Original Article

Thrombocytopenia And Estimated Mortality Probability In Relation To SOFA, APACHE II And News-2 Scoring Systems In Hospitalized Patients With COVID-19

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Abstract

Introduction:

It has been shown that thrombocytopenia, like coagulation disorders, are common complications of COVID-19, increasing the risk of thrombosis and bleeding, producing in patients symptoms such as hematomas, petechiae, equimosis and bleeding from natural cavities, which are usually related to the severity of thrombocytopenia. For this reason, the present research aimed to establish the relationship between thrombocytopenia and the probability of mortality with the SOFA, APACHE II and NEWS-2 scoring systems in patients with COVID-19 admitted to the Ambato General Hospital during the period June 2021-November 2021.

Materials and Methods :

For the development of the research, there was a sample of 216 hospitalized patients who met the inclusion criteria, where 156 patients were in the clinical unit and 60 patients in the intensive care unit. Ifit was a descriptive, retrospective and cross-sectional study, in which data from hospitalized patients were collected through the internal results reporting system DATALAB, and the AS-400 medical system for the review of patients' medical records, in addition to finding the relationship that existed between the study variables, the statistical program SPSS 25 was used.

Results and Conclusions :

The results indicate that, in terms of the risk factors of the patients, it was found that 64.81% were male, 54.6% over 50 years, 43.1% of hospitalized patients did not present or did not know their pathological history. When analyzing the analytical data of thrombocytopenia it was found that 14.8% of pacientis the presented during hospitalization, finally when analyzing the relationship between thrombocytopenia and the scoring systems SOFA, APACHE II and NEWS-2, Chi-square values of 1.329; 3.327; 2.406 respectively were obtained, indicating that no This is a correlation between the variables. It was concluded that there is no statistically significant relationship between thrombocytopenia and scoring systems. Further analyses with a larger population and that they have all theparameters necessary for the calculation of scoring systems are recommended.

Keywords: thrombocytopenia, platelet count, COVID-19, SOFA, APACHE II, NEWS-2

1. INTRODUCTION

The pandemic caused by the SARS-CoV-2 virus triggered a global health, politicaland social crisis. It began in 2019 with an outbreak of severe pneumonia cases in the city of Wuhan, Hubei province of China, which began to spread rapidly across the planet (1). The virus that causes COVID-19 belongs to the Coronavir idae family, of the zoonotic Betacoronavirus genus that is mainly characterized by conditions it can cause in humans, such as severe acute respiratory syndrome (SARS) and Near East respiratory syndrome (MERS) (2).

SARS-CoV-2 has a high tropism for cells expressing ACE-2 (angiotensin I converting enzyme to angiotensin 2-9 and angiotensin II to angiotensin 2-7), which is found mainly in the alveolar cells of the lungs; Thesefinal products have as their main function vasodilatory, antifibrotic, anti-inflammatory effects and that favor natriuresis, thus counteracting the action of angiotensin II. In severe cases of COVID-19, angiotensin II isfound to be elevated, resulting in lung damage and increased mortality (3).

As mentioned, the clinical manifestations of infection frequently occur at the level of the respiratory tract; however, they may also involve other systems such as hematopoietic. Altered cell counts are observed on the blood count , mainly leukocytes and platelets. Lymphopenia is associated with an increased risk of developing acute respiratory distress syndrome (ARDS) and thrombocytopenia presentsheterogeneously suggesting its association with an unfavorable course of the disease (4).

Severity scores play a crucial role in comparing variables and forming a diagnosis, management or prognostic criterion in patients to predict their clinical behavior and thus be able to support clinical decision-making (5).

Thrombocytopenia is among the most common laboratory findings in critically ill patients with COVID-19, according to the review study publishedby Delshad et al.(6), late-stage thrombocytopenia can prolong hospitalized patients, increasing their need for ventilation and increasing the risk of mortality. In other words, the alteration in the PLT count can play a fundamental role in the progression of the disease: the lower the level of PLT, the greater the risk of mortality. Thus, it can be shown that thrombocytopenia, like coagulation disorders, are common complications of COVID-19, increasing the risk of thrombosis and bleeding, producing symptoms in patients such as hematomas, petechiae, ecchymosis and bleeding from natural cavities, which are usually related to the severity of thrombocytopenia (7).

Tho�mbillopenia or thrombocytopenia together with the other hematological alterations present are useful in monitoring the evolution of the disease and can help prevent and / or treat possible complications, such as ARDS (Acute Respiratory Distress Syndrome) that may occur during the progression of the disease. Given the high number of patients admitted with COVID-19, a specific early warning system (EWS) that includes laboratory test results and clinical characteristics could improve the detection of high-risk patients to optimize and better manage hospital resources, mainly in countries with an underdeveloped health system such as CASor Ecuador.

Therefore, it is necessary to evaluate the behavior of thrombocytopenia with the degree of probability of mortality in patients infected with the SARS-COV 2 virus, in order to determine its usefulness as a diagnostic indicator of severity. Theplatelet count is a test that is performed on whole blood with the additive EDTA, available in any hospital that has a state-of-the-art automated analyzer, easy to perform and low cost; it is applied in all diag patientsnosticated with COVID-19 who are hospitalized at the Ambato General Hospital, in order to evaluate the patient's severity prognosis and the estimated probability of mortality measured by the scoring systems, SOFA, APACHE II used in the hospital's Intensive Care Unit, and the NEWS-2 scoring system used in the clinical area.

2. MATERIALS AND METHODS

Population and sample

In the present research, the study population were male and female patients, who have entered theAmbato General Hospital due to COVID-19, during the period June 2021-November 2021, which after doing the respective research 4160 hospitalized patients were obtained. The probability of mortality in patients will be analyzed through the scores SOFA, APACHE II and NEWS-2, relating it to the values of platelets obtained from their blood biometrics.

Sample selection

For the collection of the sample, the non-probabilistic method for convenience was used, meeting the following inclusion criteria: patients admitted to hospitalization with a diagnosis of COVID-19, male and female patients aged between 12 and 69 years, patients with a personal history of type II diabetes mellitus and hypertension Patients with a family history of autoimmune diseases. Exclusion criteria: patients younger than 12 years and older than 69 years, patients with a history of hematological diseases, and patients with COVID-19 in hospitalization who have not undergone hematological tests.

Information was collected from the medical records of patients of the hospitalization service who have been diagnosed with COVID-19 during the period June-November 2021, with a total of216 patients who were hospitalized, where the characterization of the patient was identified according to the risk factors of COVID-19, in addition to the values of the platelet count, the days of hospitalization and the SOFA, APACHE II and NEWS-2 scoring systems, in order to show if there is any relationship between thrombocytopenia and the degree of mortality in hospitalized patients.

Determination of Thrombocytopenia

For the determination of thrombocytopenia was evaluated by blood gramor blood biometrics, with platelet count (<150000/uL) pseudothrombocytopenia and (>150000/uL) thrombocytopenia, once the data were analyzed by each of the patients, the scores were determined using the SOFA, APACHE II and NEWS-2 software.

Statistical analysis

Information was collected from medical records such as age, gender, existing comorbidities, unit of admission and their blood biometrics, for further analysis through the SOFA software which analyzes 6 organ systems (respiratory, cardiovascular, hematological, renal, hepatic and central nervous system), by collecting the worst values of the agreed variables, assigning a score from 0 to 4 according to the degree of dysfunction of the organ affected. in the same way in APACHE II which assesses the severity of disease used internationally in ICUs more frequently, through two components; the first, called APS or Acute Physiology Score, rates the physiological variables. The second component, called Chronic Health Evaluation, rates age and previous health status. and in the same way it was verified by the NEWS-2 software which evaluates through 6 simple and accessible parameters (heart and respiratory rates, oxygen saturation, consciousness, temperature and blood pressure) and establishes a score according to the values of each parameter. The sum gives three categories: low, medium and high risk of deterioration.

All the results obtainedwere sent to the statistical program IBM SPSS Statistics 25.0, for the processing and analysis of data. Where correlation analysis was performed between the variables using Spearman's Rho statistical test and the descriptive and inferential Chi square test .

3. RESULTS

Study sample characterization

Table 1 presents the results of the absolute and relative values of the characterization of the study sample such as gender, age, hospitalization unit and comorbidities of 216 patients diagnosed with COVID-19. Where the sample of study showed 35.2% female and 64.85 male; with respect to age of patients a majority trend is observed from patients aged 30 to 39 years with 17.3%, patients from 40 to 49 years with 23.6% and patients ≥ 50 years 54.6%. With respect to the hospitalization unit, a higher prevalence was observed in the sample of hospitalized patients in the Clinical Unit with 72.2%, while in the Intensive Care Unit (ICU) only 27.8% of hospitalized patients. In Regarding comorbidities, it shows that 93 patients representing 43.06% had no pathological history, 6 patients representing 2.78% had a history of lung diseases, 35 patients representing 16.20% had hypertearterial hypertension (HTN), 24 patients representing 11.11% diabetes mellitus (DM), 10 patients representing 4.63% cardiovascular diseases, 5 patients representing 2.31% cancer and 43 patients representing 19.91% other conditions, mainly hypothyroidism.

Table 1:

Variable	Frequency	Percentage
Gender		
Female	76	35,2
Male	140	64,8
Total	216	100,0
Age		
<20 years	2	0,9
20 to 29 years	7	3,2
30 to 39 years	38	17,6
40 to 49 years	51	23,6
≥ 50 years	118	54,6
Total	216	100,0
Inpatient Unit		
Clinic	156	72,2
UCI	60	27,8
Total	216	100,0
Comorbilidades		
No pathological history	93	43,1
Lung Diseases	6	2,8
HTA*	35	16,2
DM*	24	11,1
Cardiovascular diseases	10	4,6
Cancer	5	2,3
Other (hypothyroidism)	43	19,9
Total	216	100,0

*HTA: Hipertensión arterial; DM: diabetes mellitus

Determination of the analytical data of thrombocytopenia in hospitalized patients

Table 2 presents the results of the absolute and relative values of the incidence of thrombocytopenia in 216 hospitalized patients and frequency of the analytical data of thrombocytopenia in hospitalized patients according to the unit de hospitalization.

It was evidenced that 72.2% of patients did not have thrombocytopenia during hospitalization, 14.8% if they had thrombocytopenia during hospitalization and 13.0% had thrombocytosis. Of the total sample, the patients who presentedthrombocytopenia were 6.48% in the clinical area and 8.33% in the ICU intensive care area, as an additional finding it was found that 8.80% of patients presented thrombocytosis in the clinical unit and 4.17% in the ICU intensive care unit.

Table 2:

Thrombocytopenia in hospitalized patients			**Hospitalization Unit**				
Variable	Frequency	Percentage			Clinic	UCI	Total
					n= 156	**n= 60**	**n=216**
Yes	32	14,8	Yes	f	14	18	32
				%	9,0%	30,0%	14,8%
No	156	72,2	No	f	123	33	156
				%	78,8%	55,0%	72,2%
Trombocitosis	28	13	Trombocitosis	f	19	9	28
				%	12,2%	15,0%	13,0%

Relationship between initial platelet count and days of hospitalization

For the relationship between the initial platelet count and the days of hospitalization, a Kolmogorov-Smirnov normality test was performed as a first step, where it was evidenced that the data follow a nonparametric distribution, since, when analyzing the level of significance, it was less than 0.05, thus concluding that the distribution is not normal.

Subsequently, a simple dispersion of the relationship between days of hospitalization and initial platelet count was performed, as shown in Figure 1 while the values of the days of hospitalization increase, the values of the initial count ofpla quetas decreases, resulting in a negative correlation, so evidenced a dispersion close to the trend line demonstrating that there is a weak correlation between both variables, which can be verified through the value of R^2 of Pearson d which obtained a value of 0.000, which is lower than the significance value 0.05. The variables of the initial platelet count and the days of hospitalization have a nonparametric distribution, so the Spearman correlation statistic was usedto establish the relationship between these variables.

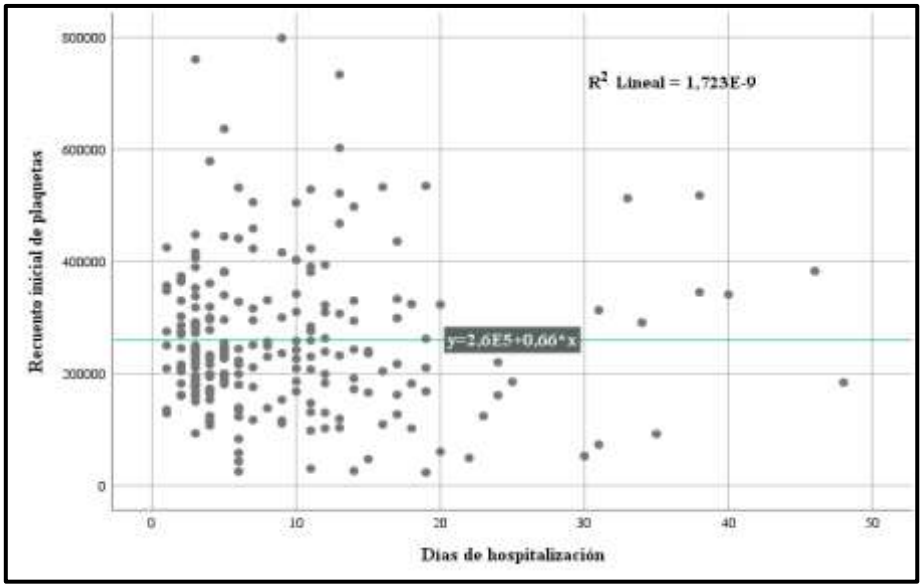

Figure 1 Simple dispersion of hospitalization days relative to baseline platelet count

Table 3 shows the Rho Spearman correlation between the days of hospitalization and the initial platelet count, where a moderate correlation level (-0.0490) was established, since it is much further from -1. On the other hand, it is established that it presents a very weak negative correlation, that is, the greater the number of days of hospitalization, the lower the initial platelet count.

Table 3:

Rho de Spearman		DH*	RIP*
DH*	Correlation coefficient	1,000	-0,049
	Sig. (bilateral)	.	0,470
RIP*	Correlation coefficient	-0,049	1,000
	Sig. (bilateral)	0,470	.

*DH, Days of hospitalization; RIP: Initial platelet count

Relationship between thrombocytopenia and SOFA, APACHE II and NEW-2 scoring systems

Table 4 presents the values of the relationship between thrombocytopenia and the SOFA, APACHE II and NEW-2 scoring systems. on the SCORE SOFA shows that thrombocytopenia in patients hospitalized in ICU, of a total of 60 patients analyzed, 13 patients representing 27.7% of the total presented a score of (0-9) defined as Low probability of mortality, 5 patients representing 41.7% presented a score of (10-14) defined as Median probability of mortality, while no patients were found with a score of (15-24) defined as High probability of mortality. In addition, the inferential analysis shows that the X^2 value between both variables was 1.329 and the p-value 0.515.

With respect to SCORE APACHE II shows that thrombocytopenia in patients hospitalized in ICU of a total of 60 patients analyzed, 3 patients representing 15.8% of the total presented a score of (0-14) defined as Low probability of mortality, in 15 patients representing 37.5% had a score of (15-29) defined as Medium probability of mortality, while no patient had a score of (≥30) defined as High probability of mortality. In addition, the inf analysiserential, shows that the value X^2 between both variables was 3.327 and the p-value 0.189. Therefore, we can affirm that there is no statistically relevant correlation between both variables.

In the SCORE NEWS-2 score shows that thrombocytopenia in patients hospitalized in the clinical unit, of a total of 156 patients analyzed, 3 patients representing 5.2% had a score of (1-4) defined as Low probability of mortality, 6 patients representing 9.4% had a score of (5-6) defined as Medium probability of mortality, while 5 patients representing 14.7% had a score of (15-24) defined as High probability of mortality. In addition, the inferential analysis shows that the X 2 value between both variables was 2.406 and the p-value 0.300. Therefore, we can affirm that there is no statistically relevant correlation between both variables.

Table 4:

Thrombocytopenia			**SCORE SOFA**		
			(0-9) BP	(10-14) MP	(15-24) AP
			n= 47	n= 12	n= 1
Yes	n=18	Frequency	13	5	0
		Percentage	27,7 %	41,7 %	0,0%
No	n=42	Frequency	34	7	1
		Percentage	72,3 %	58,3 %	100 %
Chi-square (X^2)= 1.329			p-value=0.515		
Thrombocytopenia			**SCORE APACHE II**		
			(0-14) BP	(15-29) MP	(≥30) AP
			n= 19	n= 40	n= 1
Yes	n=18	Frequency	3	15	0
		Percentage	15,8%	37,5%	0,0%
No	n=42	Frequency	16	25	1
		Percentage	84,2%	62,5%	100%
Chi-square (X^2)= 3.327			p-value=0.189		
Thrombocytopenia			**SCORE NEWS-2**		
			(1-4) BP	(5-6) MP	(≥7) AP
			n= 58	n= 64	n= 34
Yes	n=14	Frequency	3	6	5
		Percentage	5,2%	9,4%	14,7%
No	n=142	Frequency	55	58	29
		Percentage	94,8%	90,6%	85,3%
Chi-square (X 2)= 2.406			p-value=0.300		

BP (low probability of mortality), MP (medium probability of mortality) and PC (high probability of mortality).

4. DISCUSSION

We worked with a sample of 216 patients of which 64.81% (n=140) were male, 54.6% older than 50 years (n=118), 72.2% of patients were hospitalized in the clinical unit (n=156), in termsof comorbilities, 43.1% of patients did not present or were unaware of any pathological history, while the pathologies that most occurred were other conditions mainly hypothyroidism with 19.9% (n = 43) and hypertension (hypertension) with a n 16.2% (n = 35). In an article published by the Journal of the Faculty of Human Medicine of the Ricardo Palma University, Trujillo-Peru, called "Risk factors for mortality from covid-19 in hospitalized patients: a logistic regression model a", it was found that the average age of hospitalized patients was 52.56 years, with deceased

patients having an average age of 64.67 years. Likewise, 68.8% of hospitalized patients were male, in the same way85.7% of this gender predominating in the deceased. Regarding comorbidities, the most frequent in patients hospitalized for COVID-19 were hypertension in 28.1% of patients and diabetes in 6.3%. In deceased patients, 42.9% of cardiovascular disease (including hypertension), diabetes and cancer in 14.3% occurred in both comorbidities (8).

The sample was obtained randomly and only subjects with no history of hematological diseasesthat affect platelet counts (polyglubulia, leukemias, myelodysplastic syndromes / myeloproliferative neoplasms, among others) were included.

The current studies on which the problem approach was based, evaluated the relationship between thrombocytopeniaand mortality risk, mentioning the literature review study (9), which showed that of the total research articles analyzed, about 5% of patients have a platelet count below 100,000/l. However, mild thrombocytopenia (platelet count <150,000 platelets/L) occurs in 70-95% of patients with severe COVID-19 infection. However, thrombocytopenia in COVID-19 is not an important prognostic factor for disease progressionor poor outcome. In another study conducted by Plotnikow et al. (10), they analyzed 47 patients, mostly men, in which they report that the APACHE II score failed to discriminate patients according to severity in relation to mortality, without finding differences between survivors and deaths with values similar to those reported here (median APACHE II day 1: 14 - 18, survivors/non-survivors respectively).

It is important to mention that in patients who did not survive, the platelet and oxygenation index gradually decreases over time, while the six-point SOFA score increased, which meant that worse respiratory function was probably related to platelet decline, however, this did not occur with surviving patients, This may be due to the different incidences of thrombocytopenia and severity of the disease (11).

5. CONCLUSIONS

The 216 hospitalized patients were characterizedaccording to the risk factors for contracting COVID-19, finding that of the total number of patients analyzed, there are more patients in the male gender (64.81%), mainly over 50 years of age (54.6%) who are hospitalized in the clinical unit (72.2%). Regarding comorbidities, it was found that 16.2 % of patients presented arterial hypertension, most hospitalized patients did not present or did not know their pathological history (43.1%) and those who did have it hadmore other conditions (19.9%) in which we found hypothyroidism.

The frequency of the analytical data of thrombocytopenia in hospitalized patients was established, finding that 14.8 % of patients presented thrombocytopenia. In the total of patients analyzed (n=216), 6.48% of patients hospitalized in the clinical unit and 8.33% of patients hospitalized in the intensive care unit (ICU) presented thrombocytopenia and it was determined that there is a very weak negative Rho de Spearman statistical relationship (-0.049) between the initial platelet count and the days of hospitalization, in which, the more days of hospitalization, the lower the initial platelet count.

There was no evidence of a statistically significant relationshipbetween thrombocytopenia and the SOFA, APACHE II and NEWS-2 scoring systems, given that when analyzing the variables through a cross table and determining the Chi-square value, obtaining values of 1.329; 3.327; 2.406 respectively, in addition to when analyzing the significance value in the three variables was greater than 0.05, so it was concluded that there is no relationship, accepting the null hypothesis.

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