Original Article

Evaluation of Factors Associated with Oncological Emergencies in Hematological and Solid Malignancies

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ABSTRACT

Aim: The number of patients with cancer admitted to emergency service (ES) is increasing daily, and oncologic emergencies (OEs) are a significant cause of mortality among these patients. In this study, we aimed to examine the reasons for ES visits of patients with cancer and to determine the frequency of OEs and related factors.

Methods: Patients aged 18 years and older with malignant neoplasms admitted to our hospital's ES between 2017 and 2020 were retrospectively analyzed. Demographic and clinical characteristics, laboratory parameters, and diagnoses were obtained from the hospital's electronic database and patient files. In terms of diagnoses, they were classified as oncologic and other emergency diagnoses (OED), and statistical analyses were performed.

Results: The study was completed in 1.593 patients. The median age was 59. The prevalence rates of hematologic and solid malignancies were 6.5% and 93.5%, respectively. Leukemia and gastrointestinal system malignancies were the most common hematological and solid malignancies. In total, 90.8% of the patients had metastases. Forty-eight point seven percent of the patients were diagnosed as OEs. Forty-nine point five percent of the patients were discharged from the ES, 48.2% were hospitalized, and 0.6% died at the ES. In total, 11.8% died in the ES or after hospitalization. The mortality rate in the OE group was 22.2%. OEs were more common in patients with hematological malignancies, with a 67.3% ratio (p<0.001). Among solid malignancies, OEs were more frequent in gynecological, lung and central nervous system malignancies (p<0.001). No significant difference was found between the OE and OED groups in terms of the presence of metastasis (p=0.108); therefore, when evaluated with the type of organ metastasis, OEs were more common in lung, brain, liver, and bone metastases (p<0.001). Admission to ES by ambulance, presence of comorbid diseases, higher Eastern Cooperative Oncology Group Performance Status Scale (ECOG PS), potassium, calcium, total bilirubin, C-reactive protein (CRP), and lactate values were associated with an increased risk of OE, whereas female gender, solid malignancy, and higher hemoglobin and blood urea nitrogen values were associated with a decreased risk of OE. A higher ECOG PS score [odds ratio (OR)=3.806, p<0.001], presence of brain metastasis (OR=3.225, p<0.01), higher CRP (OR=1.010, p<0.001) and lactate (OR=1.227, p<0.01) were found to be associated with mortality in patients with OE.

Conclusion: Classifying cancer patients admitted to the ES as OEs and non-OEs may reduce the workload of ES, enable physicians to recognize OEs earlier, make rapid and accurate decisions appropriate to the situation, and provide emergency intervention for oncologic complications.

Keywords: Neoplasms, medical oncology, emergencies

Introduction

Cancer is a significant health problem in Turkey and worldwide. One of every six deaths in the world and one of every five deaths in Turkey are due to cancer [1,2]. Advances in medical research, treatment methods, and technology have increased life expectancy and extended the follow-up period for patients with cancer [2]. Oncologic emergencies (OEs) are clinical manifestations of metabolic, neurologic, cardiovascular, hematologic, and/or infectious origin that develop directly or indirectly due to cancer or that require emergency treatment [3]. Complaints may vary from person to person due to disease

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stage, age, diagnosis, metastasis, comorbidity, and other factors [3,4]. According to the mechanism of occurrence, they may be metabolic (tumor lysis syndrome, malignant hypercalcemia, hyponatremia and inappropriate anti-diuretic hormone syndrome), mechanical/obstructive (superior vena cava syndrome, cardiac tamponade, hyperviscosity syndrome, malignant pleural effusion/ascites, medulla spinalis compression..), treatment-related (extravascular escape of chemotherapeutics, cytokine release syndrome, anaphylaxis, and capillary leak syndrome, etc.), and blood-related (bone marrow suppression, anemia, febrile neutropenia, etc.) [4]. These events can occur at any stage of the disease, from the onset to the end stage. Failure to diagnose and treat patients with these conditions leads to high morbidity and mortality rates [4]. Patients with cancer are frequently admitted to the emergency service (ES) due to local and systemic diseases caused by cancer, treatment-related complications, end-of-life symptoms, and OEs [3]. OEs are the most important clinical conditions, accounting for 30-50% of oncology patients presenting to the ES [5]. With the increasing prevalence of cancer, ES visits among patients with cancer are increasing [5]. The follow-up and treatment of cancer requires multidisciplinary teamwork. Emergency physicians are an important part of this team. What is expected from emergency physicians on the team is to determine whether there is an OE during the emergency admission of patients with cancer. Therefore, detailed anamnesis of patients with cancer should be performed, system examinations should be performed, and diagnostic tests for complaints and examination findings should be requested within a short period. Emergency interventions should also be initiated in the presence of OE. Failure to correctly diagnose a patient and treatment delays may result in a poor prognosis for the patient [5]. The current study aimed to determine the frequency of OEs and demographic, clinical, and laboratory factors associated with diagnosis and mortality in patients with cancer admitted to our oncology branch hospital.

Methods

This retrospective study was conducted at the ES of University of Health Sciences Turkey, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital after Ethics Committee Approval (no. 2023-09/78, date: 19.10.2023). We retrospectively analyzed 5,000 patients aged 18 years and older who presented to the ES between 2017 and 2020 and were diagnosed with malignant neoplasm according to International Classification of Diseases-9. Oncology patients who were being treated in another center, palliative care patients who were not receiving active treatment, follow-up patients who were cured, newly diagnosed patients in the investigation process, and patients referred to our hospital for hospitalization from another center were excluded from the study. The study was completed in 1,593 patients. Demographic characteristics, mode of presentation (outpatient or ambulance service), presenting complaint, cancer diagnoses, oncologic treatments [surgery/chemotherapy/radiotherapy (RT)], laboratory parameters (hemogram, biochemistry, blood gas, coagulation..) Glasgow coma scale and Eastern Cooperative Oncology Group Performance Status Scale (ECOG PS), diagnoses [OE-other emergency diagnoses (OEDs)], and outcomes (hospitalization/discharge/death) were obtained from the hospital electronic database and patient files. Patients were divided into two groups: OE and OEDs according to the diagnoses received at discharge, hospitalization, and referral, and demographic, clinical characteristics, and outcomes were compared between the groups.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences 25.0 (IBM Co®. USA). The Kolmogorov-Smirnov test was used to detect the normal distribution. Categorical data are expressed as numbers and percentages (%). Numerical variables without normal distribution are presented as median and interquartile range (25th-75th percentile). Categorical data were compared using the chi-square test according to the percentage of the expected count. Yate's correction or likelihood ratio was performed. Numerical data with or without normal distribution were compared using the independent samples t-test and Mann-Whitney U test, respectively. Binary logistic regression analysis was performed to identify variables associated with OE diagnosis and mortality in patients with OE.

Results

This study included 1.593 patients diagnosed with malignancy. The average age of the patients was 59 years. 53.2% were women and 46.8% were men. 57.1% of the patients were outpatients, and 42.9% came to the ES by ambulance. 93.5% of the patients had solid organ malignancy, and 6.5% had hematologic malignancy. The most common hematologic malignancy was leukemia, with a rate of 3.3%. The most common solid malignancies were gastrointestinal cancer 32.6%, breast cancer 27.0%, lung cancer 17.3%, genitourinary cancer 8.5% and gynecologic cancer 7.6%. 90.8% of patients had metastases. The most common organ metastases were lung, bone, liver, and brain. In total, 64.5% of the patients had undergone surgery for cancer. 73.2% had received chemotherapy, and 29.7% had received RT in the previous month. Furthermore, 56.7% of the patients had at least one comorbid disease. Hypertension (39.9%), diabetes mellitus (18.8%), coronary artery disease (12.8%), and chronic obstructive pulmonary disease 8.1% were the most common comorbidities. The median ECOG PS score was 1.0. After emergency admission, 43.3% of the patients were discharged, 48.2% were hospitalized, and 0.6% died in the ES. Additionally, 10% of the patients died after transfer to another clinic or intensive care unit (ICU). The mortality rate both in the ES and after hospitalization was higher in the OE group (p<0.001). Demographic and clinical characteristics of patients with cancer admitted to the ES are presented in Table 1. The most common reasons for admission to ES were pain (abdominal pain, chest pain, muscle and joint pain, surgical site pain, pain due to mass pressure, headache) at 72.6%, fatigue at 66.5%,

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fever at 29.4%, nausea-vomiting at 27.8%, shortness of breath at 25.0%, neurologic symptoms (seizure, confusion, dizziness, loss of strength, etc.) at 18.2%, cardiac complaints (palpitations, syncope, etc.) at 9.6%, and genitourinary symptoms (dysuria, hematuria, anuria, vaginal bleeding, etc.) at 9.3%, respectively.

47.8% of the patients included in the study had OE diagnoses, and 52.2% had OED diagnoses. According to the mechanism of occurrence, the most common OEs were mechanical (47.3%), blood-related (45.6%), metabolic (11.0%), and treatment-related (2.6%). Sixty-two of the patients had two different OE diagnoses, and only 0.4% had three different OEs. Among all OE diagnoses, febrile neutropenia and sepsis were the most common (22.9%). The most common OEDs were chemotherapy side effects (nausea-vomiting, diarrhea, dehydration) at 32.6%, pain (bone-joint pain, abdominal pain, chest pain, headache, etc.) at 18.8%, and infectious diseases

(upper respiratory infections, cellulitis, etc.) with 17.5%. OE and OED diagnoses are presented in Table 2.

In our study, the mean age in the OE group was 58.63±12.97 and higher than that in the OED group, with a mean age of 57.18±12.87 (p<0.031), and the male/female ratio was higher for the OE group (p<0.01). OEs were more common in hematological malignancies, with a 67.3% ratio (p<0.001). Among solid malignancies, OEs were more frequent in lung cancer and central nervous system malignancies (p<0.001). OEs were more common in patients with metastasis; also, when evaluated with the type of organ metastasis, OEs were more common in lung, brain, liver, and bone metastases (p<0.001). The most common symptoms in the OE group were weakness (66.5%), abdominal pain (29.8%), fever at 29.4%, nausea or vomiting (27.8%), musculoskeletal pain (25.0%), and dyspnea (25.0%). The OE group's hospitalization and mortality ratios

Table 1. The demographic and clinical features of patients with cancer admitted to the emergency service		
	n/% (n=1593)	Median (IQR) or mean±SD
Age (years)		59.0 (50.0-67.0)
Sex Female Male	847 (53.2) 746 (46.8)	
The type of malignancy Solid Hematological	1489 (93.5) 104 (6.5)	
Disease status Locally advanced stage Metastatic disease Recurrence/metastasis Advanced-stage metastatic Refractory/recurrence	561 (35.1) 554 (34.8) 327 (20.5) 113 (7.1) 38 (2.4)	
Metastasis (local or distant)	1447 (90.8)	
Metastasis location Another organ/location Lung Bone Liver Brain	1403 (88.1) 486 (30.5) 423 (25.6) 401 (25.2) 119 (7.5)	
History of cancer surgery Yes No	1028 (64.5) 565 (35.5)	
Chemotherapy in the previous month	1200 (73.2)	
Radiotherapy in the previous month	473 (29.7)	
Patients with comorbidities	904 (56.7)	
ECOG PS		1.0 (1.0)
The type of admission Outpatient Ambulance	910 (57.1) 683 (42.9)	
Outcomes of emergency services Discharged Hospitalized Transferred to another center Death at the ES Refuse of treatment	789 (49.5) 768 (48.2) 24 (1.5) 10 (0.6) 2 (0.1)	
IQR: Interquartile range, SD: Standard deviation, ECOG PS: Eastern Cooperative Oncology Group Performance Status Scale, ES: Emergency service		

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Table 2. Emergency diagnosis for patients with cancer admitted to the emergency service				
Oncologic emergencies (n=761)	**(n/%)**	**Other emergency diagnosis (n=832)**	**(n/%)**
Metabolic causes	83 (11.0)		
TLS	43 (5.7)	Chemotherapy side effects	271 (32.6)
Syndrome involving inappropriate ADH	22 (2.9)	Pain	156 (18.8)
Maling hypercalcemia	18 (2.4)	Infectious diseases	146 (17.5)
Mechanic causes	361 (47.4)		
Malignant pleural effusion	128 (16.8)	Pathology of the respiratory system	58 (7.1)
Intestinal and biliary obstruction	91 (12.0)		
Increased ICP	83 (10.9)	Surgical complications	47 (5.6)
Cardiac tamponade	18 (2.4)		
Pathological fracture	14 (1.8)	Radiotherapy-associated side effects	42 (5.0)
VCSS	12 (1.6)		
Spinal cord compression	11 (1.4)	Acute renal failure	39 (4.7)
Hyper viscosity	4 (0.5)		
Treatment-related causes	20 (2.6)	Pathology of the gastrointestinal tract	31 (3.7)
Hemorrhagic cystitis	9 (1.2)		
Anaphylaxis/capillary leakage syndrome	9 (1.2)	Malnutrition/electrolyte imbalance	15 (1.8)
Chemotherapeutic extravasation	2 (0.2)		
Blood disorders	347 (45.6)	Central nervous system pathology	11 (1.3)
Febrile neutropenia and sepsis/septic shock	174 (22.9)		
Anemia/leucopenia/thrombocytopenia	85 (11.2)	Pathology of the cardiovascular system	10 (1.2)
Acute bleeding/coagulopathy	45 (5.9)		
Arterial or venous embolism	41 (5.4)	General symptom	4 (0.5)
GVHD	2 (0.3)		
Multiple oncologic emergency diagnoses	50 (6.6)	Cardiopulmonary arrest	2 (0.2)
Total number of diagnoses: ADH: Anti-diuretic hormone, ICP: Intracranial pressure, VCSS: Vena cava superior syndrome, GVHD: Graft-versus-host disease, TLS: Tumor lysis syndrome			

were significantly higher (p<0.001). The median ECOG score was 2.0 in the OE group, 1.0 in the OED group, and significantly higher in the OE group (p<0.001). The demographic and clinical findings were compared among the groups assigned according to the presence of OE (Table 3). In our study, two groups were compared in terms of laboratory parameters. White blood cells (WBC), neutrophil count, hemoglobin (HGB), platelet count, calcium, total protein, and albumin levels were significantly lower in the OE group (p<0.05). Blood urea nitrogen (BUN), uric acid, phosphorus, aspartate aminotransferase (AST), amylase, total and direct bilirubin, C-reactive protein (CRP), D-dimer, international normalization ratio (INR) and lactate levels were higher in the OED group (p<0.05). The frequency of pyuria was higher in the OED group than in the OE group (p<0.001). Abnormal electrocardiogram findings were detected in 20% of the patients. Abnormal ECG findings were more common in the OE group (p<0.001). The laboratory values of the OE and OED groups are presented in Table 4.

The binary logistic regression analysis found that admission to ES by ambulance, presence of comorbid diseases, higher ECOG PS, higher potassium, calcium, total bilirubin, CRP, and lactate values were associated with an increased risk of OE, whereas female gender, solid malignancy, and higher HGB and BUN values were associated with a decreased risk of OE (Table 5). The analysis did not include D-dimer, phosphorus, and INR because of the relatively low number of measurements. When regression analysis was performed for mortality in the OE group by adding ALT and creatinine to the variables in Table

5, a higher ECOG PS score [odds ratio (OR)=3.806, p<0.001], presence of brain metastases (OR=3.225, p<0.01), higher CRP (OR=1.010, p<0.001) and lactate (OR=1.227, p<0.01) were found to be associated with mortality in patients with OE.

Discussion

Patients with cancer present to the ES with a variety of clinical presentations related to the underlying disease or as a result of treatment complications. ES visits of patients with cancer may be associated with life-threatening OEs with a high mortality rate. Early diagnosis and appropriate treatment can effectively restore quality of life [6].

Data from the Ministry of Health and several studies have found a high rate of male sex among patients with cancer [7-11]. Therefore, female patients were predominant in our study, similar to the results of Bozdemir et al. [12] and Swenson et al. [13]. Our median age was 59 years, which is similar to that of similar studies in the literature [7,10,11]. Comorbidities are more common in patients with cancer than in the general population; one study reported that more than half of patients with cancer aged >75 years had at least three comorbidities [14]. The most common comorbidities were hypertension, diabetes, and heart disease. Comorbid conditions in patients with cancer lead to more ES visits and may lead to increased mortality [14]. In terms of cancer type, the most common solid organ cancers in our study were gastrointestinal, breast, and lung cancers. Similar to studies by Bozdemir et al. [12], Alıcı et al. [15], Kocak et al. [16]. The presence of metastases

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Table 3. Comparison of demographic and clinical features between the oncological emergency and non-oncological emergency patient groups			
	Oncological emergency (n=761)	Other emergency diagnosis (n=832)	p
Age (mean±SD)	58.63±12.97	57.18±12.87	0.031
Sex (n/%) Female Male	377 (44.5) 384 (51.5)	470 (55.5) 362 (48.5)	<0.01
Malignancy type (n/%) Hematological Solid	70 (67.3) 691 (46.4)	34 (32.7) 798 (53.6)	<0.001
Hematological (n/%) Leukemia Lymphoma Others	41 (77.4) 22 (56.4) 7 (53.8)	12 (22.6) 17 (43.6) 6 (46.2)	<0.001
Organ/system tumors (n/%) Breast Gastrointestinal system Lung Urogenital system Ear-nose-throat-larynx Gynecological Cranial Bone and soft tissue Others	130 (32.3) 215 (44.3) 160 (62.2) 56 (44.1) 14 (43.8) 72 (63.7) 25 (89.3) 9 (40.9) 10 (45.5)	272 (67.7) 270 (55.7) 97 (37.8) 71 (55.9) 18 (56.2) 41 (36.3) 3 (10.7) 13 (59.1) 12 (54.5)	<0.001
Location of metastasis (n/%) Another organ/location Lung Bone Liver Brain	682 (89.6) 658 (86.5) 318 (41.8) 240 (31.5) 229 (30.1) 87 (11.4)	765 (91.9) 744 (89.4) 168 (20.2) 183 (22.0) 172 (20.7) 32 (3.8)	0.108 0.144 <0.001 <0.001 <0.001 <0.001
Chemotherapy in the previous month (n/%)	560 (46.7)	640 (53.3)	0.130
Radiotherapy performed in the previous month (n/%)	242 (51.2)	231 (48.8)	0.879
Patients with comorbidity (n/%)	436 (48.2)	468 (51.8)	0.686
Duration of cancer diagnosis (years)	5.0 (4.0-6.0)	5.0 (4.0-5.0)	0.076
ECOG PS (median, IQR)	2.0 (1.0-2.0)	1.0 (0.0-1.0)	<0.001
Outcome of ES Hospitalized Discharged Transferred to another center Death Refuse of treatment Total mortality	606 (79.6) 28 (16.8) 19 (2.5) 6 (0.8) 2 (0.3) 169 (22.2)	162 (19.5) 661 (79.4) 5 (0.6) 4 (0.5) 20 (2.4)	<0.001 <0.001
IQR: Interquartile range, SD: Standard deviation, ECOG PS: Eastern Cooperative Oncology Group Performance Status Scale, ES: Emergency service			

is one of the most important factors in the management of patients with cancer because it causes various complications, decreases survival, and leads to frequent ED visits [7]. In our study, 90.8% of patients had metastatic disease. In similar studies from our country, the metastasis ratio was 54-72.9% [7,8,12]. The presence of metastases may be an important indicator of emergency physicians to more accurately evaluate the management of patients with cancer. In our study, 73.2% of patients had received chemotherapy and 29.7% had received RT in the previous month. A study conducted in Australia showed that 70% of visits to the ES by patients with cancer occurred within 4 weeks after chemotherapy, and 88% of such visits resulted in hospitalization [17]. Fatigue, pain, fever, and dyspnea were the most common reasons for ES visits. In similar studies conducted in our country, dyspnea was the most common cause of presentation [17-19]. Pain, gastrointestinal symptoms, and general condition deterioration have been listed as the most common reasons for admission to ES in different studies [7,9,13]. OE and OED frequencies were 47.8% and 52.2%. İn the OE group, the mean age was

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Table 4. Comparison of laboratory results between patients with and without oncological emergency			
Laboratory parameters	Oncological emergency (n=761)	Other emergency diagnosis (n=832)	p
WBC (mm³)	7700.00 (2700.00-13300.00)	8100.00 (5550.00-11450.00)	**<0.01**
Neutrophil count (mm³)	5500.0 (1400.00-9900.00)	5700.00 (3500.00-8900.00)	**<0.001**
HGB (mg/dL)	10.4 (8.8-12.0)	11.3 (10.1-12.6)	**<0.001**
Platelet count (mm³)	191.000 (95000-311000)	243000 (174000-318500)	**<0.001**
Glucose (mg/dL)	116.0 (100.0-150.0)	117.00 (101.00-148.00)	0.144
BUN (mg/dL)	19.0 (12.4-32.0)	18.0 (12.9-26.0)	**<0.001**
Creatinine (mg/dL)	0.7 (0.5-1.2)	0.8 (0.6-1.2)	0.266
Uric acid (mg/dL)	5.4 (4.0-6.9)	5.1 (4.1-6.1)	**<0.001**
Na (mg/dL)	136.0 (132.0-139.0)	136.0 (134.0-139.0)	0.051
K (mg/dL)	4.1 (3.7-4.7)	4.2 (3.7-4.6)	0.152
Ca (mg/dL)	8.3 (7.5-8.9)	8.6 (8.0-9.2)	**<0.001**
P (mg/dL)	4.1 (3.1-5.8)	3.3 (3.9-5.0)	0.028
Total protein (mg/dL)	5.4 (4.9-6.1)	6.0 (5.1-6.5)	**<0.001**
Albumin (mg/dL)	3.1 (2.4-3.5)	3.4 (3.0-3.9)	**<0.001**
ALT (U/L)	19.0 (12.0-39.0)	19.0 (12.0-30.0)	0.052
AST (U/L)	26.0 (18.0-50.0)	23.4 (17.0-37.0)	**<0.001**
Amylase (U/L)	47.0 (32.0-85.0)	45.0 (31.5-68.0)	**<0.01**
Total bilirubin (mg/dL)	0.8 (0.5-1.2)	0.6 (0.4-1.0)	**<0.001**
Direct bilirubin (mg/dL)	0.2 (0.1-0.5)	0.1 (0.1-0.3)	**<0.001**
CRP (mg/dL)	68.0 (14.0-140.0)	8.0 (0.0-62.0)	**<0.001**
D-Dimer (ng/mL)	2850.00 (1550.00-5400.00)	1260.00 (630.00-3452.25)	**<0.001**
INR	1.2 (1.1-1.5)	1.1 (0.9-1.1)	**<0.001**
Troponin (ng/mL)	0.11 (0.10-0.23)	0.10 (0.08-0.16)	**<0.001**
pH	7.36 (7.33-7.43)	7.36 (7.35-7.39)	0.403
Lactate	2.1 (1.3-3.4)	1.2 (0.9-2.1)	**<0.001**
Urinary analysis Normal Pyuria Hematuria	583 (76.6) 44 (5.8) 17 (2.2)	557 (66.9) 94 (11.3) 2 (0.2)	**<0.001**
Electrocardiography Normal sinus rhythm Abnormal findings	480 (63.1) 232 (30.4)	627 (75.4) 45 (5.4)	**<0.001**
WBC: White blood cell, HGB: Hemoglobin, BUN: Blood urea nitrogen, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, CRP: C-reactive protein, INR: International normalization ratio			

58.63±12.97 years, and male gender was more prevalent, which is consistent with the literature [7-9]. The frequency of comorbid disease was similar between the OE and OED groups. However, the incidence of diabetes mellitus was higher in the OE group. Regarding cancer type, OEs had a higher proportion of hematologic malignancies than solid malignancies. Among solid malignancies, the frequency of OE was higher in patients with central nervous system tumors, gynecological and lung cancers. We could not find any studies that would compare our data. OEs were detected at a higher rate in cancer patients with organ metastasis. Among the presenting complaints, only fever, dyspnea, and abdominal pain were associated with an increased risk of OEs. The most common OE diagnoses in our study were febrile neutropenia, malignant pleural effusion/ascites, intestinal/biliary obstruction, anemia, leukopenia,

thrombocytopenia, increased ICP, and TLS. In a study by Eşdur [20], febrile neutropenia was the most common OE (31.3%), followed by brain metastasis/increased intracranial pressure (24.5%), biliary obstruction (8%), GI obstruction (4.9%) and TLS at 3.7% [19]. Febrile neutropenia is one of the most common fatal complications of ESs, and its early diagnosis and management are crucial [20,21]. In our study, chemotherapy-related side effects, pain, and infectious diseases were the most common diagnoses in the OED group. It has been shown in the literature that chemotherapy-induced symptoms cause frequent ES visits, and ES visits may be reduced if patients are encouraged to self-manage similar symptoms through education [21].

The median ECOG score was significantly higher in the OE group. Since the performance score mainly depends on the patient's

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Table 5. The clinical and laboratory parameters associated with oncological emergency						
	B	S.E.	p	OR	95% CI for OR	
					Lower	Upper
Age	0.000	0.006	0.979	1.000	0.989	1.011
Female/male	0.372	0.137	**<0.01**	0.689	0.527	0.901
Outpatient/ambulance	0.433	0.148	**<0.01**	1.541	1.154	2.059
Duration of cancer diagnosis	0.020	0.033	0.547	0.980	0.919	1.046
Comorbidity	0.333	0.150	**0.026**	1.395	1.041	1.870
Hematological/solid malignancy	1.173	0.358	**<0.001**	0.310	0.153	0.624
Metastasis	0.025	0.312	0.935	0.975	0.529	1.798
Lung metastasis	0.587	0.156	**<0.001**	0.556	0.410	0.754
Brain metastasis	0.066	0.277	0.811	0.936	0.544	1.610
Liver metastasis	0.159	0.166	0.339	1.172	0.846	1.622
Bone metastasis	0.108	0.160	0.499	1.114	0.815	1.523
Chemotherapy in the previous month	0.038	0.156	0.805	0.962	0.709	1.305
RT in the previous month	0.144	0.148	0.330	1.155	0.864	1.543
GCS	-0.054	0.147	0.713	0.947	0.710	1.264
PS	0.695	0.092	**<0.001**	2.004	1.672	2.402
WBC (mm^3)	0.000	0.000	0.642	1.000	1.000	1.000
Neutrophil count (mm^3)	-0.055	0.016	<0.01	0.946	0.916	0.977
HGB (mg/dL)	-0.140	0.031	**<0.001**	0.870	0.819	0.923
Platelet count (mm^3)	-0.001	0.000	0.015	0.999	0.998	1.000
Glucose (mg/dL)	0.001	0.001	0.446	1.001	0.999	1.002
BUN (mg/dL)	-0.016	0.005	<0.01	0.984	0.975	0.993
Uric acid (mg/dL)	0.001	0.018	0.938	1.001	0.968	1.036
Na (mg/dL)	0.000	0.001	0.793	1.000	0.998	1.003
K (mg/dL)	0.268	0.093	**<0.01**	1.307	1.089	1.569
Ca (mg/dL)	0.124	0.050	**0.014**	1.133	1.026	1.250
Total protein (mg/dL)	0.013	0.022	0.568	1.013	0.970	1.057
Albumin (mg/dL)	-0.029	0.038	0.436	0.971	0.902	1.046
AST (IU/L)	0.000	0.001	0.965	1.000	0.998	1.002
GGT (IU/L)	0.001	0.001	0.172	1.001	1.000	1.002
Amylase (U/L)	0.001	0.001	0.346	1.001	0.999	1.003
Total bilirubin (mg/dL)	0.374	0.183	**0.040**	1.454	1.016	2.080
Direct bilirubin (mg/dL)	-0.449	0.296	0.129	0.638	0.358	1.140
CRP (mg/dL)	0.004	0.001	**<0.001**	1.004	1.002	1.007
Troponin 1 (ng/mL)	-0.020	0.023	0.373	0.980	0.937	1.025
Lactate	0.262	0.052	**<0.001**	1.300	1.174	1.438
Constant	1.901	2.503	0.448	6.692		
Nagelkerke R2: 0.426, RT: Radiotherapy, GCS: Glasgow coma scale, ECOG PS: Eastern Cooperative Oncology Group Performance Score, CRP: C-reactive protein, BUN: Blood urea nitrogen, AST: Aspartate aminotransferase, GGT: Gamma-glutamyl transferase, HGB: Hemoglobin, WBC: White blood cells, CI: Confidence interval, OR: Odds ratio						

daily activities, predicting the outcome in an emergency setting can be simple and practical. For patients with cancer, a higher ECOG PS is associated with a worse prognosis [8,22,23]. Laboratory findings are important for cancer diagnosis and treatment follow-up. In our study, we obtained laboratory findings from 88.9% of the patients. WBC, HGB, platelet count, neutrophil count, calcium, total protein, and albumin levels were lower in the OE group than in the OED group. BUN, uric acid, phosphorus, AST, amylase, total and direct bilirubin, CRP, D-dimer, INR, and lactate levels were higher in the OE group than in the OED group. The mortality rate in our study was 22.2% in the OE group and 11.9% for all patients at ES or hospitalization, consistent with previous studies that included patients with cancer who visited ES [8,13].

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Although there are few studies on biochemical data in the literature, BUN, creatinine, CRP, and potassium levels were significantly higher in patients who died or were hospitalized in the ICU [24]. In Turkish cancer statistics, low HGB, platelet, and albumin levels were associated with a significant increase in the frequency of ICU admission and mortality [25]. In this study, a higher ECOG PS, brain metastasis, CRP, and lactate levels were associated with mortality in patients with OE.

The admission to ES by ambulance, presence of comorbid diseases, higher ECOG PS, potassium, calcium, total bilirubin, CRP, and lactate values were associated with an increased risk of OE, whereas female gender, solid malignancy, and higher HGB and BUN values were associated with a decreased risk of OE in this study. We could not find any study that evaluated risk factors for OE diagnosis.

Unfortunately, ES admissions in our country have exceeded the world averages. In the case of overcrowding caused by an increasing number of patients, it is crucial to identify cancer patients and their diagnoses, especially OEs. Emergency physicians should know all the clinical and pathological conditions of patients with cancer, especially to predict, recognize, and treat potential complications early. Although considerable information on managing treatment-related complications has been published, few studies have evaluated the management of disease-related signs and symptoms requiring ES presentation [5,7-9]. Therefore, it is vital to know the reasons for the presentation of oncology patients admitted to the ES and to examine the problems encountered in the clinic for early diagnosis and treatment. Close collaboration between the oncology team and emergency physicians is required to manage the emergency medical conditions of patients with cancer to develop a common management algorithm. With the help of algorithms, early recognition of OEs, prognosis prediction, and effective treatment can be achieved. Algorithms can be a potentially valuable guiding tool for busy emergency physicians who do not have oncologist support and do not encounter many patients with cancer, and they can improve the care of these patients.

Study Limitations

The first limitation of this study was that it was a retrospective, single-center study. Patients in the terminal stages of cancer and those who have already been cured were not included in the study. The high number of patients, including patients with different cancer types, and the fact that ES physicians diagnosed with OE may be considered strong aspects of the study.

Conclusion

The results of these and similar studies may help increase the awareness of emergency physicians, who are increasingly encountering patients with cancer, about OEs and provide more information and guidance in diagnosing and identifying risk factors.

Ethics

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