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The Impact of Coronavirus Disease 2019 (COVID-19) among Immune Compromised Patients in Augusta Victoria Hospital AVH-2021

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Abstract

Background: Coronavirus disease 2019 which is officially known as COVID-19 belongs to family viruses. COVID-19 manifestations vary among affected people. These symptoms may become more serious among patients suffering from chronic disease and those who are on treatment which may affect their defense mechanism or immune-compromised patients who become more vulnerable to complications of COVID-19, and at high risk for morbidity and mortality with any bacterial or viral illness. **Method:** A retrospective, non-experimental research design was applied with a quantitative approach among patients with COVID-19 who were admitted to COVID-19 department at AVH with a total of 72 patients. Data were extracted from a patients' electronic medical record. **Results:** During COVID-19 outbreak 72 patients were admitted to COVID department at AVH, 54.2% were female and 33% of study participants were from Gaza governorate followed by Jerusalem 27%. Most participants 34.7% had first clinic visit after two days from the onset of COVID-19 symptoms. 45.8% were discharged to home while 13.9% died. All inflammatory markers that include ferritin, C-RP, IL-6 and D-dimer are increasing in all patients that were admitted to hospital; IL-6 and D-dimer were significant inflammatory markers in relation to the mortality rate. The study found the risk of mortality with IL-6 mean (218.5), and D-dimer mean (12). Furthermore there was a relation between increased risk of mortality and immune comprised. **Conclusion:** Mortality rate increased among COVID-19 patients when IL-6 was higher than 218.5 and D-dimer higher than 12, and there was a relationship between increased risk of mortality and immune comprised.

Keywords

Coronavirus, Immune Compromised, Augusta Victoria Hospital, Inflammatory Marker, Interleukin 6, Mortality

1. Introduction and Literature Review

Coronavirus disease 2019 which is officially known as COVID-19 belongs to family viruses. It was believed that the virus broke out in Wuhan city in China in December 2019, and the virus rapidly spread all over the world [1]. The World Health Organization (WHO) on March 11, 2020, announced the COVID-19 outbreak as a global pandemic [2] and declared a public health emergency problem. This health problem stressed health care systems and increased the need to assign COVID-19 special centers or hospitals worldwide.

COVID-19 manifestations vary among affected people; some people became asymptomatic, others suffer from mild symptoms like high temperature, dry cough, nasal congestion, general malaise, and sore throat, while others complain of severe symptoms like adult respiratory distress syndrome [3]. These symptoms may become more serious among patients suffering from chronic disease and those who are on treatment which may affect their defense mechanism or immune-compromised patients who become more vulnerable to complications of COVID-19.

Immune-compromised like hemato-oncology or renal replacement therapy.

Patients have a defect in immune system reaction due to a primary disease or for another superimposed which makes them at high risk for morbidity and mortality with any bacterial or viral illness and this fully applies to COVID-19 [4]. During the peak of the COVID-19 pandemic, and due to the continuous increase in the number of affected people, there was an urgent need to increase the number of hospital beds. As the immune-compromised patients are at risk for a more severe outcome, the need for hospitalization increases for these people [5]. The immune-compromised patients with COVID-19 are presumed to have severe clinical features and bad outcomes as they have a low inflammatory response [4]. However, the relationship between the immune response to coronaviruses and the severity of clinical features is still inquired, as the adaptive immune system is not an indicator to prevent a severe viral illness [6]. It is thought that these patients who are on life-sustaining treatment, will be more physiologically vulnerable to COVID-19.

Up to our knowledge, till now, there is no clear evidence that immune-compromised patients are at more risk for mortality or morbidity from COVID-19. Thus our research will focus more on these patients to explore evidence about the impact of (COVID-19) among immune-compromised patients who seek care at Augusta Victoria Hospital. Augusta Victoria Hospital (AVH) is a program of the Lutheran World Federated, a church-hospital complex and the second largest hospital located in East Jerusalem. Augusta Victoria Hospital

provides special care for Palestinian people from Jerusalem, West Bank, and Gaza Strip. It provides hemato-oncology care including bone marrow transplant, artificial kidney units, and skilled nursing care [7].

2. Methodology

A retrospective, non-experimental research design was applied with a quantitative approach, to assess the impact of Coronavirus disease 2019 (COVID-19) among immune compromised patients. Study enrolled adult inpatients (≥18 years old) from AVH (East Jerusalem, West Bank). This study enrolled in patients who were hospitalized for COVID-19 department between April/ 2020-January, 2021 and with outcome either dead or discharged.

The investigator specifies the subjects according to the inclusion criteria. Patients with other respiratory problems were excluded. This study includes 72 patients. Data for this study were obtained retrospectively from electronic medical records of COVID-19 in AVH during course of illness. The socio-demographic, laboratory tests, signs and symptoms and outcome data were extracted from a patients' electronic medical record in AVH. All required data were entered by two researchers into electronic form which was created by researchers for this purpose. Data were revised by third researcher for completeness and correctness.

3. Ethical Consideration

This study was approved by the Augusta Victoria Hospital AVH. Approval from COVID-19 patients was obtained. Several strategies were utilized to protect the subjects rights who agreed to participate in this study. Oral verbal consent of the COVID-19 patients was obtained prior to utilize data. COVID-19 patients were informed of the purpose of the study, and that they had the right to refuse to participate. Also the voluntary nature of participation was stressed as well as confidentiality.

4. Data Analysis

The quantitative data was analyzed using the SPSS (Statistical Package for Social Sciences version 23.0), and the level of significance (α) set at 0.05.

- **Descriptive statistics:** descriptive statistical analysis includes frequencies, percentages.
- **Inferential statistic:** Difference in course of illness scores analyzed by using **T-test;** to determine if there is a significant difference between the means of two groups.
- **Chi-square:** Examine the differences between categorical variables in the same population.

5. Results

The majority of sample was female (54.2%), and (62%) of them were married,

(95.8%) of study participants are lived in city, and (66.7%) never smoked (Table 1).

Results show that the majority of participants were between 56 - 75 years old, and (6%) below 18 years. Furthermore, most patients were from Gaza governorate (33%), while (27%) were from Jerusalem (Figure 1).

In addition study results revealed that there was a difference between patients regarding the time from onset of symptoms to first clinical visit that most patients had the first clinic visit after two days from the onset of symptoms (34.7%), and only (1.4%) patients have the first visit after eight days (Table 2).

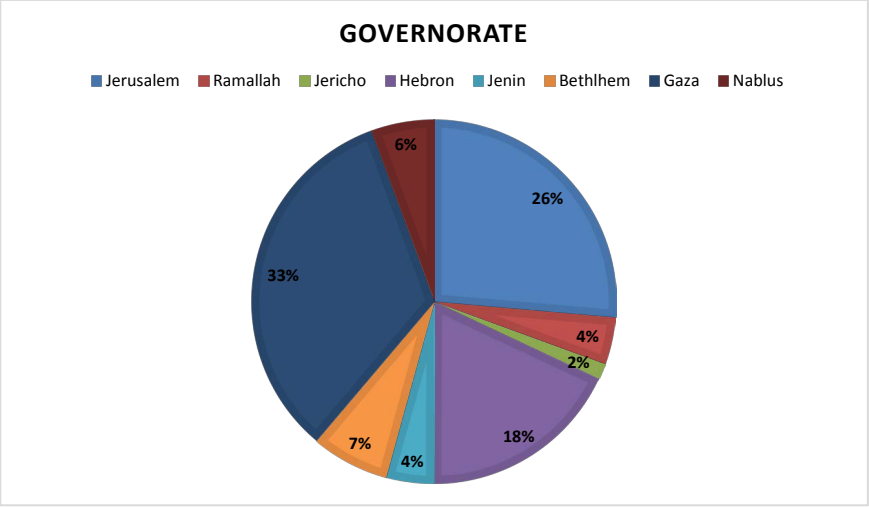

Figure 1. Distribution of participants according to governorate.

Table 1. Demographic characteristics of study participants (N = 72).

	Frequency	Percentage
Gender		
Male	33	45.8
Female	39	54.2
Marital status		
Married	62	86.1
Single	10	13.9
Residency		
City	69	95.8
Village	3	4.2
History of smoking		
Smoker	19	26.4
Ex-smoker	5	6.9
Never smoking	48	66.7

Table 2. Time from onset of symptoms to first clinical visit.

Days	Frequency	Percent
1	21	29.2
2	25	34.7
3	11	15.3
4	10	13.9
5	2	2.8
6	2	2.8
8	1	1.4
Total	72	100.0

For the end status of patients who were admitted to ICU, the majority of patients (45.8%) were discharged to home and 27.8% were transferred to more specialized hospital, and 13.9 % of patients were died (Table 3).

Regarding source of infection from COVID-19, most of patients (73.6%) got the virus from community interaction, while only (8.3%) got infection during hospitalization days (Table 4).

Alongside, to determine if there was a significant relationship between elevated inflammatory marker and mortality rate, t-test was applied to identify if there was a significant difference between the means, so study results indicated that there is significant relationship between elevated increased Interleukin 6 [IL-6] and D-dimer and mortality rate as mortality rate increased with increased Interleukin 6 [IL-6] and D-dimer as P-value less than 0.05 (Table 5).

The results show there was increase in all inflammatory markers CRP, ferritin, IL-6 and D-Dimer above normal range, and the mean risk of mortality was increased with inflammatory markers; IL-6 mean level of (218.5), and D-dimer mean level of (12) (Table 6).

Furthermore, results indicated by t-test that there is significant relation regarding WBC count as P-value less than 0.05, by more focus on WBC differential we found that there is significant relation regarding Lymphocytes count with mortality as P-value less than 0.05, while there is no significant relation regarding Neutrophils count with mortality as P-value more than 0.05 (Table 7).

The results also revealed by using Chi-square test that there is significant relation regarding mortality in immune compromised patients as P-value less than 0.05 (Table 8).

In addition, there was no significant relation by using Chi-square between end stage kidney disease and risk of mortality among patients diagnosed with COVID-19 (Table 9).

The study Chi-square results about mortality rate in oncology patients that there is no significant relation between history of cancer and COVID-19 mortality (Table 10).

The study results also show by Chi-square that there is no significant relation between history of hematological malignancies and COVID-19 mortality (Table 11).

Table 3. End status of patients who were admitted to ICU.

	Frequency	Percent
Transferred Discharged home	20	27.8
Still admitted at the time of admission died	33	45.8
Total	9	12.5
	10	13.9
	72	100.0

Table 4. Source of infection.

	Frequency	**Percent**
	13	**18.1**
family hospital community	6	**8.3**
Total	53	**73.6**
	72	**100.0**

Table 5. Relationship between inflammatory marker and mortality rate.

		Levene's Test for Equality of Variances	
		F	Sig.
CRP result	Equal variances assumed	0.000	0.995
	Equal variances not assumed		
IL-6 result	Equal variances assumed	4.314	0.047
	Equal variances not assumed		
D-dimer result	Equal variances assumed	9.738	0.004
	Equal variances not assumed		
Ferritn result	Equal variances assumed	0.00	0.99.
	Equal variances not assumed		

Table 6. Distribution of mortality cases according to inflammatory markers.

Mortality		N	Mean	Std. Deviation	Std. Error Mean
CRP result	Died	3	152.9000	127.69507	73.72478
	Survive	28	99.7282	117.25979	22.16002
IL-6 result	Died	2	218.4500	228.89047	161.85000
	Survive	28	64.3504	91.66694	17.32342
D-dimer result	Died	3	12.0267	19.03111	10.98761
	Survive	30	3.2427	6.89275	1.25844
Ferritin result	Died	1	1729.0000	.	.
	Survive	25	724.9296	1205.23681	241.04736

Table 7. Relation between complete blood count and mortality rate.

		Levene's Test for Equality of Variances	
		F	Sig.
Platelets count	Equal variances assumed Equal variances not assumed	0.705	0.405
RBC count	Equal variances assumed Equal variances not assumed	0.514	0.477
Basophils count	Equal variances assumed Equal variances not assumed	0.603	0.441
Eosinophils count	Equal variances assumed Equal variances not assumed	2.398	0.128
Neutrophils count		2.655	0.110
Lymphocytes count		5.433	0.024
WBC count		13.259	0.001
Hb count (g/dl)		4.010	0.051

Table 8. Relationship between mortality in immune compromised patients and COIVD-19.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.835[a]	1	0.049
Continuity Correction	2.601	1	0.107

Table 9. Mortality in End Stage Kidney Disease ESRD patients.

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.078[a]	1	0.780		
Continuity Correction[b]	0.000	1	1.000		
Likelihood Ratio	0.076	1	0.783		
N of Valid Cases	72			0.717	0.524

Table 10. Mortality in oncology patients with COVID-19.

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.196[a]	1	0.274		
Continuity Correction[b]	0.541	1	0.462		
Likelihood Ratio	1.148	1	0.284		
Fisher's Exact Test Linear-by-Linear Association	1.179	1	0.278	0.301	0.228
N of Valid Cases	72				

Table 11. Mortality in patients with hematological malignancies.

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.003[a]	1	0.959		
Continuity Correction[b]	0.000	1	1.000		
Likelihood Ratio	0.003	1	0.959		
Fisher's Exact Test	0.003	1	0.960	1.000	0.673
Linear-by-Linear Association					
N of Valid Cases	47				

6. Discussion

In our study we found that all inflammatory markers that include ferritin, C-RP, IL-6 and D-dimer were increased in all patients who were admitted to hospital; the same result was found in the study done in China [8].

The study revealed that there is significant relationship between elevated inflammatory marker IL-6 and the mortality rate, but in other studies, the higher mortality can be related to increased D-dimer level [9], while the results were consistent with another study which showed that increased IL-6 level was related to increased mortality rate [10].

In our study there is a relationship between increased risk of mortality and immune comprised, in particular a significant relationship cannot be identified if the patient has a hematological cancer, oncology (solid tumor) or end stage renal diseases. Up to our search there were a few studies that compared each group with risk of mortality in detail. A French study shows that the impact of COVID-19 and mortality in cancer patients depend on patients' general characteristics like type of chemotherapy [11].

Data Availability

The datasets used and/or analyzed during the current study are available from the first author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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