

Epidemiologic and Clinical Characteristics of Cancer Patients Presented to the Emergency Service with COVID-19 Symptoms

Arzu Babacan 

Department of Emergency Service, University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Ankara, Turkey

Correspondence: Arzu Babacan, University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Emergency Service, Ankara, 06200, Turkey, Tel +90 505 220 3896, Email babacan.ar@hotmail.com

Purpose: The study aimed to define the clinical characteristics of coronavirus disease (COVID-19) in cancer patients admitted to the emergency service (ES) and to determine the parameters associated with mortality.

Patients and methods: The data of patients with COVID-19 symptoms and solid or hematological malignancies under anticancer treatment, who presented to the ES between March 1, 2020, and March 31, 2021, and underwent RT-PCR (Real-Time Polymerase Chain Reaction) testing, were evaluated. Demographic, clinical, and laboratory parameters were compared between COVID-19-negative and COVID-19-positive groups, as well as between survivor and non-survivor groups in COVID-19-positive patients. Parameters associated with poor prognosis and mortality were evaluated in patients with COVID-19.

Results: The study was completed with 468 patients. The COVID-19 positivity ratio is 43.4%. The solid and hematologic malignancy ratios are 24.1% and 75.9%, respectively, in the positive group. Age, gender, comorbidities, cancer type, and stage, metastasis, and anti cancer treatments are similar between the groups ($p > 0.05$). Contact history ($p < 0.001$), musculoskeletal pain ($p = 0.015$) are more frequent, and CRP ($p < 0.01$), and lactate level ($p < 0.01$) are significantly higher in the COVID-19 group. The mortality rate is 38.4% in the COVID-19-positive group. Most of the non-survivors are male patients with advanced age, solid organ malignancy with lung metastases, with poorer performance status, low blood pressure and oxygen saturation, tachycardia, and tachypnea ($p < 0.001$). WBC, neutrophil, NLR, BUN, phosphorus, AST, GGT, LDH, troponin, fibrinogen, D-Dimer, INR, Ferritin, CRP, PRC, and lactate levels are significantly higher, while lymphocyte, calcium, total protein, and albumin levels are lower ($p < 0.05$) in the non-survivor group. These parameters were identified as risk factors associated with a poor prognosis.

Conclusion: The availability of biomarkers that predict adverse clinical outcomes of COVID-19 disease in cancer patients may enable accurate and timely risk assessment, facilitating the early initiation of appropriate treatment.

Keywords: COVID-19, SARS-CoV-2, cancer, biochemical and hematological biomarkers

Introduction

The novel coronavirus (SARS-CoV-2) made history as the most critical pandemic of the 21st century and was named Coronavirus Disease 2019 (COVID-19) by the World Health Organization (WHO). The disease continues to affect our health and lives both in our country and in the world. The WHO reported COVID-19 cases in 106 countries and COVID-19 deaths in 51 countries in its 2024 global data, emphasizing that the clinical detection of mortality rate was underestimated.¹ COVID-19 infection can cause a range of clinical presentations, from asymptomatic to respiratory failure and even life-threatening severe clinical conditions. The target organ is the lung, and it can cause a severe inflammatory response leading to multiple organ failure.^{2,3} A complete blood count, biochemical analysis, serological tests, and blood gas analysis, although non-specific, are included in the diagnostic approach. Typical ground-glass opacities and lung infiltrates seen on chest computed tomography (CT) scans may aid in diagnosis. RT-PCR testing of upper (nasopharyngeal swab) and lower respiratory tract (sputum, bronchoalveolar lavage, tracheal aspirate) samples is

required for definitive diagnosis.^{2,4} Studies have shown that cancer patients have a high risk of SARS-CoV-2 infection and severe COVID-19 clinical course due to the immunosuppressive nature of the disease and the adverse effects of treatments on the immune system.⁵

During the COVID-19 pandemic, emergency services (ES) have been at the forefront of hospital and community-based care, playing an undeniable role in diagnosis, evaluation, and treatment. The most challenging diagnosis of COVID-19 has been in oncology patients in the ES setting. Unlike the general population, the similarity in the symptoms of cancer patients during treatment and disease process, atypical laboratory and radiological findings due to their suppressed immune systems, and the presence of existing comorbid diseases caused difficulties in the diagnosis of the disease.^{6,7} Studies have aimed to define the parameters associated with the clinical outcomes of COVID-19 disease in cancer patients and to find biomarkers for the prediction of poor prognostic outcomes. In our study, we aimed to define the clinical and epidemiologic characteristics of cancer patients diagnosed with COVID-19 disease in the ES and to determine the risk factors associated with poor prognosis.

Materials and Methods

Methods

This study was conducted at the ES of Health Sciences University, Dr Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, between March 1, 2020, and March 31, 2021, in accordance with the principles of the Declaration of Helsinki, after obtaining ethics committee approval (2020–12/916). Sampling analysis was performed using G*Power 3.1.4 version. Based on the comparison of mortality ratios of hematological and solid malignancies in COVID-19 positive patients in the study by Yang et al,⁸ at least 51 patients should be included in each group for the COVID-19 positive patient group. A total of 1271 cancer patients who presented to the ES were retrospectively examined.

Patients who were admitted with cardiopulmonary arrest (n=59), who did not undergo RT-PCR testing (n=118), cancer patients who underwent RT-PCR testing but were followed up after completing anti-tumor treatment (n=394), and cancer patients in the terminal phase whose treatment had been discontinued (n=178) were excluded from the study. Data from 522 patients who underwent anti-cancer treatment were obtained. Patients who had already tested positive with a PCR test before their ES visit were excluded from the study (n=26). Demographic data, comorbidities, presenting symptoms, hematological/solid organ malignancies, disease stages, anti-tumor treatments (chemotherapy, radiotherapy, immunotherapy), contact history, vaccination status, vital signs (blood pressure, pulse, respiratory rate, oxygen saturation), ECOG PS (Eastern Cooperative Oncology Group Performance Status Scale), laboratory (complete blood count, neutrophil/lymphocyte ratio (NLR), biochemical tests, C-reactive protein (CRP), ferritin, D-dimer, procalcitonin (PRC), blood gas, troponin) and radiological examinations (chest X-ray, chest CT), RT-PCR test results and patient outcomes were obtained from the Hospital Information Management System (HIMS) and ES patient files. Patients with unavailable RT-PCR test results (n = 9) and missing laboratory data (n = 19) were excluded, and the study was completed with 468 patients. Patients were classified as COVID-19 positive and non-COVID-19 negative, and demographic, clinical, and laboratory parameters were compared. Mortality-related parameters were analyzed by categorizing patients into two groups: survivors and non-survivors.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences, version 25.0 (SPSS Inc., Armonk, NY). The normality of numerical data distribution was examined using the Kolmogorov–Smirnov and Shapiro–Wilk normality tests. Normally distributed continuous variables were presented as mean and standard deviation, while non-normally distributed continuous variables were presented as median and interquartile range (IQR; 25th–75th percentile). Qualitative data were expressed as frequency and percentage. The chi-square (χ^2) significance test was used to compare the proportions between two qualitative parameters. Independent samples t-tests and Mann–Whitney U-tests were used to compare numerical variables for parametric or non-parametric distributions. Binary logistic regression analysis was

used to analyze variables associated with mortality. The confidence interval was 95%, and the accepted margin of error was 5%. A value of $P < 0.05$ was considered statistically significant.

Results

The CONSORT flow diagram of the study is shown in Figure 1. The study evaluated patients undergoing anti-tumor treatment who presented to the ES with symptoms of COVID-19. A total of 468 patients who underwent RT-PCR testing based on their symptoms and contact history, in accordance with the “Guide for Screening Possible COVID-19 Cases Among Outpatients” published by the Ministry of Health of the Turkey Republic in 2020, and whose data were available, were included in the study. The COVID-19 positive group ($n = 203$) consisted of 159 patients with two positive RT-PCR tests with a 24-h interval and 44 patients with a negative first RT-PCR test and a positive second RT-PCR test. The COVID-19 negative group consisted of 265 patients with two negative RT-PCR tests.

In our study, the ratio of COVID-19 positive patients is determined to be 43.4%. The median age and the gender distribution are similar in both groups. Only diabetes mellitus (DM) is more frequent in the COVID-19 group among comorbidities accompanying malignancy. The rate of solid organ malignancy in the COVID-19-positive group and the COVID-19-negative group is 75.9% and 80.4%, respectively. Figure 2 shows the frequency of solid and hematological malignancies in the groups. Age, gender, comorbid conditions, cancer type, cancer stage, metastasis status, and anti-

CONSORT Diagram of the Study

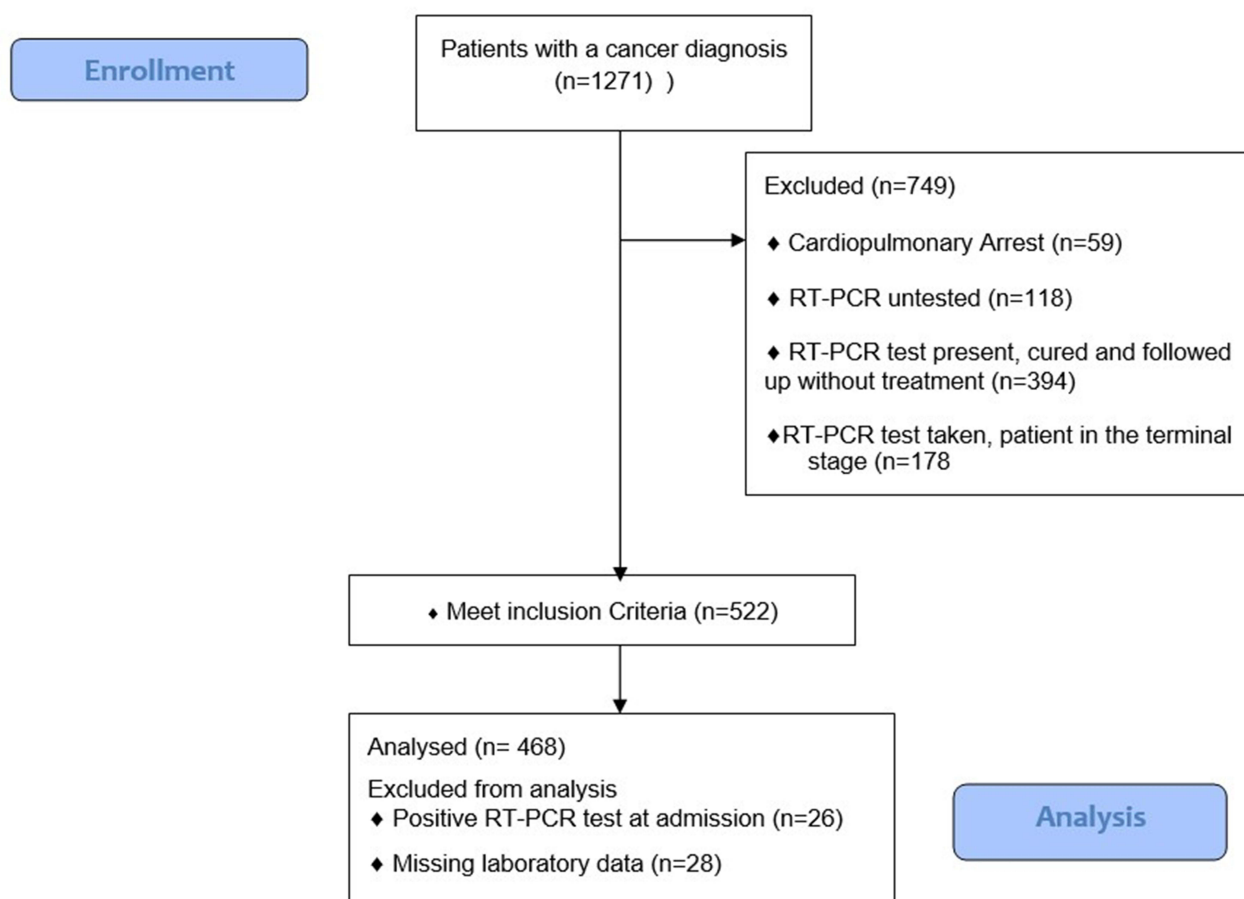


Figure 1 The CONSORT flow diagram of the study.

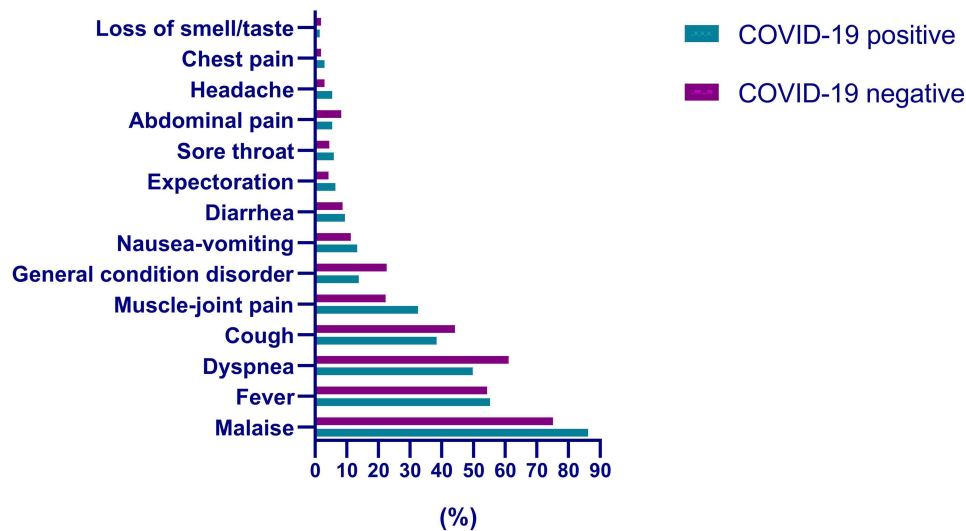


Figure 2 The distribution of COVID-19 symptoms in COVID-19 positive and negative group.

cancer treatments are similar between groups ($p > 0.05$). The demographic characteristics of the COVID-19 positive and COVID-19 negative groups are presented in [Table 1](#).

A history of contact with a COVID-19 patient ($p < 0.001$) and musculoskeletal pain ($p = 0.015$) are significantly higher in the COVID-19 group, as expectedly. The symptoms and contact history of the groups are presented in [Table 2](#), and the frequency of symptoms in both groups is illustrated in [Figure 3](#).

In terms of laboratory parameters, WBC, neutrophil, and lymphocyte counts, as well as the neutrophil-to-lymphocyte ratio (NLR), total bilirubin, direct bilirubin, D-dimer, INR, and procalcitonin (PCR), were significantly lower in the COVID-19-positive group ($p < 0.05$). Meanwhile, CRP, lactate level, total protein, and albumin were significantly higher in the COVID-19 positive group ($p < 0.05$). The patient's vital signs and laboratory parameters are shown in [Table 3](#). In the COVID-19 positive group, 75.4% of patients ($n = 153$) had ground-glass opacities and consolidated areas consistent with COVID-19, 18.7% ($n = 38$) had atypical findings, and 5.9% ($n = 12$) had normal findings on chest CT scans.

Table 1 Demographic Characteristics and Cancer-Related Clinical Features of the Patients, Presence of Systemic Disease, and Cancer-Related Characteristics

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P value
Median (IQR) or N/%			
Age	64.0 (20.0)	63.0 (20.0)	0.287 ^a
Sex			0.641 ^b
Female	101 (49.8)	125 (47.2)	
Male	102 (51.2)	140 (52.8)	
Systemic diseases	125 (61.6)	156 (58.9)	0.569 ^b
HT	91 (44.8)	99 (37.4)	0.107 ^b
DM	64 (31.5)	61 (23.0)	0.055 ^b
CAD	15 (7.4)	30 (11.3)	0.159 ^b
CHF	2 (1.0)	3 (1.1)	–
COPD	27 (13.3)	34 (12.8)	0.891 ^b
CRD	16 (7.9)	19 (7.2)	0.860 ^b
CVD	4 (2.0)	7 (2.6)	0.635 ^b
Others	4 (2.0)	10 (3.8)	0.288 ^b

(Continued)

Table 1 (Continued).

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P value
Median (IQR) or N/%			
Type of cancer			0.258 ^b
Hematological	49 (24.1)	52 (19.6)	
Leukemia	17 (8.4)	20 (7.5)	
Lymphoma	20 (9.9)	22 (8.3)	
MDS	2 (1.0)	3 (1.1)	
MM	10 (4.9)	7 (2.6)	
Solid	154 (75.9)	213 (80.4)	
Head-neck	10 (4.9)	21 (7.9)	
Respiratory system	28 (13.8)	36 (13.6)	
Gastrointestinal system	48 (23.6)	66 (24.9)	
Genitourinary system	35 (17.2)	35 (13.2)	
Breast	31 (15.3)	47 (17.7)	
Central nervous system	1 (0.5)	4 (1.5)	
Unclassified	-	4 (1.5)	
Stage			0.050 ^b
Indefinite or new diagnosis	46 (22.7)	50 (18.9)	
Local advanced	79 (38.9)	81 (30.6)	
Metastatic disease	67 (33.0)	108 (40.8)	
Advanced-stage metastatic disease	11 (5.4)	26 (9.8)	
Metastasis	115 (56.7)	173 (65.3)	0.068 ^b
Lung	43 (21.2)	77 (28.1)	0.069 ^b
Liver	33 (16.3)	72 (26.3)	<0.01 ^b
Brain	16 (7.9)	36 (13.1)	0.055 ^b
Bone	37 (18.2)	62 (22.6)	0.252 ^b
Other	79 (38.9)	111 (40.5)	0.775 ^b
Surgery for cancer	121 (59.6)	168 (63.4)	0.444 ^b
BMT	2 (1.0)	3 (1.1)	-
CT in the previous month	103 (50.7)	141 (53.2)	0.641 ^b
RT in the previous month	76 (37.4)	120 (45.3)	0.090 ^b

Notes: ^aMann-Whitney U-test, ^bPearson Chi-square test.

Abbreviations: HT, Hypertension; DM, Diabetes mellitus; CAD, Coronary arterial disease; CHF, Congestive heart failure; COPD, Chronic obstructive pulmonary disease; CRD, Chronic renal disease; CVD, Cerebrovascular disease; MDS, Myelodysplastic syndrome; MM, Multiple myeloma; BMT, Bone marrow transplantation; CT, Chemotherapy; RT, Radiotherapy.

Table 2 Contact History of Patients, Duration of Symptoms, and Distribution of COVID-19 Symptoms

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P* value
N/%			
Contact history			<0.001
Traveling abroad	2 (1.0)	2 (0.8)	
Contact with a COVID-19 positive patient	36 (17.7)	9 (3.4)	
No contact with a COVID-19-positive patient	165 (81.3)	254 (95.8)	

(Continued)

Table 2 (Continued).

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P* value
N/%			
Symptom duration			0.427
0–5 days	171 (84.2)	218 (82.3)	
5–10 days	30 (14.8)	40 (15.1)	
>10 days	2 (1.0)	7 (2.6)	
COVID-19 symptoms			
Dyspnea	101 (49.8)	162 (61.1)	0.015
Cough	78 (38.4)	117 (44.2)	0.220
Fever	112 (55.2)	144 (54.3)	0.925
Expectoration	13 (6.4)	11 (4.2)	0.296
Malaise	175 (86.2)	199 (75.1)	<0.01
Muscle-joint pain	66 (32.5)	59 (22.3)	0.015
Abdominal pain	11 (5.4)	22 (8.3)	0.276
Nausea-vomiting	27 (13.3)	30 (11.3)	0.569
Diarrhea	19 (9.4)	23 (8.7)	0.871
Loss of taste and/or smell	3 (1.5)	5 (1.9)	0.735
Chest pain	6 (3.0)	5 (1.9)	0.449
General condition disorder	28 (13.8)	60 (22.6)	0.017
Headache	11 (5.4)	8 (3.0)	0.239
Sore throat	12 (5.9)	12 (4.5)	0.531

Note: Bold values indicate $p < 0.05$.

Vaccination programs against SARS-CoV-2 in Turkey began on January 14, 2021, with the inactivated viral cell vaccine (CoronaVac®). Our study included vaccination status data from January to February and March, representing the last three months. The vaccination rate is low at 5.1% (n=24). One dose (n=8) and two doses (n=16) of the inactivated viral vaccine were administered. The number of vaccinated patients in the COVID-19 group was 2.9% (n=6).

In the COVID-19 group, 61.6% (n=125) of patients survived, while 38.4% (n=78) died. In the non-COVID-19 group, 69.0% (n=183) of patients survived, while 31.0% (n=82) died (Figure 4). Discharge from ES or hospital after hospitalization and mortality rates are similar between the two groups ($p=0.239$). The distribution of patients in the groups according to outcomes is shown in Table 4.

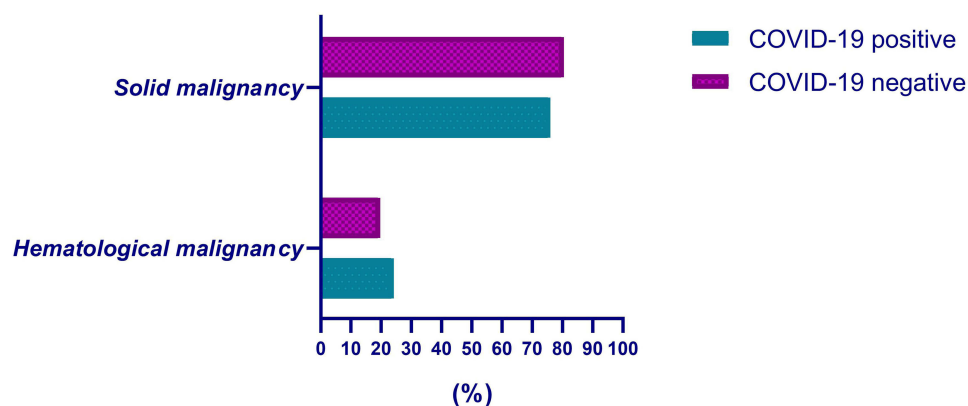


Figure 3 The distribution of hematological and solid malignancies in COVID-19 positive and negative group.

Table 3 Glasgow Coma Score, Performance Score, Vital Signs, and Laboratory Parameters of the Patients

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P* value
Median (ÇAA)			
Glasgow Coma Scale	15.0 (0.0)	15.0 (0.0)	0.050
ECOG PS score	2.0 (2.0)	2.0 (2.0)	0.173
Systolic blood pressure	110.0 (20.0)	110.0 (20.0)	0.992
Diastolic blood pressure	70.0 (20.0)	70.0 (20.0)	0.628
Pulse (min)	100.0 (30.0)	102.0 (28.0)	0.018
Temperature (°C)	37.8 (1.7)	37.8 (1.8)	0.973
Respiratory rate (min)	25.0 (10.0)	26.0 (9.0)	0.658
SpO2	92.0 (8.8)	91.0 (7.0)	0.643
WBC (mm ³)	6800.00 (5950.00)	9020.00 (10,775.00)	<0.001
HgB (m/dl)	10.9 (3.3)	10.7 (3.1)	0.238
Neutrophile count (mm ³)	5300 (5420.00)	6700.00 (9410.00)	<0.01
Lymphocyte count (mm ³)	720.00 (850.00)	800.00 (820.00)	0.026
Platelet count	180.000 (154.500)	195.000 (198.500)	0.480
NLR	5.8 (8.3)	7.3 (14.8)	<0.01
Glucose (mg/dl)	118.0 (47.5)	122.0 (54.0)	0.340
BUN (mg/dl)	20.3 (15.9)	20.1 (19.7)	0.697
Creatinine (mg/dl)	0.81 (0.70)	0.83 (0.62)	0.370
Na (mEq/L)	135.00 (7.0)	134.00 (6.5)	0.149
K (mEq/L)	4.0 (0.9)	4.1 (0.9)	0.051
Calcium (mg/dl)	8.5 (1.2)	8.5 (1.2)	0.345
Phosphor (mg/dl)	3.2 (1.5)	3.2 (1.6)	0.591
Uric acid (mg/dl)	4.9 (2.8)	5.0 (3.7)	0.446
Total protein (mg/dl)	59.1 (15.8)	54.0 (14.6)	<0.001
Albumin (g/dl)	31.3 (10.5)	28.1 (9.5)	<0.001
ALT (U/L)	20.0 (20.0)	20.0 (24.1)	0.861
AST (U/L)	30.0 (32.0)	31.0 (42.9)	0.948
GGT (U/L)	43.0 (69.5)	51.0 (87.5)	0.198
Amylase (U/L)	48.0 (44.1)	42.7 (46.1)	0.087
Total bilirubin (mg/dl)	0.68 (0.66)	0.87 (0.84)	<0.01
Direct bilirubin (mg/dl)	0.14 (0.22)	0.22 (0.45)	<0.001
LDH (U/L)	263.00 (218.50)	272.00 (49.00)	0.941
Troponin (ng/mL)	12.0 (43.3)	12.1 (26.8)	0.716

(Continued)

Table 3 (Continued).

	COVID-19 Positive Group (n=203)	COVID-19 Negative Group (n=265)	P* value
Median (ÇAA)			
Fibrinogen (ng/mL)	314.00 (232.00)	328.00 (335.50)	0.134
D-dimer (ng/mL)	1360.00 (1935.50)	2050.00 (2795.00)	<0.001
INR	1.04 (0.27)	1.10 (0.28)	<0.01
Ferritin (mL/ng)	392.00 (797.00)	423.00 (1153.50)	0.423
CRP (mg/dl)	124.00 (154.16)	90.00 (149.00)	<0.01
Procalcitonin (ng/mL)	0.12(0.64)	0.36(1.8)	<0.001
pH	7.36 (0.08)	7.40 (0.10)	0.107
Lactate (mmol/L)	1.9 (1.7)	1.6 (1.1)	<0.01

Notes: Bold values indicate $p<0.05$, * Mann–Whitney U-test.

Abbreviations: ECOG PS, Eastern Cooperative Oncology Group Performance Status Scale; WBC, White blood cell; Hb, Hemoglobin; NLR, Neutrophil-lymphocyte ratio; BUN, Blood urea nitrogen; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; GGT, Gamma-glutamyl transferase; LDH, Lactate dehydrogenase; INR, International normalized ratio; CRP, C-reactive protein.

Non-survivors in the COVID-19 positive group are mostly male (55.1%) with a median age of 67. Among comorbid conditions, diabetes mellitus (DM) is the most common (38.5%). In terms of cancer types, mortality rates are highest in the gastrointestinal system (26.9%), respiratory system (21.8%), and hematological malignancies (21.8%). Metastasis is present in 73.0% of patients, with lung metastasis being the most common one. About 47.4% of the patients had received chemotherapy within the last month. About 14.1% have a history of contact with COVID-19. The most common symptoms are dyspnea and fever. Thoracic imaging findings are consistent with the disease. They have no vaccination history and were admitted to the intensive care unit from the ES. Analysis of laboratory parameters reveals that ECOG PS, pulse, respiratory rate, WBC, NLR, BUN, phosphorus, uric acid, AST, total bilirubin, direct bilirubin, LDH, troponin, fibrinogen, D-Dimer, INR, ferritin, CRP, PRC, and lactate levels are significantly higher, while blood pressure, SpO₂, hemoglobin, lymphocyte count, calcium, total protein, and albumin levels are significantly lower in the non-survivor group ($p<0.05$). Table 5 shows the vital signs and laboratory parameters of COVID-19 positive survivors and non-survivors.

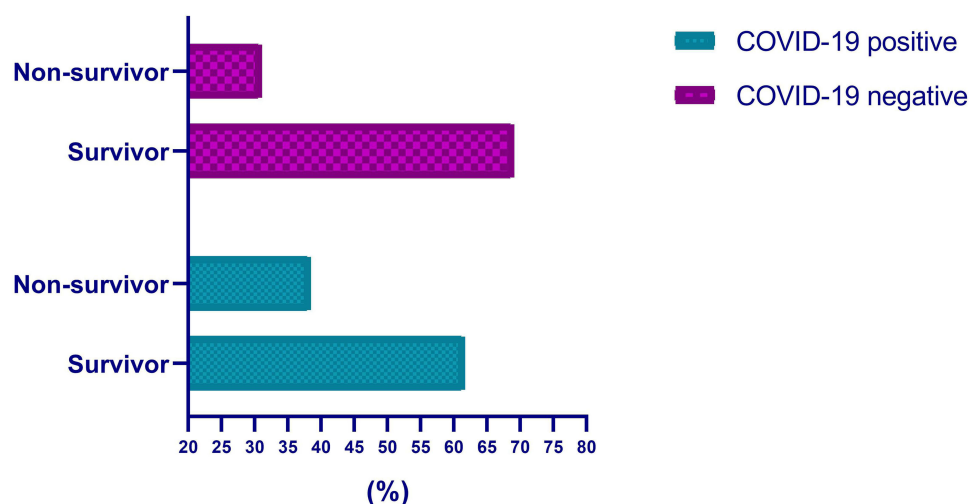


Figure 4 The frequencies of survivor and non-survivor patients in COVID-19 positive and negative group.

Table 4 Distribution of Patients According to Outcomes

	COVID-19 positive group (n=203)	COVID-19 negative group (n=265)	P* value
Discharged from Emergency service	14 (6.9)	21 (7.9)	0.239
Discharged after hospitalization	111 (54.7)	162 (59.3)	
Death after hospitalization	78 (38.4)	82 (31.0)	

Note: * Pearson chi-square test.

Table 5 Comparison of ECOG PS Score, Vital Signs, and Laboratory Parameters of COVID-19-Positive Patients According to Survival

	Survivors (n=125)	Non-Survivors (n=78)	P* value
Median (IQR)			
ECOG PS score	1.0 (1.0)	3.0 (0.0)	<0.001
Systolic blood pressure (mmHg)	112.0 (20.0)	110.0 (28.0)	0.051
Diastolic blood pressure (mmHg)	70.0 (20.0)	63.5 (22.0)	<0.001
Pulse (min)	97.5 (24.0)	111.0 (37.0)	<0.001
Temperature (°C)	37.8 (1.6)	37.8 (1.7)	0.512
Respiratory rate (min)	23.0 (8.0)	30.0 (10.0)	<0.001
SpO2	94.0 (5.0)	86.5 (13.0)	<0.001
WBC (mm ³)	6295.0 (5530.0)	7627.50 (7723.0)	0.023
HgB (mg/dl)	11.0 (3.4)	10.4 (2.4)	0.011
Neutrophile count (mm ³)	4500.0 (4620.0)	6150.0 (6540.0)	0.007
Lymphocyte count (mm ³)	900.0 (820.0)	675.0 (750.00)	0.002
Platelet count	192500.0 (143,000.0)	157,500.0 (165,750.0)	0.142
NLR	3.8 (6.2)	8.3 (12.6)	<0.001
Glucose (mg/dl)	117.0 (41.0)	121.5 (76.0)	0.673
BUN (mg/dl)	16.3 (11.0)	27.1 (24.8)	<0.001
Creatinine (mg/dl)	0.80 (0.60)	0.90 (1.24)	0.160
Na (mEq/L)	134.5 (7.0)	135.0 (8.3)	0.387
K (mEq/L)	4.0 (0.7)	4.1 (1.4)	0.443
Calcium (mg/dl)	8.6 (1.0)	8.1 (1.7)	<0.001
Phosphor (mg/dl)	3.1 (1.0)	3.8 (2.3)	<0.001
Uric acid (mg/dl)	4.6 (2.5)	5.8 (4.7)	0.031
Total protein (mg/dl)	62.0 (12.8)	54.0 (16.7)	<0.001
Albumin (g/dl)	34.0 (9.0)	26.9 (8.7)	<0.001

(Continued)

Table 5 (Continued).

	Survivors (n=125)	Non-Survivors (n=78)	P* value
Median (IQR)			
ALT (U/L)	19.5 (15.5)	20.5 (30.3)	0.752
AST (U/L)	27.5 (21.9)	37.2 (58.3)	0.034
GGT (U/L)	35.5 (44.5)	66.0 (120.0)	<0.001
Amylase (U/L)	49.7 (44.4)	45.0 (45.0)	0.856
Total bilirubin (mg/dl)	0.60 (0.50)	0.74 (0.90)	0.033
Direct bilirubin (mg/dl)	0.12 (0.16)	0.20 (0.50)	<0.001
LDH (U/L)	244.5 (129.0)	328.5 (429.0)	<0.001
Troponin (ng/mL)	7.5 (12.4)	40.9 (99.4)	<0.001
Fibrinogen (ng/mL)	289.0 (234.8)	335.0 (270.3)	0.040
D-dimer (ng/mL)	835.0 (1420.0)	2105.0 (2665.0)	<0.001
INR	1.01 (0.20)	1.22 (0.41)	<0.001
Ferritin (mL/ng)	305.0 (481.00)	615.0 (1179.3)	<0.001
CRP (mg/dl)	64.00 (116.00)	137.5 (113.5)	<0.001
Procalcitonin (ng/mL)	0.07 (0.19)	0.47 (2.03)	<0.001
pH	7.37 (0.07)	7.37 (0.20)	0.087
Lactate (mmol/L)	1.27 (0.86)	2.05 (1.94)	<0.001

Notes: Bold values indicate $p < 0.05$, * Mann–Whitney U-test.

Abbreviations: ECOG PS, Eastern Cooperative Oncology Group Performance Status Scale; WBC, White blood cell; Hb, Hemoglobin; NLR, Neutrophil lymphocyte ratio; BUN, Blood urinary nitrogen; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; LDH, Lactate dehidrogenaz; INR, International normalized ratio; CRP, C-reactive protein.

Discussion

Due to the rapid spread, emergence of new variants, and changing clinical symptoms over time, COVID-19 is considered one of the most devastating global health crises of the 21st century. The first case in our country was reported in March 2020, and the process was managed using the COVID-19 guidelines prepared and updated by the Ministry of Health of the Republic of Turkey.⁹ Many scientific studies have been published since the outbreak of the pandemic to identify high-risk groups and determine clinical and biochemical markers that predict disease and mortality. It is accepted that individuals with comorbidities such as cancer, diabetes, hypertension, chronic lung disease, obesity, immune deficiencies, and advanced age are at higher risk of developing severe and critical COVID-19 infections.¹⁰

The risks associated with cancer itself and the treatments, along with accompanying comorbid conditions, nutritional deficiencies, and frequent hospital visits, may increase the risk of contact and infection with COVID-19 in cancer patients.¹¹ Some studies compared COVID-19 patients with and without malignancy; survivors and non-survivors of cancer patients with COVID-19, and patients under treatment or cured.^{8,12,13} In this study, we aimed to determine mortality-related parameters, examining their demographic, clinical, and laboratory findings in COVID-19 positive and negative cancer patients who were receiving anti-tumor treatment.

It has been reported in multicenter studies that cancer patients have worse outcomes (intensive care unit admission, need for invasive ventilation, mortality, etc.) and higher COVID-19 incidence than in the general population.^{14,15} Various studies have reported COVID-19 positivity rates ranging from 7.3% to 64.0%.^{6,7,14–17} In our study, the rate of COVID-19

positivity was found to be 43.4%. This is similar to the rates reported in the literature. The emergence of highly virulent variants, the increase in the number of tests, and the reduced implementation of precautions in community life may have contributed to the higher positive ratios.

The mean age of cancer patients with COVID-19 has been reported to range from 35 to 73 years, with a higher incidence in males in some meta-analyses.^{13,18–20} Also, male gender is considered one of the highest risk factors for COVID-19.⁷ The findings of our study support the relevant literature.

Previous studies investigating the course and outcomes of COVID-19 in cancer patients have shown that cardiovascular and metabolic comorbidities are among the main risk factors for mortality.²¹ In most studies in the literature, HT is the most common comorbidity in COVID-19 patients. In this study, HT and DM are also the most common comorbidities. This finding is similar to previous studies in the literature.^{21–23}

According to the literature, COVID-19 is more frequently observed in solid organ malignancies. It has been reported that the rates vary between 18.4% and 32.0% for hematological malignancies and between 68.0% and 85.3% for solid organ malignancies.^{22–24} In this study, the rate of COVID-19-positive patients was 24.1% and 75.9% in hematological and solid tumors, respectively, which is consistent with the literature.

Cancer patients usually visit health centers more often for treatment, follow-up, and supportive care. Indeed, Yu et al²⁵ reported that the risk of contact with a COVID-19-positive patient was twice as high in cancer patients compared to the general population. Najjar et al²⁶ reported that 57.2% of patients had a history of contact with an infected person. Pascarella et al²⁷ and Shahidsales et al¹⁷ reported that the history of contact among cancer patients in the positive group was considerably high. In our study, the history of contact was significantly higher in the COVID-19 patient group. COVID-19 symptoms in cancer patients are usually similar to those in the general population.²⁷ Fever, dry cough, fatigue, and shortness of breath have been reported as the most prevalent symptoms.^{14,20,28,29} Ferhatoğlu et al³⁰ reported that muscle and joint pain (86.2%) and fatigue (67.8%) were significantly more prevalent in the COVID-19 positive group. Similarly, in this study, muscle/joint pain was significantly more common in the COVID-19 positive group.

With the emergence of evidence suggesting that biomarkers can be an effective tool in risk assessment, disease forecasting, determining prognosis, and predicting mortality, studies with different results for various biomarker combinations have been published. Lee et al²⁸ analyzed changes in biochemical and hematological parameters before and during infection in cancer patients. Lymphopenia, elevated CRP levels, and hypoalbuminemia were reported as the most important biochemical abnormalities for disease diagnosis and prognosis. Kosovalı et al²³ found that leukocyte, lymphocyte, and ferritin levels were lower, while CRP levels were higher in the COVID-19 positive group. Another study reported that anemia, lymphopenia, neutrophilia, thrombocytopenia, and increases in ALT, AST, CRP, creatinine, and blood urea levels were associated with severe and critical COVID-19.²⁶ In our study, WBC, neutrophil, lymphocyte, and NLR levels were found to be significantly lower in the COVID-19-positive group compared to the COVID-19-negative group. On the other hand, CRP, lactate, total protein, and albumin levels were higher. These results are partially consistent with the literature. However, hematological and biochemical parameters in cancer patients vary considerably due to many factors such as the presence of an underlying tumor, the stage of the disease, and cancer treatment. Due to this heterogeneity, even large-scale studies have failed to provide consistent and robust evidence for the diagnosis of the disease.^{31,32}

Early reports have shown that cancer patients have higher mortality rates than the general population in COVID-19 disease. Shahidsales et al¹⁷ reported a mortality rate of 41.3%, Iskender et al²² reported 53.2%, Kosovalı et al²³ reported 39.3%, Martin et al³³ reported 30%, and El Majzoub et al³⁴ reported 34.8%. In the present study, the mortality rate was found to be 38.4%, in line with previous studies. Several studies have identified significant demographic, clinical, and biochemical predictors of mortality in cancer patients with COVID-19. Advanced age, male gender, concomitant cardiovascular disease, and metabolic comorbidities have been reported as factors associated with mortality in cancer patients with COVID-19.^{2,5,6} Martin et al³³ and Raez et al³⁵ found that advanced age, male gender, and DM were associated with mortality. In our study, most of the non-survivor patients were older, male, and had metabolic comorbidities.

Lee et al²⁸ reported that COVID-19-related mortality varies according to cancer type and that not all cancer patients have the same risk profile. The literature reports that patients with hematological malignancies have a poorer prognosis

and higher mortality rates than patients with solid organ cancers, and that lung cancer also has a high mortality rate among solid malignancies.^{14,19,36–38} Contrary to these findings, Martin et al³³ showed that patients with GI cancer have a higher mortality risk compared to other solid tumors. In our study, the mortality rate was found to be higher in patients with GI cancer and lung metastases. This finding supports the findings of Martin et al, as opposed to other studies. Therefore, the heterogeneity of our patient group and the imbalance in the number of cancer types may have contributed to this finding.

Shortness of breath in COVID-19 disease is considered a critical prognostic indicator because it is associated with lung involvement and hypoxia.^{28,39} Dai et al¹⁴ reported that 75.7% of patients in the non-surviving group had dyspnea and hypoxia. Song et al³⁶ reported that most of the deceased patients were male, elderly, and had dyspnea and high pulse rates. El Majzoub et al³⁴ emphasized that mortality was significantly higher in tachypneic patients with dyspnea. In our study, all patients in the non-survivor group experienced dyspnea, and this group had significantly higher respiratory rates and pulse rates, as well as lower oxygen saturation levels, compared to the survivor group.

Although there are conflicting reports on whether ECOG-PS is a prognostic factor for cancer patients with COVID-19, it has been reported that ECOG-PS scores of 3 and above are associated with increased mortality.^{11,19,24,33} ECOG-PS score was higher in the non-survivor group than in the survivor group, consistent with previous reports.

Different parameters have been highlighted in various studies as biomarkers to predict mortality. Hematological parameters such as leukocytosis, neutrophilia, lymphopenia, and thrombocytopenia,^{14,22,26,29,36,40} and biochemical parameters such as CRP, PRC, LDH, D-Dimer, troponin, BUN, total and direct bilirubin, ferritin, elevated ALT, AST, and low albumin levels^{19,22,26,29,34,36} have been highlighted as important indicators of mortality.

In summary, we found that lymphocyte count, hemoglobin level, total protein, and albumin were lower, and WBC, neutrophil counts, NLR, BUN, phosphorus, uric acid, AST, GGT, total and direct bilirubin, troponin, LDH, D-dimer, INR, fibrinogen, INR, ferritin, CRP, PRC, and lactate were high in the non-survivor group. Cancer patients with COVID-19 share common epidemiological and clinical characteristics with the general population, but they may also exhibit unique clinical features. The nature of the disease, medications, anti-tumor treatments, the stage of the disease and metastases, and oncological emergencies (such as tumor lysis syndrome, cardiac dysfunction, metabolic disorders, and neutropenic fever) may have contributed to the differences in these laboratory parameters, outcomes, and mortality.

Limitations

Our study is a single-center, retrospective observational study with a relatively small sample size. Patients presented to the ES were screened for symptoms and exposure according to the “Possible COVID-19 Case Screening Guide” of our country; so, asymptomatic cases may have been missed. Since the study included biomarker values at the time of initial admission, pre-infection laboratory values are unknown. Furthermore, our study was conducted based on RT-PCR test results; although radiological data were provided, the radiological findings were not used in our analyses. A heterogeneity of clinical and laboratory parameters is possible because various cancer types were included. Although our vaccination rate was low, it was noted that most of our patients presented before the pre-vaccination period in our country.

Conclusion

Laboratory and clinical parameters may help predict morbidity and mortality in cancer patients with COVID-19. More prospective, randomized studies are needed to investigate how SARS-CoV-2 interacts with specific cancer subtypes and to characterize morbidity and mortality risk in greater detail among COVID-19 patients undergoing different cancer treatments. Accurate and timely assessment of patient risk by physicians can enable the early initiation of appropriate treatment and the prioritization of patients for hospitalization.

Abbreviations

HT, Hypertension; DM, Diabetes mellitus; CAD, Coronary arterial disease; CHF, Congestive heart failure; COPD, Chronic obstructive pulmonary disease; CRD, Chronic renal disease; CVD, Cerebrovascular disease; MDS, Myelodysplastic syndrome; MM, Multiple myeloma; BMT, Bone marrow transplantation; CT, Chemotherapy; RT,

Radiotherapy; WBC, White blood cell; HgB, Hemoglobin; NLR, Neutrophile-lymphocyte ratio; BUN, Blood urinary nitrogen; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; GGT, Gama-glutamyl transferase; LDH, Laktat dehydrogenase; INR, International normalized ratio; CRP, C-reactive protein; PS, Performance score.

Disclosure

The author reports no conflicts of interest in this work.

References

1. WHO. Available from: <https://www.who.int/publications/m/item/covid-19-epidemiological-update-15-march-2024>. Accessed October 9, 2025.
2. Jee Y. WHO International Health Regulations Emergency Committee for the COVID-19 outbreak. *Epidemiol Health*. 2020;42:e2020013. doi:10.4178/epih.e2020013
3. WHO. World Health Organization. (2022). Available from: <https://www.who.int/data>. Accessed October 9, 2025.
4. WHO. Coronavirus Disease Pandemic. Website Available from: <https://www.who.int/emergencies/diseases/novelcoronavirus-2019>. Accessed October 9, 2025.
5. Moss C, Dolly S, Russell B, et al. One piece of the jigsaw for the cancer recovery strategy: prevalence of COVID-19 in patients with cancer. *Cancer Control*. 2020;27(3):1073274820950844. doi:10.1177/1073274820950844
6. Assaad S, Avrillon V, Fournier ML, et al. High mortality rate in cancer patients with symptoms of COVID-19 with or without detectable SARS-CoV-2 on RT-PCR. *Eur J Cancer*. 2020;135:251–259. doi:10.1016/j.ejca.2020.05.028
7. Ayhan M, Laçın Ş, Özyükseler DT, et al. Does systemic anti-tumor therapy increase COVID-19 risk in patients with cancer? *J Oncol Pharm Pract*. 2021;27(6):1461–1467. doi:10.1177/10781552211015762
8. Yang K, Sheng Y, Huang C, et al. Clinical characteristics, outcomes, and risk factors for mortality in patients with cancer and COVID-19 in Hubei, China: a multicentre, retrospective, cohort study. *Lancet Oncol*. 2020;21(7):904–913. doi:10.1016/s1470-2045(20)30310-7
9. Available from: <https://covid19.saglik.gov.tr/>. Accessed October 9, 2025.
10. El Mahmoud A, Karam EJ, Abou Zeidane R, et al. Outcomes of cancer patients affected by COVID-19 in different settings: a retrospective study in Lebanon. *Cancer Rep*. 2024;7(11):e70045. doi:10.1002/cnr2.70045
11. Ozer M, Goksu SY, Mahdi M, Gandhi N. Characteristics and outcomes of cancer patients with covid-19 at a safety-net hospital. *Cancer Treat Res Commun*. 2021;28:100418. doi:10.1016/j.ctarc.2021.100418
12. Sawyers A, Chou M, Johannet P, et al. Clinical outcomes in cancer patients with COVID-19. *Cancer Rep*. 2021;4(6):e1413. doi:10.1002/cnr2.1413
13. Fu C, Stoeckle JH, Masri L, et al. COVID-19 outcomes in hospitalized patients with active cancer: experiences from a major New York City health care system. *Cancer*. 2021;127(18):3466–3475. doi:10.1002/cncr.33657
14. Dai M, Liu D, Liu M, et al. Patients with cancer appear more vulnerable to SARS-CoV-2: a multicenter study during the COVID-19 outbreak. *Cancer Discov*. 2020;10(6):783–791. doi:10.1158/2159-8290.Cd-20-0422
15. Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *Lancet Oncol*. 2020;21(3):335–337. doi:10.1016/s1470-2045(20)30096-6
16. Valdiviezo N, Alcarraz C, Castro D, et al. Oncological care during first peruvian national emergency COVID-19 pandemic: a multicentric descriptive study. *Cancer Manag Res*. 2022;14:1075–1085. doi:10.2147/cmar.S350038
17. Shahidsales S, Aledavood SA, Joudi M, Molaie F, Esmaily H, Javadinia SA. COVID-19 in cancer patients may be presented by atypical symptoms and higher mortality rate, a case-controlled study from Iran. *Cancer Rep*. 2021;4(5):e1378. doi:10.1002/cnr2.1378
18. Nichetti F, Bini M, Ambrosini M, et al. COVID-19 risk for patients undergoing anticancer treatment at the outpatient clinic of the National Cancer Institute of Milan: the COVINT study. *ESMO Open*. 2020;5(Suppl 3):e000883. doi:10.1136/esmoopen-2020-000883
19. Lee L, Cazier JB, Starkey T, et al. COVID-19 prevalence and mortality in patients with cancer and the effect of primary tumour subtype and patient demographics: a prospective cohort study. *Lancet Oncol*. 2020;21(10):1309–1316. doi:10.1016/s1470-2045(20)30442-3
20. Russell B, Moss CL, Palmer K, et al. COVID-19 risk factors for cancer patients: a first report with comparator data from COVID-19 negative cancer patients. *Cancers*. 2021;13(10):2479. doi:10.3390/cancers13102479
21. Hingmire S, Wategaonkar R, Hegde S, et al. Outcome of COVID-19 infection in cancer patients in Pune. *South Asian J Cancer*. 2021;10(1):23–27. doi:10.1055/s-0041-1731910
22. Iskender G, Mert D, Yapar Toros G, et al. COVID-19 in cancer patients: patient characteristics and outcomes in the post-COVID-19 vaccination period. *Turk J Med Sci*. 2023;53(6):1744–1755. doi:10.55730/1300-0144.5744
23. Kosovalı B, Koç İ, Kocabeyoğlu G, Küçük B, Mutlu M. The difference in mortality between COVID-19 and non-COVID-19 malign intensive care patients? *Turkish J Clin Laboratory*. 2022;13(2):263–268. doi:10.18663/tjcl.1098395
24. Kiani A, Roesch R, Wendtner CM, et al. Preinfection laboratory parameters may predict COVID-19 severity in tumor patients. *Cancer Med*. 2021;10(13):4424–4436. doi:10.1002/cam4.4023
25. Yu J, Ouyang W, Chua M, Xie C. SARS-CoV-2 transmission in patients with cancer at a tertiary care hospital in Wuhan, China. *JAMA Oncol*. 2020;6(7):1108–1110. doi:10.1001/jamaoncol.2020.0980
26. Najjar M, Albuaini S, Fadel M, et al. COVID-19 disease in Syrian patients with cancer: clinical manifestations, laboratory findings, treatment, and outcomes. *JCO Glob Oncol*. 2022;8:e2100283. doi:10.1200/go.21.00283
27. Pascarella G, Strumia A, Piliego C, et al. COVID-19 diagnosis and management: a comprehensive review. *J Intern Med*. 2020;288(2):192–206. doi:10.1111/joim.13091
28. Lee R, Wysocki O, Bhogal T, et al. Longitudinal characterisation of haematological and biochemical parameters in cancer patients prior to and during COVID-19 reveals features associated with outcome. *ESMO Open*. 2021;6(1):100005. doi:10.1016/j.esmoop.2020.100005
29. Zhang L, Zhu F, Xie L, et al. Clinical characteristics of COVID-19-infected cancer patients: a retrospective case study in three hospitals within Wuhan, China. *Ann Oncol*. 2020;31(7):894–901. doi:10.1016/j.annonc.2020.03.296

30. Ferhatoğlu F, Kapağan T, Paksoy N, et al. Poor risk factors affecting cancer patients infected with Covid-19: a retrospective comparative study from a pandemic hospital. *Turkish J Oncol.* **2023**;38(1):1.
31. Bakouny Z, Hawley JE, Choueiri TK, et al. COVID-19 and cancer: current challenges and perspectives. *Cancer Cell.* **2020**;38(5):629–646. doi:10.1016/j.ccell.2020.09.018
32. Giesen N, Sprute R, Rüttrich M, et al. Evidence-based management of COVID-19 in cancer patients: guideline by the Infectious Diseases Working Party (AGIHO) of the German Society for Haematology and Medical Oncology (DGHO). *Eur J Cancer.* **2020**;140:86–104. doi:10.1016/j.ejca.2020.09.009
33. Martin S, Kaeuffer C, Leyendecker P, et al. COVID-19 in patients with cancer: a retrospective study of 212 cases from a French SARS-CoV-2 cluster during the first wave of the COVID-19 pandemic. *Oncologist.* **2021**;26(9):e1656–e1659. doi:10.1002/onco.13831
34. El Majzoub I, Kalot N, Khalifeh M, Estelly N, El Zahran T. “Predictors of in-hospital mortality in adult cancer patients with COVID-19 infection presenting to the emergency department: a retrospective study”. *PLoS One.* **2023**;18(1):e0278898. doi:10.1371/journal.pone.0278898
35. Raez LE, Tarockoff M, Carracedo Uribe CR, et al. Mortality and prognostic factors in hospitalized COVID-19 patients with cancer: an analysis from a large healthcare system in the United States. *Ann Transl Med.* **2022**;10(20):1090. doi:10.21037/atm-22-1667
36. Song C, Dong Z, Gong H, et al. An online tool for predicting the prognosis of cancer patients with SARS-CoV-2 infection: a multi-center study. *J Cancer Res Clin Oncol.* **2021**;147(4):1247–1257. doi:10.1007/s00432-020-03420-6
37. Fernandes GA, Feriani D, França E, Silva I, et al. Differences in mortality of cancer patients with COVID-19 in a Brazilian cancer center. *Semin Oncol.* **2021**;48(2):171–180. doi:10.1053/j.seminoncol.2021.01.003
38. Garassino M, Whisenant J, Huang L, et al. COVID-19 in patients with thoracic malignancies (TERAVOLT): first results of an international, registry-based, cohort study. *Lancet Oncol.* **2020**;21(7):914–922. doi:10.1016/s1470-2045(20)30314-4
39. Liu L, Liao Y, Yu XH, et al. Clinical characteristics and prognostic factors of COVID-19 infection among cancer patients during the december 2022 - february 2023 omicron variant outbreak. *Front Med.* **2024**;11:1401439. doi:10.3389/fmed.2024.1401439
40. Zarifkar P, Kamath A, Robinson C, et al. Clinical characteristics and outcomes in patients with COVID-19 and cancer: a systematic review and meta-analysis. *Clin Oncol.* **2021**;33(3):e180–e191. doi:10.1016/j.clon.2020.11.006

International Journal of General Medicine

Publish your work in this journal

The International Journal of General Medicine is an international, peer-reviewed open-access journal that focuses on general and internal medicine, pathogenesis, epidemiology, diagnosis, monitoring and treatment protocols. The journal is characterized by the rapid reporting of reviews, original research and clinical studies across all disease areas. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/international-journal-of-general-medicine-journal>

Dovepress
Taylor & Francis Group