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Clinical Characteristics and Outcomes in Hospitalized Patients with COVID-19 and Cancer History: A Multicenter Cross-Sectional Study in Southwestern Iran

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ABSTRACT

Background: Cancer patients are more exposed to opportunistic infections, such as COVID-19, due to their poor health status. The aim of this study was to identify the clinical characteristics of cancer and non-cancer patients with COVID-19 that may lead to death, intubation, and ICU admission.

Materials and Methods: A Multicenter Cross-Sectional study was conducted on confirmed COVID-19 adult patients with and without a history of cancer from March 2019 to March 2021. Demographic and clinical features, ICU admission, intubation, and discharge status have been extracted from patients' medical records. Chi-square, odds ratio, Mann-Whitney test, and logistic regression were used to analyze the data.

Results: The death rate in 1332 cancer patients was 28% compared to the 91464 noncancer patients which was 9% with an odds ratio of 3.94 and $p<0.001$. ICU admission rates among the cancer group were 43%, while in the noncancer group, it was 17.9% ($p<0.001$). Moreover, intubation was done for 20.9% of cancer patients and 7.4% of non-cancer patients ($p<0.001$). However, no significant difference was observed between the two groups in terms of length of stay in the hospital. Multivariable logistic regression analysis showed that age, level of consciousness, SPO2, and autoimmune disorders were associated with mortality in cancer patients with COVID-19.

Conclusion: This study showed that older age, loss of consciousness, low oxygen saturation, and suffering from autoimmune disorders were the predictors of death in cancer patients with COVID-19. These results can have important implications for the management and care of cancer patients with COVID-19.

Keywords: COVID-19, Cancer, Mortality, Prognostic Factors, Severe clinical events, Iran

INTRODUCTION

COVID-19 is a potentially contagious infection, which has been associated with a high prevalence around the world, and despite the fact that more than thirteen billion doses of vaccine have been distributed worldwide; the rate of COVID-19-induced mortality is not yet negligible[1]. Unfortunately, the multiple mutations in the COVID-19 virus in different countries, including England, India and South Africa have caused a more intense spread of the disease throughout the world and thus increased case fatality[2,3]. According to the latest statistics of the World Health Organization, as of April 26, 2023, there have been more than 764 million confirmed cases of COVID-19 worldwide, and nearly 7 million patients died due to this disease[1]. In Iran, as of March 29, 2023, more than 7.5 million cases of COVID-19 with more than 145 thousand deaths from this disease have been reported[4]. According to the reports of various studies, a number of factors including underlying diseases and some specific laboratory parameters have been associated with admission to the intensive care unit (ICU) and mortality related to COVID-19 (5,6). Cancer has also been confirmed as one of the risk factors related to mortality caused by COVID-19 in many studies [7-12].

Cancer patients are more exposed to opportunistic infections, such as COVID-19, due to their poor health status, simultaneous suffering from other chronic diseases, and their weak immune system, which is one of the side effects of anti-cancer treatments[8,13]. According to the literature, the sensitivity to infection is higher in patients who are treated with anti-cancer drugs and suffer from COVID-19 at the same time, and these patients are at risk of increasing side effects of COVID-19 and are likely to experience a more severe disease[14,15]. In addition, based on existing evidence, a high percentage of these patients need ICU admission and ventilation[7,16,17]. The results regarding the location of the disease have also shown that patients with hematological malignancies have a poorer prognosis than patients with solid tumors, and the mortality rate in patients with hematological malignancies has been reported to be higher in some studies[8,11]. However, there are some contradicting results from different studies. In Li et al, for example, the mortality rate in these two groups of patients was reported to be similar [10].

In addition, studies have shown a poor prognosis in cancer patients who suffer from the complications of the disease. Meng et al.'s study showed that complications, such as acute respiratory distress syndrome, myocardial damage, arrhythmia, kidney damage, secondary infection, and shock were associated with an increase in the mortality rate among COVID-19 patients with cancer[7]. The results of some studies also indicate a significant difference between cancer patients and non-cancer patients in terms of laboratory parameters such as increased level of tumor necrosis factor, low volume of T cells and CD4, reduced ratio of albumin-globulin, leukocytosis, and thrombocytopenia, which may indicate specific immune and inflammatory reactions in COVID-19 patients with cancer [8,9,11,18]. However, based on the available evidence regarding the risk of mortality in cancer patients with COVID-19, there are still major gaps in the literature, and there is a dire need to conduct more extensive studies to determine the role of cancer in increasing the mortality associated with COVID-19 [15].

More particularly, there is a need to conduct extensive and focused studies to comprehensively describe the characteristics of COVID-19 and investigate its consequences in cancer patients. However, limited studies have thus far been conducted on patients hospitalized in Iranian hospitals, and the majority of these studies were conducted on a small sample [11,12,16,17]. Therefore, we conducted a focused study to check the prognosis of cancer patients with COVID-19. In the present study, we performed a retrospective analysis in hospitals affiliated to Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, and compared COVID-19 patients with cancer against COVID-19 patients without cancer in terms of their clinical characteristics, outcomes, and risk factors leading to death, intubation, and ICU admission.

MTERIALS AND METHODS

Study sample and data collection

This is a retrospective study conducted in 2022 based on information obtained from the disease registration system. The research population

consisted of all patients with probable or confirmed cases of COVID-19 who referred to 32 hospitals affiliated to Ahvaz Jundishapur University of Medical Sciences, in Khuzestan province, southwest of Iran. To access patient information, the data registered in the COVID-19 registry system in Khuzestan province was used. Case finding, minimum data set, and data quality control mechanism in the aforementioned registry system have been published in previous studies[19,20]. The database of the COVID-19 registry system included information about 136,541 inpatients and outpatients from the first of March 2019 to the end of March 2021. This database includes the demographic data of patients, the date of visit, the hospital where the patient was admitted, the type of admission, the type of inpatient department, the way of exposure to COVID-19, signs and symptoms (such as fever, cough, etc.), CT Scan, PCR test, vital signs, pregnancy and underlying diseases, ICU admission, intubation, discharge status (discharge, transfer, or death) of patients with COVID-19, and those suspected of having COVID-19.
The present study was conducted in four stages, namely extracting data from the database of the registry system, checking the data to ensure the diagnosis of cancer, determining the outcome of the disease, and data analysis. First, a Microsoft Excel document was prepared which contained data about all patients in the database of the COVID-19 registry system. Then, the initial samples of the research were selected based on the study inclusion criteria, which were cases of COVID-19 disease based on a positive PCR test, or a symptomatic CT scan (in patients with a negative PCR test or no PCR test result) and hospitalization. Suspected cases of COVID-19 (patients with negative PCR test or those without PCR test and having asymptomatic CT scan) and outpatient referrals were excluded from the study. The initial sample included 92,796 patients. In the next step, the status of cancer in the selected patients was investigated. The goal was to ensure the accuracy of cancer diagnosis. For this purpose, two other sources of data were used. The first source was the population-based cancer registry system in Khuzestan province. After arrangements were made with the officials of the COVID-19 and cancer registry systems, a joint team was formed to review the patients' records (which were in Excel documents). Using the unique national patient ID number, the data of the patients was checked in the cancer registry software system. The second source was the review of patients' records at Shahid Beqaei Hospital 2, which is the specialist oncology hospital in Khuzestan province. The Excel file of patients whose data was not in the population-based cancer registry software system was provided to the health information management department of Shahid Beqaei 2 Hospital to check the patients' history in the HIS software using the patients' national ID number. In total, out of the 1524 patients with the underlying disease of cancer mentioned in the Excel file, 124 patients did not have cancer and 68 patients had a past history of cancer. Therefore, the data related to these patients was corrected.

Consequences of diseases

In the third stage, the results were used to investigate the impact of cancer on COVID-19 patients. The study outcomes included length of hospital stay, intubation rate, ICU admission, and mortality rate.

Data analysis

The fourth stage involved data analysis. Patients were divided into two groups of cancer patients and non-cancer patients based on the presence of underlying cancer disease, and the status of COVID-19 disease and its outcome were compared in the two groups. For data analysis, descriptive statistics indicators (frequency, mean and standard deviation, median, and quartile) and inferential statistics indicators (Chi-square, odds ratio, Mann-Whitney test, and logistic regression) were used. Significance level was set at 0.05 in all tests.
SPSS software version 22 was used to analyze the data.

Ethical considerations

This study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1400.445).

RESULTS

In the present study, 1332 cancer patients with confirmed COVID-19 were compared with 91464 noncancerous confirmed COVID-19 patients. Demographics and clinical characteristics of the total cancerous and noncancerous patients are summarized in Table 1. The mean age of cancerous and non-cancerous patients was 51.74 ± 22.8 and 49.96 ± 18.08 years old respectively. The participants consisted of 47301 men (51%) and 45495 women (49%).

The most common symptoms at admission in our population were cough (64.3%), dyspnea (51.3%), fever (37.7%), and muscle pain (37.3%). Loss of consciousness, fever, stomach ache, nausea, vomiting, diarrhea, headache, and anorexia were significantly higher among COVID-19 patients with cancer. Among the underlying diseases, diabetes with 14732 patients (15.9%), and hypertension with 13720 patients (14.8%) had the highest frequency in our population. Hypertension, liver diseases, hematologic disorders, chronic kidney disease, autoimmune disorders ,and chronic respiratory diseases, except asthma, were significantly higher in cancer patients, while the prevalence of asthma was higher in non-cancer patients (Table 1).

The result of the present study showed death rates, ICU admission, and intubation were significantly higher among cancer patients with COVID-19. The death rate in 1332 cancer patients was 28% compared to the 91464 noncancer patients which were 9% with an odds ratio of 3.94 and $p<0.001$. ICU admission rates among the cancer group were 43%, while in the noncancer group ,it was 17.9% ($p<0.001$). Moreover, intubation was done for 20.9% of cancer patients and 7.4% of non-cancer patients ($p<0.001$). However, no significant difference was observed between the two groups in terms of length of stay in the hospital (Table 2).

Table 3 focuses on the predictors of outcomes (death rates, ICU admission, intubation) in cancer patients with covid-19. Multivariable logistic regression analysis showed that older age, loss of consciousness, no headache, low oxygen saturation, and suffering from autoimmune disorders were associated with an increased risk of death, while lower age, loss of consciousness, low oxygen saturation, and suffering from chronic kidney disease increased the risk of ICU admission. Moreover, loss of consciousness, no stomach ache, low oxygen saturation, and suffering from autoimmune disorders were associated with an increased risk of intubation (Table 3).

Table 1: Demographics, baseline characteristics and outcome of hospitalized patients with COVID-19 categorized in cancer, and without cancer subgroups, N=92796

	Non cancer patients n=91464 (%)	Cancer patients n=1332 (%)	Total	Chi-Square	P value	OR (CI95%)
Age	49.96 (18.08)	51.74 (22.8)	49.98 (18.16)	67761252.5	<0.0001	-
Mean (± SD), Median (Q1, Q3)	49 (37,63)	57 (40, 68)	50 (37,63)			
Sex						
Male	46649 (51.1)	652 (48.9)	47301 (51)	2.216[a]	0.137	1.08 (0.97-1.21)
Female	44815 (48.9)	680 (51.1)	45495 (49)			
Fever (yes)	34345 (37.6)	612 (45.9)	34957 (37.7)	39.413[a]	<0.0001	1.41 (1.26-1.57)
Cough	58823 (64.3)	841 (63.1)	59664 (64.3)	0.789[a]	0.374	0.95 (0.85-1.06)
Myalgia	34086 (37.3)	531 (39.9)	34617 (37.3)	3.788[a]	0.052	1.11 (0.99-1.24)
Dyspnea	46898 (51.3)	668 (50.2)	47566 (51.3)	.665[a]	0.415	0.95 (0.85-1.06)
Loss of consciousness	2877 (3.1)	133 (10)	3010 (3.2)	195.684[a]	<0.0001	3.41 (2.84-4.1)
Loss of Smell	1136 (1.2)	14 (1.1)	1150 (1.2)	0.391[a]	0.532	0.84 (0.49-1.43)
Loss of Taste	1014 (1.1)	10 (0.8)	1024 (1.1)	1.541[a]	0.214	0.67 (0.36-1.26)
Seizure	285 (0.3)	6 (0.5)	291 (0.3)	0.810[a]	0.368	1.44 (0.64-3.25)
Abdominal pain	1316 (1.4)	42 (3.2)	1358 (1.5)	26.840[a]	<0.0001	2.23 (1.63-3.05)
Nausea	5684 (6.2)	182 (13.7)	5866 (6.3)	123.413[a]	<0.0001	2.39 (2.04-2.8)
Vomit	3819 (4.2)	100 (7.5)	3919 (4.2)	36.184[a]	<0.0001	1.86 (1.51-2.29)
Diarrhea	2316 (2.5)	50 (3.8)	2366 (2.6)	7.932[a]	0.005	1.5 (1.13-2)
Loss of appetite	12333 (13.5)	396 (29.8)	12729	293.736[a]	<0.0001	2.72 (2.41-3.06)
Headache	9513 (10.4)	181 (13.6)	9694 (10.5)	14.376[a]	<0.0001	1.35 (1.15-1.58)
Dizziness	3729 (41)	58 (4.4)	3787 (4.1)	.266[a]	0.606	1.07 (0.82-1.39)
Paresis of limbs	291 (0.3)	5 (0.4)	296 (0.3)	0.137[a]	0.711	1.18 (0.48-2.86)
Paralysis of limbs	158 (0.2)	2 (0.2)	160 (0.2)	0.845	1	0.87 (0.21-3.51)
Chest pain	3009 (3.3)	35 (2.6)	3044 (3.3)	1.798[a]	0.180	0.79 (0.56-1.11)
skin rash	107 (0.1)	3 (0.2)	110 (0.1)	1.303[a]	0.254	1.92 (0.61-6.08)
PO2 saturation scale						
Upper 93 percent	69885 (76.4)	913 (68.5)	70798	44.887[a]	<0.0001	1.48 (1.32-1.67)
Under 93 percent	21579 (23.6)	419 (31.5)	21998			
Current smoker	739 (0.8)	23 (1.7)	762 (0.8)	13.608[a]	<0.0001	2.15 (1.41-3.27)
Drug use	385 (0.4)	16 (1.2)	401(.4)	18.577[a]	<0.0001	2.87 (1.73-4.75)
Chronic liver disease	260 (0.3)	15 (1.1)	275 (0.3)	31.610[a]	<0.0001	4 (2.37-6.75)
Diabetic	14507 (15.9)	225 (16.9)	14732 (15.9)	1.121[a]	0.290	1.08 (0.93-1.24)
Hematologic disorders	375 (0.4)	83 (6.2)	458 (0.5)	908.207[a]	<0.0001	16.18 (12.67-20.65)
HIV/AIDS	62 (0.1)	2 (0.2)	64 (0.1)	1.300[a]	0.254	2.22 (0.54-9.09)
Autoimmune disorders	204 (0.2)	8 (0.6)	212 (0.2)	8.251[a]	0.004	2.7 (1.33-5.5)
Pregnancy	1161 (1.3)	2 (0.2)	1163 (1.3)	13.250[a]	<0.0001	0.11 (0.02-0.47)
Heart disease	7932 (8.7)	131 (9.9)	8063 (8.7)	2.318[a]	0.128	1.15 (0.96-1.38)
HTN	13494 (14.8)	226 (17)	13720 (14.8)	5.272[a]	0.022	1.18 (1.02-1.36)
Chronic Kidney disease	1592 (1.7)	39 (2.9)	1631 (1.8)	10.814[a]	0.001	1.7 (1.23-2.35)
Dialysis	728 (45.7)	14 (35.9)	742 (45.5)	1.484[a]	.223	0.66 (0.34-1.28)
Asthma	1755 (1.9)	8 (0.6)	1763 (1.9)	12.187[a]	<0.0001	0.31 (0.15-0.62)
Other chronic respiratory disorders	675 (0.7)	22 (1.7)	697 (0.8)	14.788[a]	<0.0001	2.26 (1.47-3.47)
Diseases of the nervous system	686 (0.8)	11 (0.8)	697 (0.8)	0.106[a]	0.745	1.1 (0.6-2)

Table 2: Outcomes in 1332 cancer and 91464 control patients

	Non cancer patients n=91464 (%)	Cancer patients n=1332 (%)	Total	Chi-Square/ U	P value	OR (CI95%)
ICU						
No	63360 (82.1)	668 (57.0)	64028 (81.7)	482.351[a]	<0.0001	3.44 (3.06-3.87)
Yes	13854 (17.9)	503 (43.0)	14357 (18.3)			
Death						
No	83259 (91.0)	957 (72.0)	84216 (90.8)	564.926[a]	<0.0001	3.94 (3.49-4.45)
Yes	8205 (9.0)	372 (28.0)	8577 (9.2)			
Intubation						
No	84698 (92.6)	1054 (79.1)	85752 (92.4)	342.812[a]	<0.0001	3.31 (2.90-3.79)
Yes	6733 (7.4)	278 (20.9)	7011 (7.6)			
LOS	5.74 (6.5)	5.73 (5.6)	5.74 (6.5)	37032046.5	0.758	-
Mean (± SD), Median (Q1, Q3)	4 (3,7)	4 (2,7)	4 (3,7)			

Table 3: The predictors of outcomes (death rates, ICU admission, intubation) in cancer patients with covid-19

	ICU			Intubation			Death		
	B	S.E.	P value	B	S.E.	P value	B	S.E.	P value
Age	-0.007	0.003	0.025	0.006	0.004	0.156	0.011	0.004	0.003
Fever	0.102	0.135	0.448	0.074	0.165	0.653	0.127	0.150	0.397
Loss of consciousness	0.945	0.227	<0.0001	1.959	0.228	<0.0001	1.852	0.239	<0.0001
Abdominal pain	-0.184	0.394	0.641	-2.601	1.087	0.017	-0.865	0.550	0.116
Nausea	0.328	0.223	0.141	0.157	0.295	0.595	0.154	0.267	0.563
Vomit	-0.154	0.300	0.609	-0.186	0.383	0.627	-0.299	0.354	0.399
Diarrhea	0.262	0.362	0.470	-0.017	0.469	0.970	-0.237	0.445	0.594
Loss of appetite	-0.208	0.151	0.170	-0.094	0.191	0.621	-0.202	0.174	0.245
Headache	-0.351	0.203	0.084	-0.482	0.282	0.088	-0.602	0.253	0.017
PO2 saturation scale	1.417	0.141	<0.0001	1.704	0.165	<0.0001	1.727	0.149	<0.0001
Current smoker	0.334	0.495	0.500	-0.272	0.588	0.643	-0.723	0.577	0.210
Drug use	0.603	0.633	0.341	1.312	0.702	0.062	0.766	0.677	0.257
Chronic liver disease	-0.641	0.656	0.328	0.654	0.708	0.356	1.057	0.714	0.139
Hematologic disorders	0.344	0.270	0.203	-0.205	0.375	0.584	-0.193	0.341	0.571
Autoimmune disorders	0.056	0.771	0.943	2.294	0.840	0.006	1.694	0.804	0.035
Pregnancy	0.404	1.617	0.803	1.363	1.502	0.364	0.723	1.472	0.623
HTN	0.232	0.178	0.193	0.281	0.207	0.174	0.059	0.193	0.760
Chronic Kidney disease	0.903	0.408	0.027	0.759	0.414	0.067	0.511	0.407	0.209
Asthma	0.842	0.944	0.373	0.855	0.892	0.338	1.153	0.853	0.176
Other chronic respiratory disorders	0.013	0.475	0.978	0.069	0.549	0.900	0.760	0.498	0.127
Diseases of the nervous system	1.320	0.835	0.114	0.311	0.748	0.678	0.889	0.765	0.245

DISCUSSION

In the present study ,we compared the clinical characteristics and outcomes of 1332 cancer patients with COVID-19 and 91464 noncancerous COVID-19 patients. This study showed that the most common symptoms at the time of hospitalization in our population (cancer and non-cancer patients) were cough, dyspnea, fever, and muscle pain. These results were consistent with the results of many recent studies [8,11,21,22].

According to our results, the following symptoms were significantly higher in COVID-19 patients with cancer compared with those without cancer: fever, heartburn, nausea and vomiting, diarrhea, headache, and anorexia. In Sorouri et al.'s study, fever and fatigue [11], and in Taghizadeh-Hesary et al. 's study [16], fever and dry cough were significantly more common symptoms in cancer patients as opposed to non-cancer patients. However, we could not find any study reporting the high prevalence of gastrointestinal symptoms in COVID-19 patients with cancer. Contrary to the results of the present study, the results of a previous study in Iran showed that symptoms such as fever and vomiting were significantly lower in cancer patients compared to non-cancer patients [12]. Of course, our review of past studies on this topic showed that most of these studies were conducted on a small sample, and there was no comparison group in most of them. However, one of the major strengths of the present study is the use of a large sample size and having a comparison group that yielded more definitive results regarding the existing differences. It should be noted that cancer patients usually suffer from side effects such as nausea and vomiting, diarrhea and loss of appetite due to the anti-malignancy treatments they receive[23]. Unfortunately, in the present study, due to the large sample size and the multicenter nature of the study, we could not obtain specific information on cancer patients, including the type of anti-malignancy treatments. However, the results of similar studies show that anti-malignancy treatments, including chemotherapy, are among the factors influencing the presentation of more severe symptoms in cancer patients with COVID-19 [8,17].

Moreover, in the present study, blood disorders were significantly higher in cancer patients compared to non-cancer patients, which could be attributed to the underlying malignancy and mainly the side effects of anti-malignancy treatments. Consistent with the results of the present study, Zhou et al. found that patients with cancer had significantly lower numbers of erythrocytes, platelets, and lymphocytes compared to non-cancer patients[24]. In Ruiz et al.'s study, 75.9% of cancer patients with COVID-19 had blood disorders including leukopenia, leukocytosis, and lymphopenia[21]. Yang et al. reported low blood cell count in almost all cancer patients participating in their study, which they attributed to anti-malignancy treatments including chemotherapy[8]. In a, these studies showed a worse prognosis in patients with blood disorders compared to other patients. In the present study, blood disorders were not identified as a predictor of mortality or a factor related to the severity of the disease. However, in order to draw solid conclusions, access to the type of malignancy (blood malignancy or solid tumor) is needed. In the present study, we could not access the type of cancers, which limited our work.

In addition, the prevalence of concomitant diseases such as high blood pressure, hepatic diseases, chronic kidney disease, autoimmune disorders, and chronic respiratory diseases except asthma was significantly higher in cancer patients, while the prevalence of asthma was higher in non-cancer patients. In the present study, high blood pressure was the most common comorbidity in cancer patients and the second most common disease in non-cancer patients, which is consistent with many previous studies[7,10,11,12]. However, contrary to the results of the present study, no significant difference was found between the cancer and non-cancer groups in any of the mentioned studies. This may be explained by the large sample size in the present study. However, despite its high prevalence among cancer patients, hypertension was not identified as a risk factor predicting death in cancer patients with COVID-19 in this study. The results of previous studies have also shown that although they lead to a poorer prognosis in patients with COVID-19 (25), co-morbidities are not an independent risk factor for death in patients[8, 26, 27]. However, contrary to these results, some studies conducted on cancer patients

have identified high blood pressure as a predictor of death [28,29].

In our study, only 1.1% of cancer patients had liver failure and 2.9% had chronic kidney failure. However, a statistically significant difference was observed between the two groups of cancer and non-cancer patients in terms of suffering from these disorders. In line with the results of the present study, the results of some previous studies also show that liver and kidney disorders are more common in cancer patients with COVID-19 compared to other patients. In Jiandong Zhou et al.'s study, for instance, there were significant differences between cancer and non-cancer patients in terms of liver and kidney function, with the former having a lower albumin and higher urea levels [24]. In Sorouri et al.'s study, the level of liver enzymes was significantly higher in cancer patients compared to the control group [11]. In Yang et al.'s study[8], liver disorders were among the predictors of death in cancer patients with COVID-19. Although this finding is not consistent with the present study, the high prevalence of liver disorders in cancer patients can show the importance of examining these disorders in cancer patients with COVID-19 and monitoring patients from this point of view. In addition, the regression results in the present study showed that chronic kidney disease in cancer patients is one of the predictors of ICU admission. The results of a systematic review study that examined 69 systematic review studies and 66 primary studies in CKD patients with COVID-19 also showed that CKD patients are highly in need of ICU admission[30]. The results of Mamlouk et al.'s study also showed that CKD in cancer patients with COVID-19 is associated with a high need for ICU admission as well as high mortality[31]. Cancer patients with COVID-19 who suffer from chronic kidney failure are more sensitive to COVID-19 due to the severe weakness of the immune system, which leads to a poor prognosis in these patients and requires hospitalization in the ICU [30].

The present study also showed that the prevalence of chronic respiratory diseases, except for asthma, was significantly higher in cancer patients with COVID-19, which is consistent with a number of previous studies[32,24]. On the contrary, some studies reported that there is no significant difference between cancer and non-cancer patients in terms of the prevalence of chronic respiratory diseases [9,10,12]. The results of previous studies have shown that chronic respiratory diseases are a risk factor for lung cancer[33,34]. Although we did not have access to the type of cancer in the present study, the high prevalence of chronic respiratory diseases due to air pollution and the high prevalence of lung cancer in Khuzestan province[35], where this study was conducted, can be a reason for this finding.

According to the results of the present study, there was a significant difference between the two groups of patients in terms of autoimmune disorders. These disorders included lupus erythematosus, systemic rheumatism, systemic sclerosis, and allergic disorders. To the best of our review of the literature, we could not find any study to investigate the presence of autoimmune disorders as a co-morbidity in cancer patients with COVID-19. However, the results of previous studies have shown that many autoimmune disorders and immunosuppressive treatments are associated with increased risk of cancer development[36]. Cancer may also cause autoimmune disease [35]. The results of a systematic review and meta-analysis study on COVID-19 patients also showed that the risk of contracting COVID-19 in patients suffering from autoimmune diseases is significantly higher than that in control patients[38]. In addition, the regression results in the present study showed that having autoimmune disorders was one of the factors predicting the need for intubation, ventilation, and death in cancer patients with COVID-19. The results of a previous study showed that patients with autoimmune disorders experienced more severe clinical manifestations when they contracted COVID-19, and the prevalence of shortness of breath, cough, nasal congestion, and fatigue was significantly higher in them[39], which can explain why most of these patients require mechanical ventilation. On the other hand, based on the results of previous studies, the rate of hospitalization and mortality in COVID-19 patients suffering from autoimmune disorders has been high[38], which is in line with the results of the present study.

In the present study, the percentage of arterial oxygen saturation in cancer patients with COVID-19

was significantly lower compared to non-cancer patients. Furthermore, COVID-19 patients with cancer were 3.4 times more likely to experience a decreased level of consciousness than non-cancer patients with COVID-19. The regression results also showed that the risk of death in cancer patients increases 1.7-fold for each decrease in arterial oxygen level and 1.8-fold for each decrease in consciousness level. In Yang's study, a high mortality rate was reported in patients with low oxygen saturation [8]. In addition, the rates of ICU admission, intubation and death in cancer patients were significantly higher compared to non-cancer patients. These findings are in line with some previous studies[11,16,24] showing that cancer patients with COVID-19 were at higher risk for ICU admission, intubation, and death compared to people without malignancy. Patients with malignancy need more attention due to their sensitivity to infections and weak immune system, so under particular circumstances such as an epidemic of a viral disease, they definitely experience weaker outcomes compared to other patients. Due to some limitations, we could not access the complete information of cancer patients including the use of anti-malignancy treatments. However, the results of similar studies show that the use of anti-malignancy treatments can have adverse effects on the respiratory capacity of patients and that the death rate in cancer patients is higher compared to other patients with COVID-19[15,29]. The present study did not show a significant difference between the two groups in terms of length of stay, which is consistent with Meng et al.'s study[7]. However, contrary to our results, compared to non-cancer patients, cancer patients with COVID-19 were reported to have a shorter hospital stay in Sorouri et al.'s study conducted in Iran[11] and longer hospital stay in Asghar et al.'s study conducted in Pakistan [40]. In Sorouri et al.'s study, this finding was attributed to the higher mortality in these patients, while Asghar et al.'s explained it by early admission, which will thus lead to prolonged length of stay. It seems that different factors can affect the length of stay of cancer patients with COVID-19 in hospital, which requires more studies on this topic.

Besides, the results of the regression showed that old age is one of the predictors of death in cancer patients with COVID-19, which is not an unexpected finding since many previous studies have mentioned old age as a strong risk factor for death in cancer patients with COVID-19 [8, 28, 29]. Also, the results of a systematic review that examined 15 studies including 3019 cancer patients with COVID-19 also showed that old age is associated with severe events, death, and poor prognosis, which is in line with the results of the present study[41].

CONCLUSION

The present study showed that cancer is a strong risk factor for ICU admission, intubation, and death related to COVID-19. According to the results of the present study, older age, loss of consciousness, low oxygen saturation, and suffering from autoimmune disorders were the predictors of death in cancer patients with COVID-19. These results can have important implication for the management and care of cancer patients with COVID-19.

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CONFLICT OF INTEREST

The authors state that there is no competing interest in this article.

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