ARTICLE / INVESTIGACIÓN

The Impact of Vaccination on Severity of COVID-19 Illness in Hematologic Malignancies Patients

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Abstract: Covid 19 in hematological cancer patients can lead to a deterioration in the clinical course and a reduction in life expectancy leading high fatality rate. Vaccines developed against the causative virus may reduce the severity of the disease and a decline in mortality rate. This study aims to determine the impact of vaccination on the severity of COVID-19 illness in patients with hematologic malignancies. A multicenter retrospective observational study was conducted on 60 hospitalized patients admitted to intensive care units (ICUs). All patients were previously diagnosed with leukemia or lymphoma and tested positive for COVID-19 by real-time polymerase chain reaction (RT-PCR). Protocol version 8 was used to determine the patients' results, including improvement to discharge criteria or deterioration to death. The most results in this study; The mean age of the patients was 33.63± 16.5 years (range 6-72 years). Diabetes was the most common comorbid illness (10%). The Oxygen saturation range was (70-95%). Among (60) patients enrolled in this study;29(48.33%) was not received any Covid-19 vaccine while 31(51.67%) were fully vaccinated; concerning patients with positive COVID19; the underlying hematological malignancy was leukemia (63.3%) while patients with lymphoma were (36.7%); after 30-day follow up, depending to the outcome. The number of deaths was 14 cases (23.3%) of patients while the other 46 patients (74.7%) survived and were discharged from the hospital. Our study concludes that vaccinating hematological malignancy patients against Covid19 may provide clinical protection from this illness compared to no vaccination patients.

Key words: COVID-19 disease, Hematological Malignancy, Vaccine, intensive care units.

Introduction

World Health Organization (WHO) in March 2020 stated that Coronavirus disease 19 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was a pandemic[1]. Within a year, the mortality rate of this disease increased over the world; some groups of individuals are at high risk of developing severe and life-threatening infections. One of them is patients with hematological disorders due to immunocompromised status as chemotherapy treatments. Covid 19 disease in hematological cancer patients can lead to a deterioration of the clinical result and a reduction in life expectancy leading high fatality rate[2].

Patients with hematological malignancies deal more with the healthcare system, which puts them at a higher risk of contracting COVID-19. Furthermore, preliminary trials in China revealed that severe COVID-19 infection and death were common in all types of cancer patients compared to the general population[3].

Another study in this regard reported that patients suffering from blood malignancy are more susceptible to developing more severe infection and a high death rate of Covid-19 among all cancer patients. This could be because hematological malignancy patients frequently exhibit innate and adaptive immunological abnormalities, which is a critical risk factor for increased mortality in older age when it's associated with cancer disease[4].

After the scientist develops many types of Covid19 vaccines, professional oncology societies declare an urgent need for vaccination in patients with cancer, including hematological malignancies[5].

In people who have been vaccinated, the rate of hospital admissions and death from Covid 19 remained stable. According to Public Health England's latest surveillance report, unvaccinated people have a "significantly higher" risk than vaccinated people[6]. Some studies reported that patients with immunocompromise might be less likely to produce a robust immune response to the vaccine, putting them at a higher risk of moderate to severe covid-19[7].

This study was conducted to determine the impact of vaccination on the severity of COVID-19 illness in Hematologic malignancy patients.

Materials and methods

A Multicenter retrospective observational study was conducted on 60 hospitalized patients who were admitted to intensive care units (ICUs). All patients were previously diagnosed with leukemia or lymphoma from January 2021 to the end of December 2021. All patients were tested positive for COVID-19 by real-time polymerase chain reaction (RT-PCR) assay, which was achieved in the hospital-based clinical laboratory.

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All patients under investigation in this study were referred by consultation of a hematological specialist and verification of the information in the medical record. Patients with incomplete data, information or presented with non-malignant hematological diseases or solid cancer were excluded from this study.

Demographics, clinical and laboratory data were accumulated from a medical record for all participants; patients who are fully vaccinated have positive COVID-19 laboratory testing and symptoms that appear >14 days after the second dosage; while Individuals who have positive laboratory COVID-19 tests but no record of receiving any type of COVID-19 immunization or first-dose vaccination after symptom start are considered unvaccinated.

Outcomes

To observe the principles of early detection, reporting, quarantine and treatment of COVID-19 patients to increase recovery rates and lower fatality rates. Protocol version 8 was used to determine the patients' results, including improvement to discharge criteria or deterioration to death[8]. COVID-19 death was defined as the death of COVID19 patients who died as a direct result of coronavirus infection but not due to the pandemic's indirect effects[9].

Statistical Analysis

The quantitative data were expressed as mean ± standard deviation. Binomial data were presented as frequency percentages. Comparisons between quantitative were performed by the parametric Student t-test, while the Chi-square test made the comparison between binomial data. Multivariate analysis was performed with a binary logistic regression test. The odds ratio (OR) and its corresponding 9% confidence interval (CI) were calculated from this test. All data were analyzed with SPSS for Windows, v.25.0; IBM Corp, Armonk, USA.

Results

Demographic Characteristics of the Patients

The mean age of the patients was 33.63± 16.5years (range 6-72 years); about two-thirds of them (60%) were females. Only a small percentage (15%) of the patients were ex/current smokers. Diabetes was the most common comorbid illness (10%). Many patients had more than one comorbidity (Table 1).

Clinical Characteristics of the patients

During the sickness, all patients underwent respiratory support, and the oxygen saturation (SpO2) was measured using pulse oximetry; the saturation range (was 70-95%); among (60) patients enrolled in this study; 29 (48.33%) was not received any COVID-19 vaccine while 31 (51.67%) was fully vaccinated; Headache is the most prominent complaint in 39 (65%) of patients followed by cough in 38 (63.33%) in addition to that fatigue and loss of smell and taste was also reported as frequent symptoms and was 27 (45%) and 22 (36.67%) respectively. The other complaints include three cases of abdominal pain and two cases of vomiting and sore throat were much less frequent symptoms 7 (11.67%) table (2).

Type of Malignancies

Concerning patients positive for COVID-19, the underlying hematological malignancy was leukemia at 63.3%, while patients with lymphoma were 36.7%. After a 30-day follow-up, depending on the outcome, death was reported in 14 patients (23.3%), while the other 46 patients (74.7%) survived and were discharged from the hospital figure (1) and (2).

Association of Clinical Characteristics with a Survival rate

Patients were classified into two groups according to outcomes (survival and dead patients); patients in the survived group reported SPO2% (88.9±4.1%) compared to (81.79±7.56) in dead patients with significance differences (P-value <0.001). Many patients in the survived group underwent fully COVID 19 vaccination 31 (67.39%). On the other hand, no patients in the dead group received such vaccines with a significant difference (P-value <0.001). Among clinical symptoms, non -significant differences were obtained between the two groups. Concerning the type of hematological malignancies, the leukemic patients were more common among survival (33 patients, 71.74%) than deceased patients (5 patients, 35.71%) with a significant difference (Table 3).

Multivariate Analysis

All variables that demonstrated significant association with the patient's outcome in univariate analyses were entered into multivariate analysis. The results are shown in Table 4. Two variables remained significantly associated with the patients' outcomes. More than half of deceased patients (57.14%) had SPO2 <85% compared with 23.91% of surviving patients who had such percent with a significant difference (OR= 2.62, 95% CI 1.21-3.48   P=0.042). Furthermore, 76.39% of surviving patients were vaccinated versus none of the deceased patients who had a vaccine, with a highly significant difference (OR=15.6, 95% CI 1.75-18.17, P=0.003).

Discussion

The rapid spread of SARS-CoV-2 worldwide has created a unique medical situation for individuals with chronic diseases, including patients with hematological malignancies who are at the most significant risk of severe COVID-19. As a result, incremental vaccines have been a top goal; and highly protective vaccinations are already being distributed. The current study looked at the crucial role of COVID-19 vaccination in the survival of patients with hematological malignancies who were admitted to the hospital.

Among sixty patients with hematological malignancy confirmed to COVID-19 infection in this study, the mean age of the patients suffering from this infection was 33.63± 16.5 with a range of 6-72 years. However, this observation disagreed with many studies that reported severe cases of COVID-19 were more common in older patients 65 years old[10,11].

The difference in this study from other studies can be attributed to the fact that the selection of patients in this study is restricted to people who suffer from hematological diseases, and it is known that blood malignancy affects different ages.

In the current study,60% of patients were female, and (40%) of them were male and male to female (1:1.5). Much

Variables	Values
Age, years	
Mean±SD	33.63± 16.5
Range	6-72
Gender	
Male	24(40%)
Female	36(60%)
Smoking	
Never	51(85%)
Ex/current	9(15%)
Comorbidities	
No	50(83.33%)
DM	6(10%)
HTN	3(5%)
IHD	3(5%)
Others	3(5%)

Table 1. Patients' characteristics and demographic data (n=60).

Variables	Values
SPO$_2$ (%)	
Mean±SD	87.02±6.05
Range	70-95
Vaccination	
No	29(48.33%)
Yes	31(51.67%)
Sinopharm	11(18.33%)
Pfizer	16(26.67%)
AstraZeneca	4(6.67%)
Clinical presentation	
Cough	38(63.33%)
Fever	15(25%)
Fatigue	27(45%)
Running nose	11(18.33%)
Loss of smell and taste	22(36.67%)
Diarrhea	18(30%)
Headache	39(65%)
Others	7(11.67%)

Table 2. Clinical presentation (n=60).
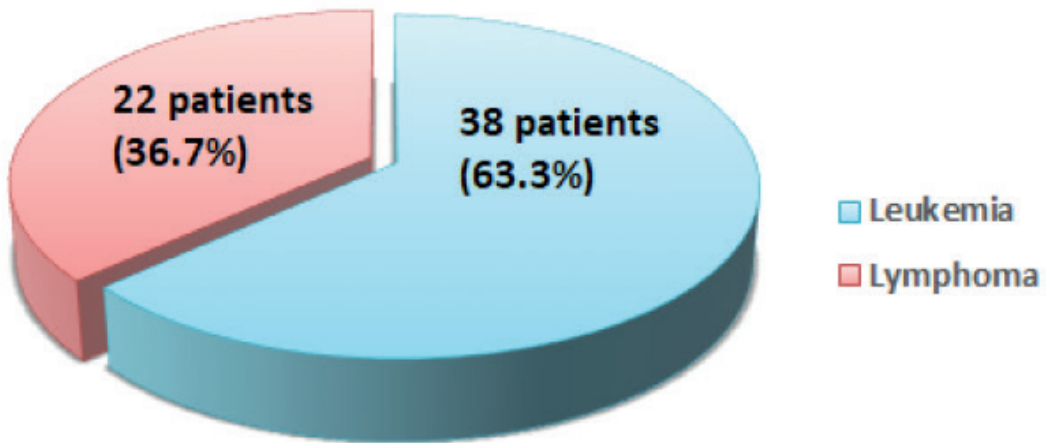
Figure 1. The proportion of leukemia and lymphoma in patients with COVID1-9.
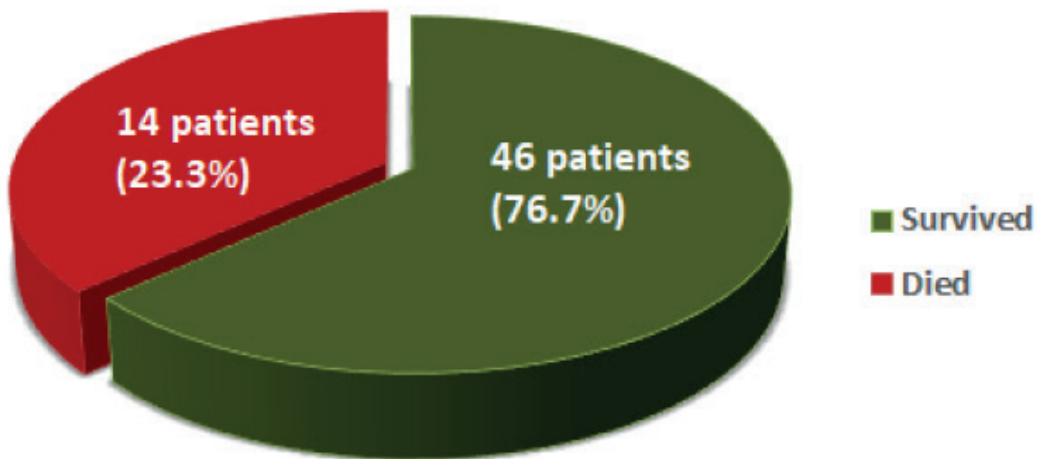
Figure 2. Mortality and Survived Percentage.

Variables	Survived patients (n=46)	Died patients (n=14)	p-value
SPO$_2$ (%)	88.9±4.1	81.79±7.56	**<0.001**
Vaccination			
No	15(32.61%)	14(100%)	**<0.001**
Yes	31(67.39%)	0(0.00%)	
Clinical presentations			
Cough	28(60.87%)	10(71.43%)	0.473
Fever & Fatigue	11(23.91%)	4(28.26%)	0.724
Running nose	10(21.74%)	1(7.14%)	0.217
Loss of smell and taste	16(34.78%)	6(42.86%)	0.583
Diarrhea	14(30.43%)	4(28.57%)	0.894
Headache	28(60.87%)	11(78.57%)	0.224
Others	5(10.87%)	2(14.29%)	0.660
Type of Malignancy			
Leukemia	33(71.74%)	5(35.71%)	**0.014**
Lymphoma	13(28.26%)	9(64.29%)	

Table 3. Association of clinical characteristics with outcomes.

Variables	Survived (n=46)	Died (n=14)	p-value	OR (95%CI)
SPO$_2$ (%)				
≤85	11(23.91%)	8(57.14%)	**0.042**	**1.0**
>85	35(76.09%)	6(42.86%)		**2.62(1.21-3.48)**
IHD				
No	45(97.83%)	12(85.71%)	0.129	1.0
Yes	1(2.17%)	2(14.29%)		0.15(0.02-1.17)
Vaccination				
Non -vaccinated	15(32.61%)	14(100%)	**0.003**	1.0
Vaccinated	31(67.39%)	0(0.00%)		15.6(1.75-18.17)
Malignancy				
Leukemia	33(71.74%)	5(35.71%)	0.086	1.0
Lymphoma	13(28.26%)	9(64.29%)		3.45(0.82-12.84)

Table 4. Multivariate Analysis.

literature on gender as a risk of in-hospital mortality provides mixed results. According to a few studies, sex differences may exist in COVID-19 individuals with severe illnesses, with men being more likely than women and recovery is more challenging[12,13].

This result is incompatible with those obtained in the above studies. However, many researchers in Middle Eastern countries, including Iraq, mentioned that hematological cancer affects females more than males[14,15].

The majority of patients in the current study (85%) were nonsmokers, and it was higher than the results obtained by Prats-Uribe et al., Who mentioned that (56.2%) of COVID-19 patients were nonsmoker[16]; Conversely, it was less than the results reported by Heydari et al. (77.8%)[17].

The explanation for these variations in smokers and nonsmoker COVID-19 patients could be attributed to differences in the socioeconomic and geographical aspects of the studied locations and differences in the study methods. The size of the sample and the distinction in the mode of life factors.

The data reported that most patients had no comorbidities (83.33%) while (16.67%) of the patients had comorbid diseases. Furthermore, diabetes mellitus is the most frequent comorbidity in the current study but less than the finding of other studies conducted in Myanmar 37.8%[18]. Singapore 28.3%[19]. But it's higher than the finding reported in China, 15.8%[20]. This disparity in such results could be explained by differences in the prevalence of chronic diseases by age, gender, and geographic region.

In the current study, headache (65%) and cough (63.33%) are the predominant clinical impression associated with COVID 19 infection, followed by fatigue (45%) then smell and taste (36.67%); this result is inconsistent with prior studies stated that fatigue, sore throat, shortness of

breath and rhinorrhea were the most common presenting symptoms of COVID 19 patients[21,22].

In this study, patients were classified into two groups according to outcomes (survival and dead patients); overall results in the current study showed a considerable decline in Oxygen saturation SPO_2% in Died (81.79%). Such results are in line with other studies that stated decreasing in SPO_2% is closely related to an increased mortality rate in COVID19 patients in which pulmonary infection may affect the oxygenation state, resulting in a decrease in peripheral SpO_2, which subsequently leads to acute respiratory distress syndrome (ARDS) and acute hypoxemic respiratory failure[23,24].

In the current study, out of 14 deceased patients, 2 (14.29%) were presented with IHD. Such a finding is lower than the result by Shi *et al.*[25]. Who reported that 19.7% of COVID 19 patients displayed heart disease. In another study conducted in China, the authors displayed that the SARS-CoV-2 infection has a more significant clinical impact in people who have had previous cardiovascular illness[26].

This study reported a higher mortality rate in non-vaccinated patients than surviving. Many studies mentioned that vaccination against COVID-19 is a cornerstone for reversing the COVID-19 pandemic; all vaccines have reduced disease severity and mortality, particularly in immunocompromised individuals[27].

Our data confirm that a more significant number of COVID-19 cases were diagnosed with leukemia 63.3%; most of the patients recorded 33 (71.74%) in a survived group with leukemia, however; 13 (28.26%) of the survived patients presented with lymphoma comparatives for 9 (64.29%) in the dead group. This result contradicts the finding of Xuejun *et al.*, Who found that most patients with COVID-19 had lymphoid malignancies[28]. This discrepancy may be due to our regional patient population distribution, which has higher rates of leukemia malignancies. Pagano *et al.* mentioned that a clear correlation between the type of hematological malignancy and the incidence of COVID-19 had not been described in the literature[29].

Furthermore, COVID-19 and Cancer Consortium (CCC19), the UK Coronavirus Cancer Monitoring Project (UKCCMP), and the American Society of Hematology (ASH) Research Collaborative are all larger cohort and registry studies that will give insight to the present questions about hematological malignancies and COVID-19. However, it is evident that patients with such malignancies are a susceptible group, and further research is needed to comprehend COVID-19's influence on these individuals 30 fully.

Conclusions

The current study results suggest that; vaccinating hematological malignancy patients against COVID19 may provide clinical protection from this illness compared to no vaccination, patients which supports national and international public health policy suggestions for the targeting of immunocompromised patients for such vaccination.

Author Contributions

(1) Design and acquisition of data.

(2) Writing the article and revising it critically for important intellectual content analysis and interpretation of results.

(3) & (4): Samples collection from patients and Statistical analysis.

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