ORIGINAL ARTICLE

Characteristics and mortality in patients with cancer and COVID-19

Características y mortalidad en pacientes con cáncer y COVID-19

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Abstract

Objective: *Throughout the COVID-19 pandemic, care protocols were created to apply in hospital units and care for the vulner- able populationin. The objetive was to describe clini- cal manifestations, comorbidity and mortality in cancer patients with SARS CoV-2 infection, as well as sanitary measures carried out in COVID centers.* **Method:** *Retrospective study of 1752 patients admitted to a respiratory care unit.* **Results:** *5% of the population studied had a previous diagnosis of cancer; 59.1% were solid neoplasms and 40.9% hematologic neoplasms. Patients with cancer showed lower rates of admission to the intensive care unit (ICU) compared to patients without cancer (8% vs. 17.4%), with no differences in survival.* **Conclusions:** *Oncology patients hospitalized with COVID-19 did not have different survival rates and were less likely to require ICU care compared to non-cancer patients, this is likely due to multidisciplinary teamwork during the pandemic.*

Keywords: *Neoplasm. SARS Cov-2. Mortality.*

Resumen

Objetivo: *Durante la pandemia de COVID-19 se crearon protocolos de atención para aplicar en unidades hospitalarias y atender a las poblaciones vulnerables, el objetivo fue describir las manifestaciones clínicas, la comorbilidad y la mortalidad en pacientes oncológicos con infección por SARS-CoV-2, así como las medidas sanitarias aplicadas por el personal de salud durante la estancia en unidades COVID.* **Método:** *Estudio retrospectivo de 1752 expedientes clínicos de pacientes que ingre- saron a la unidad de cuidados respiratorios de un hospital de tercer nivel en la Ciudad de México de mayo de 2021 a enero de 2022.* **Resultados:** *El 5% de la población estudiada contaba con diagnóstico previo de cáncer; el 59.1% eran neoplasms sólidas y el 40.9% hematológicas. Los pacientes con cáncer mostraron tasas más bajas de ingreso en la unidad de cuidados intensivos (UCI) que los pacientes sin cáncer (8% frente a 17.4%), sin diferencias en la supervivencia.* **Conclusiones:** *Los pacientes oncológicos hospitalizados con COVID-19 no tuvieron tasas de supervivencia diferentes y fueron menos propensos a requerir cuidados en la UCI en comparación con los pacientes sin cáncer; esto se debe probablemente al trabajo en equipo multidisciplinario durante la pandemia.*

Palabras clave: *Cáncer. SARS-CoV-2. Mortalidad.*

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Introduction

Worldwide, 19.3 million new cancer cases and 10 million cancer-related deaths are reported annually[1]. In Mexico, the *Red Nacional de Registros de Cáncer* (RNRC) reports more than 195,000 new cases and 84,000 deaths from this disease, making it the third leading cause of mortality in the country[2].

The COVID-19 pandemic has significantly impacted cancer patient care, particularly due to the immense workload burdening health care systems, causing delays in diagnosis, treatment administration, and surgical management, leading to disease progression[3,4]. According to a report by Colaterall Global, the true extent of these delays impact may never be fully known[5].

Due to the immunosuppressive effects of underlying cancer and treatments such as chemotherapy, radiotherapy, and surgery, it was initially believed that patients with active cancer were more susceptible to contracting COVID-19 and developing severe disease vs the general population[6,7]. However, cancer does not seem to be a significant risk factor for SARS-CoV-2 infection or its exacerbation, at least not in the same way as other comorbidities such as cardiovascular diseases, diabetes, and chronic lung diseases. Nevertheless, when COVID-19 is acquired, cancer patients are at higher risk for complications[8].

Cancer patients are often older than 60 years and present with comorbidities, which increases their risk of mortality associated with COVID-19 due to immunosenescence and their propensity for exaggerated inflammatory responses caused by a reduction in naïve T cells. The proportion of naïve T cells vs memory T cells is a determining factor in the degree of the adaptive immune response specific to COVID-19, which leads to more severe symptoms in individuals aged 30 to 70 years[9,10].

A key factor in reducing mortality among cancer patients with COVID-19 has been health care professionals, including nurses, doctors, psychologists, and respiratory therapists, who have acted with strict planning from the patient's initial triage to hospital discharge. Health care professionals are involved in every stage of patient care for COVID-19. During the pandemic, the goal was to protect the workforce while prioritizing quality care based on established processes and the experience of other institutions[11,12].

The objective of this study is to describe the clinical characteristics and mortality of cancer patients with COVID-19, as well as the strategies implemented by health care personnel to mitigate the impact of this disease on a respiratory care unit.

Method

We conducted a retrospective study was on 1,752 patient records with SARS-CoV-2, confirmed by a positive polymerase chain reaction test, in the pulmonology unit of Hospital General de México Dr. Eduardo Liceaga from May 1st, 2021 through January 31st, 2022. Statistical analysis was performed using descriptive statistics based on the level of variable measurement. Categorical variables were expressed as frequencies and proportions, while quantitative variables were presented as means with standard deviations or medians with interquartile ranges, depending on data distribution. The chi-square test was used to compare categorical variables across groups (cancer and non-cancer). For continuous quantitative variables, the Student's t-test or Mann-Whitney U test was employed for comparisons between two independent groups. Kaplan-Meier survival analysis (log-rank or Breslow) was utilized. Statistical tests were conducted using SPSS v.26.

Results

A total of 1,752 clinical records were included, 58.7% (1,028) of which corresponded to men and 41.3% (724) to women. The most common age range was 45–55 years, accounting for 24.7% of all hospitalized patients, with an age range spanning from 18 up to 97 years; the mean age was 54.1 years, with a standard deviation of ±15.4 years.

A total of 88 (5%) out of the 1,752 patients studied were diagnosed with neoplasm associated with SARS-CoV-2 infection, while the remaining 95% did not have cancer. Among the cancer cases, a distinction was made between solid and hematological neoplasms: 60.2% were solid tumors, and 39.8% were hematological neoplasms.

Patients with cancer required admission to the respiratory intensive care unit (ICU) at a lower rate than non-cancer patients (8% vs. 17.4%). Additionally, they had a lower proportion of diabetes mellitus diagnoses (19.3% vs. 32.8%) and a lower prevalence of kidney disease (3.4% vs. 10.8%, according to Fisher's exact test) compared to individuals without cancer (Table 1).

Kaplan-Meier survival analysis for hospitalized COVID-19 patients revealed no statistically significant differences in survival between individuals with and without neoplasm. After 50 days of hospitalization, the probability of survival in both groups was approximately 20% (Fig. 1).

Table 1. Sociodemographic and Clinical Characteristics of Patients Hospitalized for COVID-19 With and Without Cancer

Variable	Total (n = 1752)	Without Cancer (n = 1664)	With Cancer (n = 88)	p
Sex, n (%)				
Female	724 (41.3)	684 (41.1)	40 (45.5)	
Male	1028 (58.7)	980 (58.9)	48 (54.5)	0.228[a]
Cancer type, n (%)				
No cancer	1659 (94.7)	1659 (100.0)	0 (0.0)	
Solid	56 (3.2)	0 (0.0)	56 (60.2)	
Hematologic	37 (2.1)	0 (0.0)	37 (39.8)	< 0.001[b]
Outcome, n (%)				
Survived	1247 (71.2)	1185 (71.2)	62 (70.5)	
Died	505 (28.8)	479 (28.8)	26 (29.5)	0.850[a]
ICU admission, n (%)				
No	1448 (83.1)	1367 (82.6)	81 (92.0)	
Yes	294 (16.9)	287 (17.4)	7 (8.0)	0.013[a]
Clinical severity, n (%)				
Mild	222 (12.7)	201 (12.1)	21 (23.9)	
Moderate	1238 (70.7)	1185 (71.3)	53 (60.2)	
Severe	267 (15.2)	253 (15.2)	14 (15.9)	
Critical	24 (1.4)	24 (1.4)	0 (0.0)	0.012[b]
Diabetes mellitus, n (%)				
No	1190 (67.9)	1119 (67.2)	71 (80.7)	
Yes	562 (32.1)	545 (32.8)	17 (19.3)	0.003[a]
Hypertension, n (%)				
No	1218 (69.5)	1152 (69.2)	66 (75.0)	
Yes	534 (30.5)	512 (30.8)	22 (25.0)	0.089[a]
Renal disease, n (%)				
No	1570 (89.6)	1485 (89.2)	85 (96.6)	
Yes	182 (10.4)	179 (10.8)	3 (3.4)	0.008[b]
Age, mean (SD)	54.1 (15.4)	54.3 (15.2)	50.8 (18.5)	0.075[c]
Length of stay (days), mean (SD)	13.1 (11.5)	13.0 (11.1)	15.5 (17.2)	0.161[c]
$SatO_2$, mean (SD)	86.2 (14.8)	86.4 (14.5)	82.0 (18.8)	0.053[c]
D-Dimer, mean (SD)	3525.5 (7680.5)	3525.3 (7734.1)	3528.3 (6647.8)	0.997[c]
Ferritin, mean (SD)	1173.4 (1678.8)	1156.9 (1676.0)	1505.3 (1712.3)	0.103[c]
Troponin, mean (SD)	104.9 (935.5)	108.7 (956.3)	21.1 (50.3)	0.501[c]
Myoglobin, mean (SD)	136.1 (220.6)	137.6 (221.6)	99.5 (194.8)	0.227[c]
CRP, mean (SD)	143.4 (157.0)	143.0 (159.0)	150.8 (109.5)	0.711[c]
Procalcitonin, mean (SD)	3.1 (28.3)	3.3 (29.1)	1.1 (2.9)	0.511[c]
BNP, mean (SD)	191.6 (532.3)	191.3 (530.4)	197.8 (578.7)	0.935[c]

BNP: Brain Natriuretic Peptide; CRP: C-Reactive Protein; SD: Standard Deviation; SatO2: Oxygen Saturation.
[a]Chi-square test
[b]Fisher's exact test
[c]Student's t-test for independent samples.

Similarly, Kaplan-Meier analysis based on the type of neoplasm found no statistically significant differences in survival between patients with solid and hematological neoplasms and SARS-CoV-2 infection (Fig. 2).

Bivariate analyses revealed a statistically significant difference in the clinical presentation between patients with and without neoplasm, with non-cancer patients showing higher prevalence of symptoms such as cough (p = 0.004), fever (p = 0.006), myalgia/

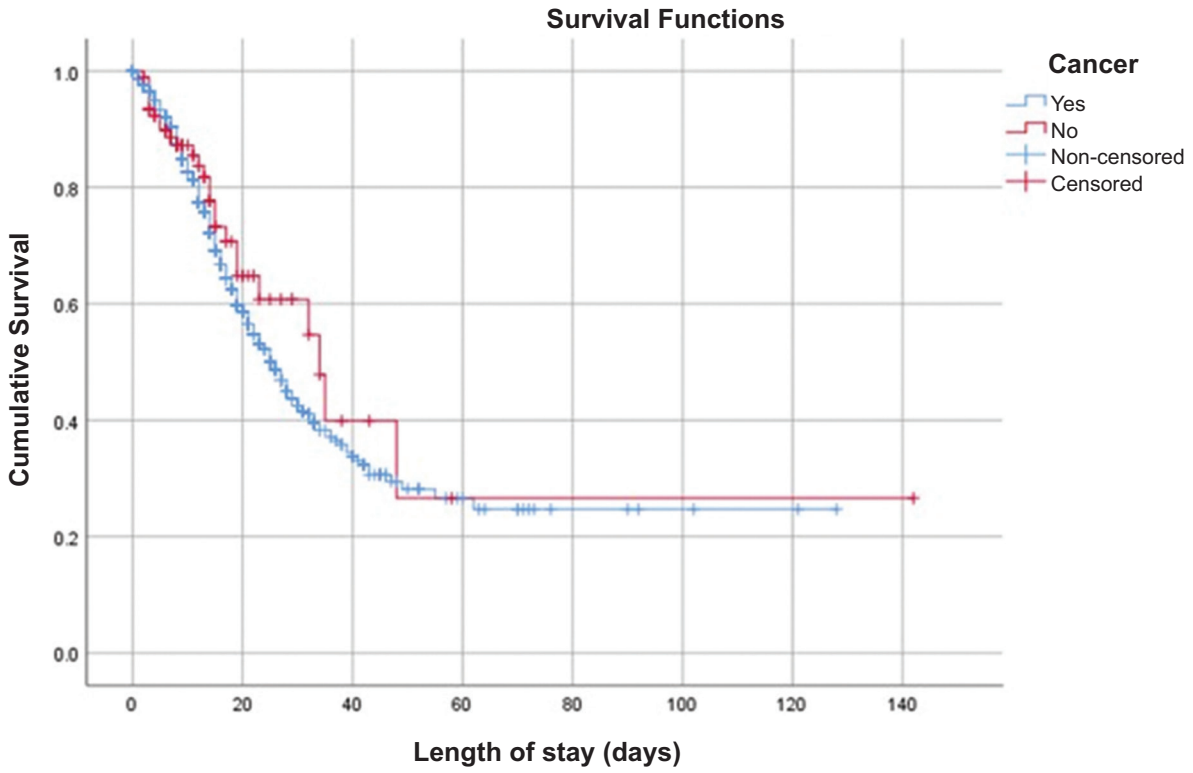

Figure 1. *Kaplan-Meier survival analysis of patients with SARS-CoV-2 infection with and without neoplasm.*

arthralgia (p = 0.006), dyspnea (p < 0.001), and odynophagia (p < 0.001) (Table 2).

The severity of COVID-19 in cancer patients was classified as mild in 23.9% (n = 21), moderate in 60.2% (n = 53), severe in 15.9% (n = 14), and critical in 0% (n = 0).

According to the multiple logistic regression model, for every additional year of age in patients with COVID-19, the likelihood of death increased by 4.5%. The likelihood of death for men was 42% higher vs women. Furthermore, severely and critically ill COVID-19 patients were 2 and 3 times more likely to die than those with mild illness (odds ratio [OR], 2.4 vs. 3.6; p < 0.05) (Table 3).

Discussion

The onset of the global COVID-19 pandemic served as a catalyst for revealing the strengths and weaknesses of health care systems. Patients with various comorbidities, including cancer, were significantly affected, leading to increased mortality, largely due to delays in timely medical care and the rising number of infected patients.

The distribution of COVID-19 patients in our study aligns with other reports, with males being predominant (58.7%) vs females (41.3%), and the most frequently reported age group being 45–55 years (24.7%)[13].

A total of 88 out of all patients were diagnosed with neoplasm and COVID-19, corresponding to 5% vs those without neoplasm (95%). The predominant type of neoplasm was solid tumors, reported in 59.1% of cancer patients, with lung cancer being the most common, followed by GI, breast, and thyroid cancers. Hematological cancers represented 40.9% of neoplasms in our series[14].

The main symptoms in cancer patients were dyspnea (59.1%), cough (47.3%), and fever (44.1%), consistent with findings by Zhang et al.[15], who reported fever (82.1%), cough (81.0%), fatigue (64.3%), and dyspnea (50.0%) as the most common symptoms in cancer patients with COVID-19, along with elevated levels of C-reactive protein, lactate dehydrogenase, lymphocytopenia, anemia, hypoalbuminemia, and leukocytopenia. While symptoms are generally similar in patients with and without cancer, fatigue and dyspnea are more associated with cancer patients,

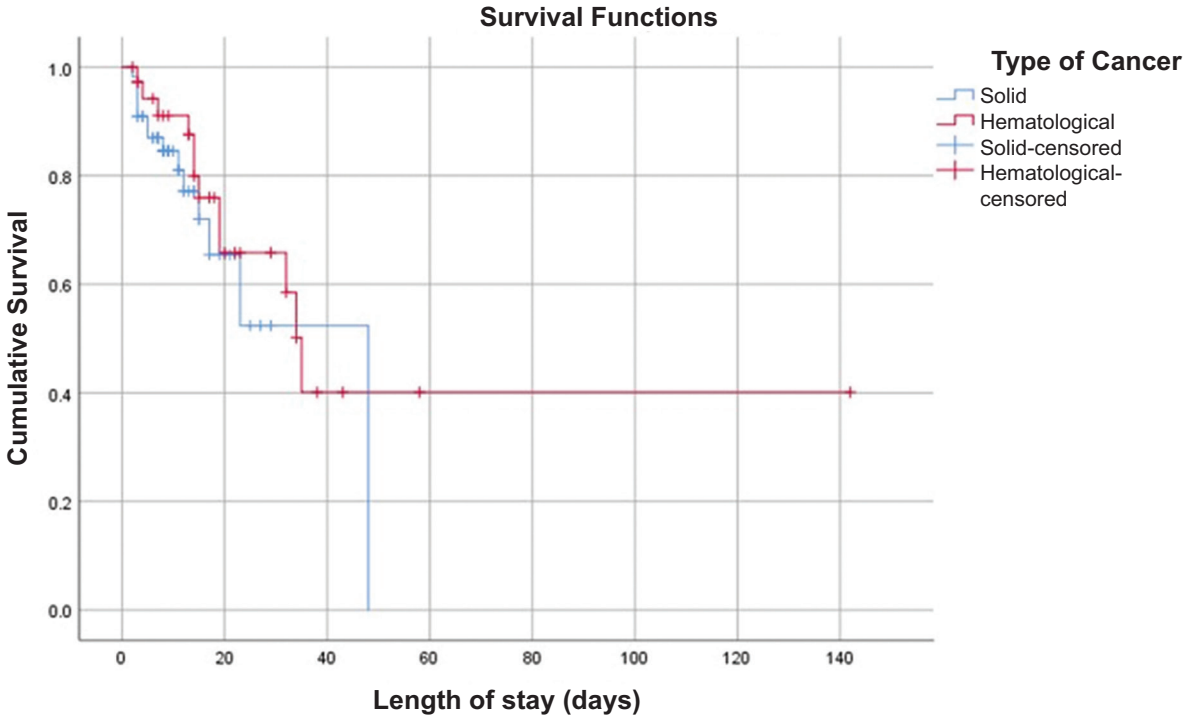

Figure 2. *Kaplan-Meier survival analysis of patients with SARS-CoV-2 infection and neoplasm, categorized by neoplasm type.*

Table 2. COVID-19 Symptoms in Patients With and Without Cancer

Symptom, n (%)	Total (n = 1752)	Without Cancer (n = 1664)	With Cancer (n = 88)	p
Cough	1075 (61.4)	1031 (62.2)	44 (47.3)	0.004[a]
Fever	1014 (57.9)	973 (58.7)	41 (44.1)	0.006[a]
Headache	628 (35.9)	606 (36.6)	22 (23.7)	0.400[a]
Myalgia/Arthralgia	866 (49.5)	833 (50.2)	33 (35.5)	0.006[a]
Dyspnea	1308 (74.7)	1253 (75.6)	55 (59.1)	< 0.001[a]
Sore Throat	371 (21.2)	367 (22.1)	4 (4.3)	< 0.001[b]
Rhinorrhea	157 (9.0)	152 (9.2)	5 (5.4)	0.213[a]
Chest Pain	233 (13.3)	227 (13.7)	6 (6.5)	0.045[a]
Gastrointestinal Symptoms	368 (21.0)	352 (21.2)	16 (17.2)	0.352[a]

[a]Chi-square test
[b]Fisher's exact test.

especially those with lung cancer or metastases. In our study, non-cancer patients more frequently exhibited symptoms such as dyspnea, cough, fever, myalgia/arthralgia, and had higher ICU admission rates. These findings may be related to the fact that non-cancer patients also had more comorbidities, such as diabetes mellitus and kidney disease, which conditioned a higher rate of hospital admissions, severe pneumonia, and mortality[15-17].

The overall mortality rate in our study was 28.8% [505 deaths] (28.8% [479] among non-cancer patients and 29.5% [26] among cancer patients). Analysis of COVID-19 patients revealed no statistically significant difference in mortality between those with and without neoplasm (OR, 1.2; 95% confidence interval [CI], 1.037-1.053; p = 0.97), which contrasts with a French cohort where hospital mortality rates were twice as high among cancer vs non-cancer patients[18]. However,

Table 3. Logistic Regression Model for Mortality from COVID-19

Variable	OR	95%CI	p
Age	1.045	1.037-1.053	< 0.001
Cancer			
No	1	-	-
Yes	1.2	0.725-1.963	0.488
Sex			
Female	1	-	-
Male	1.426	1.138-1.785	0.002
Clinical Severity			
Mild	1	-	-
Moderate	1.423	0.975-2.075	0.067
Severe	2.347	1.515-3.636	< 0.001
Critical	3.635	1.456-9.074	0.006

95%CI: 95% Confidence Interval; OR: Odds Ratio.

having cancer and COVID-19 was associated with greater clinical severity (OR, 2.347; 95%CI, 1.515-3.636; p = 0.012). The reduced mortality may be attributed to measures implemented by health care personnel, including a designated entry for cancer patients without respiratory symptoms to facilitate timely care and treatment, short lengths of stay, limited waiting room access to avoid overcrowding, and ongoing education for patients and families on preventive measures (handwashing, coughing protocol, social distancing, mask use) and recognition of COVID-19 symptoms[19].

The health care workforce underwent restructuring, with alternating schedules to prevent widespread absenteeism and service disruptions in case of infections. Precautionary and protective measures were established at the pandemic's onset. Unfortunately, according to data published by the Ministry of Health, 251,237 health care workers in Mexico were infected, 62% of whom were male with an average age of 37 years. Among them, 32% were nurses and 25.7% were doctors, resulting in 4,127 deaths.

Conclusions

Although cancer patients presented with greater clinical severity, there were no differences in mortality vs non-cancer patients. Additionally, cancer patients had lower ICU admission rates. The findings of this study provide only an approximation of the characteristics of COVID-19 patients with cancer in Mexico. Further studies are needed to identify factors worsening the prognosis for these patients. Part of the outcomes can be attributed to the diligent efforts of health care personnel, who consistently implemented appropriate sanitary measures. These results underscore the importance of organizing health care units to prevent infections, not only from SARS-CoV-2 but also from any nosocomial infections, in cancer patients undergoing treatment. Preventive measures, including physical protocols and vaccination, remain essential.

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Conflicts of interest

None declared.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed their workplace protocols regarding the publication of patient data.

Right to privacy and informed consent. The authors obtained approval from the Ethics Committee for the analysis and publication of clinically obtained data. Informed consent from patients was not required as this is a retrospective observational study.

Declaration on the use of artificial intelligence. The authors declare that they have not used any type of generative artificial intelligence in the drafting of this manuscript, nor for the creation of figures, graphics, tables, or their corresponding footnotes.

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