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ARTÍCULOS ORIGINALES

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Length of stay in intensive care unit and characteristics of COVID-19 patients: a single-center observational retrospective study in Hospital Metropolitano, Quito, Ecuador

Tiempo de estancia en unidad de cuidados intensivos y características de los pacientes con COVID-19: un estudio retrospectivo observacional unicéntrico en el Hospital Metropolitano, Quito, Ecuador

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ABSTRACT

Introduction: Coronavirus disease 2019 (COVID-19) has been identified by the World Health Organization as a global pandemic. **Objectives:** To describe data on COVID-19 hospitalization cases from March 2020 until January 2021 in Hospital Metropolitano of Quito, Ecuador. **Methods:** Retrospective study conducted that included 515 adult subjects with COVID-19 diagnosis. **Results:** We included 332 males and 183 females. From the total, 91 patients were admitted to the intensive care unit (ICU) and the mean (±SD) length of ICU stay was 13.5 ± 8.2 days and mean (±SD) length of hospital stay was 5.9 (±3.3) days. In the period analyzed, 37 in-hospital deaths were observed (7.2% of all patients). Thirty-four percent of the patient that were admitted in ICU had died by the end of this study and those that died had a higher mean age compared to survivors (65.6 ± 13.4 vs 56.3 ± 16.1, P = 0.000). The most prevalent comorbidities were hypertension, hypothyroidism and diabetes. Amongst the patients admitted (survivors and non survivors) there were significant differences in the neutrophil counts, D-dimer levels, creatinine, glucose, IL6, triglycerides (TGL), lactate dehydrogenase (LDH), troponin, sodium and potassium count. The most frequent symptoms were dyspnea, fever and cough. **Conclusions:** Patients admitted to the intensive care unit had longer length of stay than the rest, they were older and with lower oxygen saturation level. The laboratory parameters were significantly higher in patients who died. Abnormal count of neutrophils and LDH as well as age were risk factors for mortality in these patients.

Keywords: coronavirus; COVID-19; intensive care unit; mortality; Ecuador.

RESUMEN

Introducción: La enfermedad por coronavirus 2019 (COVID-19) ha sido identificada por la Organización Mundial de la Salud como una pandemia global. Objetivos: Describir datos de casos de hospitalización por COVID-19 desde marzo de 2020 hasta enero de 2021 en el Hospital Metropolitano de Quito, Ecuador. **Métodos:** Estudio retrospectivo realizado que incluyó a 515 sujetos adultos con diagnóstico de COVID-19. **Resultados:** Se incluyeron 332 hombres y 183 mujeres. Del total, 91 pacientes ingresaron en la unidad de cuidados intensivos (UCI) y la duración media (± DE) de la estancia en la UCI fue de 13,5 ± 8,2 días y la duración media (± DE) de la estancia hospitalaria fue de 5,9 (± 3,3) días. En el período analizado, se observaron 37 muertes intrahospitalarias (7,2% del total de pacientes). Treinta y cuatro por ciento de los pacientes que ingresaron en la UCI habían fallecido al final de este estudio y los que fallecieron tenían una edad media más alta en comparación con los sobrevivientes (65,6 ± 13,4 vs 56,3 ± 16,1, P = 0,000). Las comorbilidades más prevalentes fueron hipertensión, hipotiroidismo y diabetes. Entre los pacientes ingresados (supervivientes y no supervivientes) hubo diferencias significativas en el recuento de neutrófilos, niveles de dímero D, creatinina, glucosa, IL6, triglicéridos (TGL), lactato deshidrogenasa (LDH), troponina, sodio y potasio. Los síntomas más frecuentes fueron disnea, fiebre y tos. **Conclusiones:** Los pacientes ingresados en la unidad de cuidados intensivos tenían mayor tiempo de estancia que el resto, eran de mayor edad y con menor nivel de saturación de oxígeno. Los parámetros de laboratorio fueron significativamente más altos en los pacientes que fallecieron. El recuento anormal de neutrófilos y LDH, así como la edad, fueron factores de riesgo de mortalidad en estos pacientes.

Palabras clave: coronavirus; COVID-19; unidad de Cuidados Intensivos; mortalidad; Ecuador

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INTRODUCTION

According to data officially published in Ecuador, the number of COVID-19 infected until February 2021 was 269,860 confirmed cases with PCR tests and several deaths in the entire country (15,444 subjects)[1]. Regarding the percentage of mortality, Ecuador, Bolivia and Peru have values above the world average (3.45%) and Latin America (4%), with Ecuador being the country with the highest figure, equivalent to 9.05% approximately[2].

Based on current studies the clinical course of COVID-19 can be variable[3]. Of the population infected with COVID-19, 80% will have an asymptomatic or mild clinical presentation, approximately 15% will have a moderate clinical presentation and 5% will have a critical presentation that includes hypoxemia, acute respiratory distress syndrome (ARDS), shock (both distributive and cardiogenic) and multiple organ dysfunction syndrome[4]. Poorer prognosis has been associated with older age, being male, and having comorbidities, such as hypertension, cardiovascular or coronary disease, and diabetes mellitus[5]. It has been demonstrated that survival decreases with advanced age and with underlying comorbidities, and also more complications have been seen in these subjects[6].

Among hospitalized patients, the presence and severity of respiratory failure are usually the most important issues to decide the admission to the intensive care unit (ICU) or to treat on regular wards.

Some studies have reported an Intensive Care Unit (ICU) mortality ranging from 20-40%[7,8].

Blood biomarkers are often considered routinary and important means for diagnosis in clinical practice. Previous studies reported that some hematological and biochemical tests are used for the differentiation of COVID-19 patients from patients without COVID-19 and also for differentiate severity from non-severity in these subjects[9-11].

Hospital Metropolitano de Quito is a private secondary third level hospital with 128 beds, including 10 beds in the intensive care unit (ICU); for patients with SARS COV2 are designed 16 beds in a general ward and 5 beds in ICU. The aim of this study is to describe symptoms, comorbidities and laboratory results of hospitalized patients with COVID-19 during their stay in ICU and on regular general ward as well as mortality in the Hospital Metropolitano of Quito, Ecuador during March 2020 until January 2021.

METHODS

Study design

This is a retrospective single-center study of 515 consecutive patients with coronavirus disease 2019 (COVID-19) with rt-PCR positive admitted to Hospital Metropolitano in Quito, Ecuador between March 2020 and January, 2021.

Participants

A total of 515 participants were included. The inclusion criteria were adults over 18 years of age, of both sexes who were admitted to the hospital with a diagnosis of COVID-19, confirmed by rt-PCR. Patients were hospitalized on ICU or on a general ward for SARS-CoV-2 according to their severity.

Variables

Demographic data such as gender and age, comorbidities, length of stay in a general ward or in the ICU , laboratory values, were collected from electronic health records of the Hospital Metropolitano. Obesity was defined as BMI > 30 kg/m^2. Whole blood samples were obtained routinely at the time of admission in all patients as per standard of care.

Statistical analysis

For the qualitative variables, absolute and relative frequencies were calculated. For quantitative variables, mean and standard deviation (SD) were calculated. Comparisons of proportions were made in the case

of qualitative variables (Fisher's exact test and Chi-square test) to know if there were significant differences between groups. For quantitative variables, the nonparametric Mann and Whitney test was performed to determine differences in the means of laboratory parameters between survivors and non survivors Univariate and multivariate logistic regression analyses were conducted to identify independent risk factors (Logistic regression models); the odds ratio (OR), adjusted odds ratio (AOR) and the 95% confidence interval (CI) were calculated. A value of p <0.05 was considered statistically significant and 0.01 as highly significant. SPSS version 25 was used for data analysis.

Ethical aspects

Due to the retrospective nature of this study, informed consent was not requested from the participating subjects. The data collected has been kept confidential, for which numerical codes were used to identify the subjects. The identity of the subjects, their dignity and rights, as well as their privacy were protected at all times. This project is of minimal risk for its participants and the STROBE list was followed to report the results.

RESULTS

A total of 515 subjects were analyzed (cut off January 31, 2021). Baseline characteristics of all patients as well as the subgroups of ICU and general ward with isolation are summarized in Table 1. Of the total, 332 were men (64.4%) and 183 were women (35.6%). The mortality was significant higher in patients staying in ICU. The most common comorbidity was hypertension (25.8%) followed by hypothyroidism (13%) and diabetes (12.6%). The two groups exhibited a similar prevalence of comorbidities except for coronary heart diseases, finding significant statistical difference between the two groups. Most of patients were admitted on a general ward while 17.7% went to an ICU. Mean age of ICU patients was 65.6 years. Average stay in ICU was 13.5 days and 5.4 days for the patients with no need of intensive care with a very significant statistical differences between the groups. The average age for those requiring intensive care was 65.6 years, also oxygen saturation was different between groups (p values of 0.001). (Table 1)

The percentage of deaths was 7.2% (37 subjects), 26 men (70.3%) and 11 women (29.7%). The average stay at the hospital of the analyzed subjects was 7.26 days, 12.5 for the deceased and 6.9 for those alive subjects (p <0.001 **). The average age of the deceased patients was 75.2, while the average age of the survivors was 56.6 years, with highly significant statistical differences (p <0.001 **). It should be noted that oxygen saturation was also different between non-survivors and survivors. (Table 2)

Regarding the laboratory findings, Table 3 shows highly significant statistical differences between the two groups for the following tests: neutrophils, D-dimer, creatinine, glucose, Il6, triglycerides (TGL), troponin, sodium and potassium. (Table 3)

Dyspnea was the most common symptom (62.9%), followed by fever (37.5–40 °C), cough and diarrhea. (Table 4)

In the multivariate logistic regression analysis, the following risk factors were associated with a higher risk of death among patients with COVID-19: increased neutrophils (AOR: 1.00;1.01-1.02). The OR value indicate that the probability of mortality increases by 1.00-fold with each unit increase in the neutrophils count. For age and for LDH values were (AOR: 0.88;0.83-0.94) and (AOR: 0.99;0.98-1.01), respectively. (Table 5)

Table 1. Comparison of the demographics variables by staying or not in ICU facility on admission

	All patients (n = 515)		General ward (n = 424) 82.3%		ICU (n = 91) 17.7%		P value
	n	%	N	%	N	%	
Mortality							
Survivors	478	92.8	418	98.6	60	65.9	0.00
Non-Survivors	37	7.2	6	1.4	31	34.1	
Gender							
Male	332	64.5	266	80.1	66	19.9	0.07
Female	183	35.5	158	86.3	25	13.7	
Comorbidities							
Comorbidities (general)	241	46.8	193	80.1	48	19.9	0.21
Hypertension	133	25.8	103	77.4	30	22.6	0.08
Hypothyroidism	67	13.0	49	86.0	8	14.0	0.56
Diabetes	65	12.6	50	76.9	15	23.1	0.22
Coronary heart diseases	32	6.2	22	68.8	10	31.3	0.03
Pulmonary diseases	21	4.1	17	81.0	4	19.0	0.86
Immunosuppression	17	3.3	15	88.2	2	11.8	0.73
Active cancer	15	2.9	12	80.0	3	20.0	1.00
Obesity (BMI >30 kg/m^2)	5	0.1	5	100.0	0	0	0.65
Hepatic diseases	1	0.2	1	100.0	0	0	1.00
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age	57.9	16.1	56.3	16.1	65.6	13.4	0.001
Stay length (days)	7.3	5.4	5.9	3.3	13.5	8.2	0.001
$SATO_2$	84.3	8.9	85.6	6.3	78.2	14.9	0.001

Table 2. In-hospital mortality according to baseline characteristics of subjects

	Non-survivors n=37(7.2%)		Survivors n=478(92.8%)		p value*
	No	%	No	%	
Gender					
Male	26	70.3	306	64.0	0.44
Female	11	29.7	172	36.0	
Comorbidities					
Hypertension					
No	19	51.3	362	75.9	0.001
Yes	18	48.7	115	24.1	
Diabetes					
No	31	83.8	418	87.6	0.49
Yes	6	16.2	59	12.4	
Obesity (BMI >30 kg/m^2)					
No	37	100.0	473	99.0	0.53
Yes	0	0.0	5	1.0	
Active cancer					
No	37	100.0	461	96.8	0.27
Yes	0	0.0	15	3.2	

Immunosuppression					
No	36	97.3	460	96.6	0.82
Yes	1	2.7	16	3.4	
Coronary heart disease					
No	32	86.5	449	94.3	0.12
Yes	5	13.5	27	5.6	
Pulmonary diseases					
No	36	97.3	456	95.8	0.99
Yes	1	2.7	20	4.2	
	Mean	**SD**	**Mean**	**SD**	
Stay length (days)	12.5	8.7	6.9	4.8	0.001
Age	75.2	12.5	56.6	15.5	0.001
$SATO_2$	75.3	16.1	85.0	7.6	0.001
***Chi square**					

Table 3. Laboratory values according to mortality

	Survivors Mean(SD)	**Non-survivors Mean(SD)**	**p value***
Hemoglobin (g/dL)	15.71	15.20	0.610
Neutrophils (10^3/mL)	6249.08	8273.19	0.004
Lymphocytes (10^3/mL)	1231.44	1087.70	0.560
Platelets	225032.14	219513.51	0.700
Dimer (mg/L)	0.68	2.1	0.000
Creatinine (mg/dL)	0.98	1.35	0.007
Glucose (mg/dL)	129.60	166.87	0.000
Il6	397.43	2559.20	0.000
ALT/SGPT (UI/L)	61.12	53.06	0.490
AST/SGOT (UI/L)	51.84	68.14	0.050
TGL (mg/dL)	148.43	340.25	0.005
LDH (mg/dL)	501.31	805.84	0.000
Troponin	14.6066	51.5628	0.000
Sodium (mEq/L)	136.43	138.77	0.004
Potassium (mEq/L)	4.11	4.34	0.010
***Chi square**			

Table 4. Symptoms of included patients

	Yes	**No**
	Nº (%)	**Nº (%)**
Dyspnea	324(62.9)	191(37.1)
Fever	308(59.8)	207(40.2)
Cough	306(59.4)	209(40.6)
Diarrhea	108(21.0)	407(79.0)
Anosmia	67(13.0)	448(87.0)
Disgeusia	49(9.5)	466(90.5)

Table 5. Symptoms of included patients

Characteristics	Non-Adjusted		Adjusted (AOR)	
	OR (95% CI)	p value	OR (95% CI)	p value*
Comorbidities				
Hypertension				
Yes	Reference		Reference	
No	0.33 (0.17-0.65)	0.002	0.49 (0.17-1.37)	0.17
Laboratory parameters the normal range is the reference category				
Neutrophils (10^3/mL)	1.00(1.01-1.02)	0.005	1.00(1.01-1.02)	0.03
LDH (mg/dL)	0.99(0.98-1.01)	0.00	0.99(0.98-1.01)	0.02
Troponin	0.98(0.97-1.02)	0.00	0.99(0.98-1.00)	0.53
BUN	0.95 (0.92-0.97)	0.00	1.02(0.97-1.07)	0.36
Creatinine (mg/dL)	0.75(0.58-0.95)	0.02	0.72(0.45-1.14)	0.16
Glucose (mg/dL)	0.98(0.97-0.99)	0.00	0.99(0.98-1.00)	0.26
Sodium (mEq/L)	0.87(0.80-0.95)	0.00	0.91(0.80-1.02)	0.12
Potassium (mEq/L)	0.50 (0-27-0.89)	0.01	1.51(0.46-4.94)	0.82
Other variables				
Age	0.92 (0.89-0.94)	0.00	0.88(0.83-0.94)	0.00
$SATO_2$	1.07(1.04-1.10)	0.01	1.04(0.98-1.10)	0.16
***Logistic regression**				

DISCUSSION

This study characterizes patients suffering from COVID-19 treated inside and outside the intensive care unit (ICU) admitted at Hospital Metropolitano de Quito, Ecuador from March 2020 until January 2021. The majority of patients in this study were male, which is consistent with several sex-stratified studies that have identified male sex as a risk factor for worse prognosis and higher mortality[12-14]; most were normal weight and a low BMI in our study subjects may have been protective. It has been reported in a systematic review with metanalysis that COVID-19 subjects with obesity are more severely affected than those without it[15-18].

Velez et al reported that the mean body mass index (BMI) in 89 patients studied was 30.84, with significant differences being observed between survivors (28,98) and non-survivors (31.99) being these differences statistically significant[19].

General mortality rate was 7.2%, and mortality rate of ICU patients was 34.1%, while prior reports have suggested highly variable mortality rates[20,21]. Despite this high variability the mortality in the Hospital Metropolitano is lower that what has been reported by other authors[22,23]. The reasons for the variability in mortality are not yet defined and may include genetic factors, differences in local testing strategies and epidemiological reporting between countries, and differing capacity of local health systems to cope with the epidemic[23]. The mortality of patients admitted to ICU have significantly decreased since the beginning of the pandemics because a better understanding of COVID-19 pathophysiology and also because more specific treatments.

In a study performed in five countries of Latinoamerica, including Ecuador, of a total of 298 patients, 60% were male, with a mean age of 60 years, and 74% of patients had at least one comorbidity. Of those, 137 (46%) patients were transferred to the intensive care unit and 66 (22.1%) patients died during hospitalization. The mortality rate of the our study was higher than reported in this study[24].

Consistent with previous studies, hypertension was the most common comorbidity seen in the included subjects in this study[25,26]. Hypertensive patients may have decreased expression of ACE2, which suggests that this medical condition may be involved in the pathogenesis of COVID-19[27].

Subjects with pre-existing endocrine disorders are at higher risk of suffering severity or death disease. We found a high prevalence of patients with hypothyroidism. Nevertheless, according to patients with hypothyroidism and receiving thyroid therapy were not found to be associated with an increased risk of hospitalization for patients with COVID-19[28,29].

A study from Ecuador reported also that he most frequent comorbidity was hypertension (HT) in 20.22% (n=18) followed by obesity 16.85% (n=15)and diabetes mellitus (DM) 8.99% (n=8)[19].

Length of stay for these patients had a mean of 5 days, which increases to 13 days for ICU patients. Some studies report longer stays at ICU and at general wards.20 Subjects admitted at ICU are older that those admitted to the general ward at the hospital. Age has been considered by many authors an independent predictor of severity and mortality in COVID-19 patients[30-32].

Velez et al. reported no statistically significant difference in mean length of hospital stay (ALOS) between those who survived (9.31 days) versus those who died (10.29 days). They also reported that 33.71% of died due to COVID-19[19].

The patients included in this study presented with a typical set of symptoms of COVID-19. The most common symptom was dyspnea in 324 cases (62.9%), followed by fever and cough. Olfactory and Gustatory disorders were experienced by 116 patients (22.5%) out of 515 patients. In our study, none of the symptoms were not significantly different between survivors and non-survivors. Dyspnea has been reported to affect less than 50% of COVID-19 patients but in our case most of the subjects suffered from this symptom. This differ from was reported by Ortiz et al., that mentioned that the most common symptom was fatigue or general tiredness (53.2%), followed by headaches (43%), and dry cough (41.7%). I n this study, 37.1% of the patients reported loss of taste (ageusia), 36.1% reported loss of smell (anosmia) and 35% reported muscle and joint pain[33].

Some blood parameters as neutrophils counts and lactate dehydrogenase are higher in severe patients and are predictors of mortality[34]. Many other authors have reported alteration in many other blood parameters[9,35,36].

In a study performed at the Hospital IESS Quito Sur the authors found differences in laboratory parameters between intensive care unit (ICU) and non-ICU cases considering C-reactive protein, lactate dehydrogenase, and lymphocytes[37].

The present study has some limitations due to the retrospective nature of the study and because all patients were enrolled in the same center and may not be generalizable to other hospitals of the city.

CONCLUSIONS

This study has corroborated what other authors worldwide have reported regarding COVID-19 infection. Patients admitted to the intensive care unit had longer length of stay than the rest were older and with lower oxygen saturation level. The laboratory parameters were significantly higher in patients who died. Hypertension and age were risk factors for mortality in these patients.

Declarations

Ethics approval and consent to participate

This was a retrospective study in which a secondary analysis of a database was performed. Research committee of the Hospi-

tal Metropolitano approved this study. Our study was conducted in accordance with the ethical standards of the institution. This report follows the STROBE guidelines for observational studies.

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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No funds were received.

Author contributions

The authors' responsibilities were as follows: CF, FA, CD and MF designed the research; CD, CF and FA extracted and curated data. MF analyzed the data. All the authors participated in writing and reviewing the manuscript. All authors critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

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