platelet, x10 ³ /mm ³	293±69	300±90	0.77
Mean Platelet Volume, fl	8.2±0.8	8.5±1.1	0.54
Eosinophyl, x10 ³ /mL	0.11 (0.01-0.60)	0.08 (0.01-0.20)	0.65
Neutrophyl, x10 ³ /mL	4.8 (1.8-13.6)	7.2 (3.4-20.8)	<0.01
Lymphocyt, x10 ³ /mL	1.94 (0.20-6.10)	1.52 (0.70-3.10)	0.13
NLR	4.4 (1.4-42.5)	5.6 (1.4-20.6)	<0.01
WBC, x10 ³ /mL	7.4±3.3	9.6±4.3	0.04

ALT: Alanine transaminase, AST: Aspartate transaminase, NEWS2: The National Early Warning Score 2, NLR: Neutrophil lymphocyte ratio, WBC: White blood cells

Discussion

In this study, NEWS2 was used to predict postoperative complications in patients with gynecologic oncology who underwent major abdominal surgery. In patients undergoing major abdominal surgery for gynecologic oncology, those with a NEWS Score of <3 had significantly shorter durations of ICU stay, intubation time, and hospitalization compared to those with a NEWS Score >3. Gynecological oncology cases that undergo major open abdominal surgery should be carefully evaluated in terms of perioperative complications. Factors such as age, type of malignancy, patient weight, and length of hospitalization are associated with increased complications⁽⁷⁾. Enhanced recovery after surgery protocols, which have been actively implemented in our clinic in major gynecologic oncology cases, are a set of recommendations that reduce the length of stay, complications, and cost without increasing readmission or mortality rates in gynecologic oncology surgery⁽⁸⁾.

In major abdominal surgeries, early and efficient pain management prevents atelectasis, facilitates early mobilization, and shortens the length of hospitalization^(9,10). In our study, all

Table 3. The results of the binary logistic regression. The dependent variable was the NEWS2 score, independent variables were the ICU time, hospitalization time, operation time, MV time, and NLR. High values of the NEWS2 score (>3) were significantly associated with the length of stay in the ICU

	B	S.E.	Wald	df	Sig.	Exp (B)	Lower	Upper
The ICU time, hour	0.156	0.077	4.142	1	0.042	1.169	1.006	1.358
Hospitalization time, day	0.057	0.053	1.151	1	0.283	1.059	0.954	1.175
Operation time, hour	-0.003	0.005	0.364	1	0.564	0.997	0.987	1.007
MV time, hour	0.086	0.082	1.096	1	0.295	1.090	0.928	1.281
NLR	-0.008	0.070	0.014	1	0.906	0.992	0.864	1.138
Constant	-1.758	2.526	0.485	1	0.486	0.172		

ICU: Intensive care unit, MV: Mechanical ventilation, NLR: Neutrophil lymphocyte ratio

eligible patients received a combined epidural catheter during the pre-operative period; intrathecal morphine was administered during the pre-operative period; and analgesia was provided with an epidural catheter during the follow-up. There was no need to administer parenteral rescue analgesics during or after the intensive care period. The severity of surgery is associated with increased major postoperative complications after gynecologic procedures^(7,11). There are a limited number of studies with scoring systems for the early detection of patients with high probability of complications. In studies involving gynecologic oncology patients, 24% of all unplanned readmissions were attributed to uncontrolled symptoms or minor complications that were potentially preventable^(11,12). The identification of these patients with simple scoring systems may also prevent complications such as rehospitalization. It is evident that new studies are needed in this regard. Early warning scoring systems are scoring systems calculated on the vital signs of patients and are widely used to identify patients who are ill or whose condition is deteriorating, including those admitted to surgical areas of hospitals⁽¹³⁾. NEWS2 has been shown to be very useful for predicting conditions such as ICU admission, death, and cardiopulmonary resuscitation. There have been very limited studies in patients before or after surgery. Although NEWS2 is a score developed for general hospitalization, it is beneficial for scoring for surgery⁽¹⁴⁾. There are very limited studies predicting patient outcomes in gynecologic oncology patients undergoing major surgery. The Surgical Apgar score, APACHE 2, and the surgical complexity score have been used and recommended for this purpose. The Surgical Apgar Score predicts postoperative complications in patients undergoing cytoreductive surgical procedures for stage III and IV ovarian cancer. It is an easy-to-apply scoring system as simple parameters are used, similar to our study⁽¹⁵⁾. A surgical complexity score is a scoring system produced for this purpose, similar to the surgical Apgar score. It can be predicted and quality of care can be improved with this score calculated⁽¹⁶⁾.

High APACHE 2 scores were associated with mortality in gynecologic oncology patients⁽¹⁷⁾. In contrast to this study, we

did not find a significant association between the APACHE 2 score and mortality.

The SOFA score is a scoring system that indicates the severity of the disease in the ICU. It is frequently used to indicate mortality, especially in sepsis patients. This scoring system, which evaluated six different systems, is difficult to implement outside the ICU due to the necessity of blood collection from the patient and its cost. In one study, it was used to predict mortality in cardiovascular surgery patients⁽¹⁸⁾. In our study, the SOFA score correlated with NEWS2 and with the duration of intensive care and hospitalization. Multiple blood draws and laboratory dependency limit its use, especially in surgical patients. We found no use for major gynecologic oncology surgery in the literature.

Conclusion

We suggest that the NEWS scoring system, which is more commonly used in nonsurgical patients, can predict postoperative patient parameters in gynecologic oncology patients undergoing major abdominal surgery, and further studies are warranted in this regard.

Ethics

Ethics Committee Approval: This study was conducted prospectively at the Süleyman Demirel University Faculty of Medicine Hospital. Necessary permissions for the study and ethics committee approval were obtained from the local ethics committee (date: 11.02.2023, approval number: 58).

Informed Consent: Informed consent was obtained from all patients or their relatives.

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Authorship Contributions

Surgical and Medical Practices: P.K., İ.T., E.E., Concept: P.K., A.B., B.G.C., Design: P.K., E.E., B.G.C., Data Collection or Processing: P.K., A.B., İ.T., Analysis or Interpretation: P.K., B.G.C., Literature Search: P.K., A.B., İ.T., Writing: P.K., A.B., B.G.C.

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