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Original Article

Cardiovascular risk factors and evolution of patients attended with COVID-19 in a National Reference Hospital from Lima, Peru

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Running Head: COVID-19 and Cardiovascular risk factors in Peru

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Abstract:

Objectives. Coronavirus disease 2019 (COVID-19) fatal outcomes have been associated with multiple cardiovascular risk factors. In new epidemic areas, such as Latin America, there is a lack of studies about this. Here, we evaluated those factors in a retrospective cohort of patients in a national reference hospital of Lima, Peru. Design. A retrospective cohort observational study was done. For this study, information was obtained from clinical records of the hospital for the cases that were laboratory-diagnosed and related, during March 6th and April 30th, 2020. rRT-PCR was used for the detection of the RNA of SARS-CoV-2 following the protocol Charité, Berlin, Germany, from nasopharyngeal swabs at the National Institute of Health. Calculation of the odds ratio (OR) with the respective 95% confidence interval (95% CI) was done, also logistic regression for adjusted OR (multivariate) was done. Values of $p < 0.05$ were considered significant for all analyses. *Results*. One hundred six hospitalized patients were evaluated. The mean age of patients was 61.58 years (SD 16.81). Cardiovascular risk factors among them were hypertension (46.2%), diabetes (28.3%), and obesity (28.3%), among others. Fifty-six patients died (52.8%). Mortality associated factors at the multivariate analysis were arterial hypertension (OR=1.343, 95% 1.089-1.667), myocardial injury (OR=1.303, 95% 1.031-1.642), and mechanical ventilation (OR 1.262, 95% 1.034-1.665), as associated factors. *Conclusion*. As observed in other regions of the world, cardiovascular risk factors represent a significant and independent threat to be considered in patients with COVID-19. Further studies and interventions in Peru and Latin America are expected.

Keywords: COVID-19; SARS-CoV-2; risk factors; outcomes; cardiovascular; Latin America.

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Introduction

Coronaviruses are single-stranded positive-sense RNA viruses, with the capacity for rapid mutation and recombination. They are known to cause respiratory or intestinal infections in humans and animals. Moreover, acute respiratory infections including influenza, respiratory syncytial and bacterial pneumonia are triggers for cardiovascular diseases and, on the other hand, the underlying cardiovascular disorders are usually associated with comorbidities, which may increase tie incidence and severity of infectious diseases.[1-3]

Cardiovascular complications associated with the coronavirus infection were described since infections with SARS-COV and recently with SARS-COV-2. The later generate the clinical pattern defined as COVID-19, described in the first time in December 2019 in Wuhan-China. After that, there were mentioned direct effects of the virus and the consequences associated with the host immune response. [1,4-8]

Cardiovascular compromise in patients with COVID-19 has not been well studied because data is scarce. However, there were described cases of myocardial injury, myocarditis, thromboembolic disease, arrhythmias, among others. But there is no information about the long-term consequences of this disease [2,9]

Edgardo Rebagliati Martins national hospital is the largest hospital of the Peruvian social security with 2,000 hospital beds and is considered as a national reference center for patients with COVID-19 and concentrate a higher quantity of severe cases associated with this clinical condition.[19]

The objectives of the present study are to describe the prevalence of cardiovascular risk factors in the selected population, to evaluate the clinical findings, laboratory and electrocardiographic data, and describe the evolution of patients, taking into count the presence of some cardiovascular risk factors.

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Methods

An observational, retrospective study carried out in the adult emergency service of Hospital Nacional Edgardo Rebagliati Martins- EsSalud, located in the district of Jesus María in Lima-Perú. This service accounts for 180 beds and realizes 164,370 medical attentions per year and 22,883 admissions per day in patients over 14 years of age with a public health insurance system.

Patients considered for this study were those with a clinical diagnostic of COVID-19 and confirmed by molecular testing, RT-PCR, from nasopharyngeal swabs, attended and hospitalized between March 6th and April 30th in the Hospital Rebagliati. Only patients with confirmed pulmonary lesions by CT scan and oxygen saturation level below 93% were hospitalized due to a higher demand for health care services in Peruvian public hospitals. There were excluded patients transferred to other health centers and patients that arrive without vital signs.

Data from an electronic clinical record of patients was obtained, identifying clinical and laboratory variables, and their evolution during hospitalization. A twelve-lead ECG was recorded too. We used SPSS 24.0 for statistical analysis that includes descriptive, bivariate analysis, and multivariate analysis (binary logistic regression). A p-value of less than 0.05 was considered statistically significant.

The project was authorized for the emergency department and the Ethics and investigation committee for COVID-19 in EsSalud (study approval number: 83328). The principle of confidentiality was guaranteed. Informed consent was not obtained because the source document was secondary (an electronic clinical record), and there was not any intervention for the patient.

Results

One hundred six hospitalized patients were evaluated. The mean age of patients was 61.58 years (SD 16.81), 47 (44.34%) had more than 65 years of age, 81 (76.4%) were of male gender (Table 1). Cardiovascular risk factors among the study population were hypertension (46.2%), diabetes

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(28.3%), and obesity (28.3%). Sixteen patients (6.76%) report a previous cardiovascular disease (15.09%).

They arrived in the emergency room with more than seven days of symptoms: 7.35 (SD 3.53). Thirty-two cases (30.18%) had symptoms between 3 and 7 days and 54.71% with more than seven days.

The most frequent signs and symptoms during emergency arrival (Figure 1) were dyspnea (82.07%), tachycardia (35.8%), and higher levels of blood pressure (17.9%), defined as levels over 140 mmHg of systolic or levels over 90 mmHg of diastolic pressure.

Troponin T values higher than 99th percentile of superior reference limit, suggestive of myocardial injury was found in 40 of 79 patients tested (50.6%). The median value was 0.033 (IQR 0.047).

In 40 patients, 12-lead ECG recorded was obtained. 22 (55%) had an ECG without specific alterations. In 11 cases (27.5%) there were rhythm alterations (atrial fibrillation,4 cases; sinus bradycardia, 2 cases; sinus tachycardia, 1 case; 3rd degree A-V block 1 case; 1st degree A-V block 2 cases; and ventricular extrasystoles, 1 case) in 4 cases (10%) left ventricular hypertrophy and in 3 cases (7.5%) findings that suggest acute ischemia (ST elevation in 1 case and ST depression in 2 cases).

The median of hospitalization was eight days (IQR 12.25). In 64.15% of cases, the time of admission was higher than seven days, and in 17 patients (16.04%) was more top than 30 days. 22 (20.75%) patients entered to invasive mechanical ventilation.

Fifty-six patients died, which corresponds to a mortality rate of 52.8% (Figure 1). Mortality associated factors (Table 2) were age more than 65 years, myocardial injury, mechanical ventilation, and arterial hypertension were associated with statistical differences in bivariate

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analysis. In the multivariate analysis, we found arterial hypertension, myocardial injury, and mechanical ventilation as associated factors (Table 2).

Discussion

The present report describes cardiovascular risk factors and some clinical, laboratory, and electrocardiography findings in a group of patients hospitalized for moderate to severe COVID-19 attended in a national reference hospital of social security.

Although multiple studies have reported the clinical findings in COVID-19,[20-27] and some of the associated risk factors,[25,26] few in Latin America have shown the relationship between cardiovascular risk factors and fatal outcomes.[26]

The prevalence of cardiovascular risk factors was similar to CDC and Italian reports (from the Lombardy region) for arterial hypertension (46.2%) and higher in comparison with reports of Chinese hospitals (30.5%). A similar phenomenon occurs for diabetes found in 28.3%, which was identical to the CDC report and superior to Italian and Chinese reports, 17.3% and 14% respectively [3,5,6,16] But, the prevalence of cardiovascular risk factors and previous cardiovascular disease is higher in patients with severe COVID-19 and in patients who died due to COVID-19.[21]

However, these prevalences in hospitalized patients with COVID-19 were superior to the Peruvian TORNASOL report, which corresponds to a national evaluation for hypertension and other cardiovascular risk factors, carried out in 2011, where a prevalence of 27.3% was found. [13] At the national level, the prevalence of Diabetes in Peru was reported in ranges between 5 and 7%.[14]

Hypertension and cardiovascular disease were associated with a higher risk of severity and mortality in patients infected with COVID-19 because their conditions could damage the vascular structure, and it is more likely to develop into critical disease during the infection. Moreover,

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patients with chronic cardiovascular disease are more likely to be infected due to their weakened heart function and low immunity, developing severe disease patterns. [20-22]

Recent studies indicate multi-organ tropism of SARS-CoV-2, including heart, vascular system, and the circulation, which is speculated to influence the course of the disease as well as aggravate preexisting conditions. The increased-myocardial expression of ACE2 in patients with cardiovascular disease and COVID-19 has been suggested as a possible mechanism of myocardial cell invasion and injury levels to worse outcomes. [21]

Myocardial injury is manifested as an elevation of troponin levels above the 99th percentile of superior normality level and is associated with an increase in mortality. It could be presented with electrocardiographic and echocardiographic changes. In some cases, could evolution to a fulminant myocarditis [1,2,6,15]

We found a prevalence of myocardial injury of 50.6%, superior to report in the hospitalized population (7-17%), and ICU population (22-31%) [1,12,15]. Moreover, in a recent metanalysis of 26 clinical studies with 11,685 patients, the prevalence was 20%.[17] However in subpopulations of severe or critical COVID-19 cases, similar to the cases described in this report, the prevalence could be much higher: from 65.2% and 80%.[21]

In a retrospective study of 191 patients, older age was recognized as a risk factor of mortality and has been reported as a significant predictor of mortality in SARS and MERS, probably because of age-dependent defects in T-cell and B-cell function and the excess production of type 2 cytokines that could amplify viral replication and prologs proinflammatory responses.[23] Other factors like the presence of comorbidities in older patients (particularly hypertension) are believed to be risk factors for severe disease and death for SARS-Cov-2 infection.

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Moreover, in deceased patients, higher levels of cardiac troponins were associated with poorer outcomes and mortality, as was described in several reports.[16,24] In a recent study in Bolivia, the mortality rate was 5.6%, but age and hypertension (OR=3.284, 95%CI 1.276-6.291) were the main associated factors with the fatal outcomes, very similar to our current findings for this factor (Table 2).[26]

Previously a preliminary description of patients with severe COVID-19 was reported in our hospital. This study described 17 patients, 5 of them died. Authors identified advanced age (6), arterial hypertension (4), and obesity (3), as the main observed risk factors in these patients.[27]
This study is an exploratory case-series without randomization, that obtain data from electronic clinical reports. We did not register body mass index, and there was not a formal criterion to get troponin dosage or ECG recording in every patient hospitalized for COVID-19. Although there is an essential number of patients in this region, and describe the cardiovascular findings associated with this disease.

Conclusions

There is a high prevalence of cardiovascular risk factors in our patients with severe COVID-19 disease. Dyspnea, tachycardia, and a higher level of blood pressure at admission were the most frequent clinical manifestations. We found myocardial injury in almost half of the total population and ECG changes in more than a fourth of our population. On the other hand, arterial hypertension, the use of mechanical ventilation, and myocardial injury were associated with higher mortality in our patients.

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None.

Conflict of Interests

None.

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Table 1. Clinical and demographical features of the patients with COVID-19.

Variable	**N**	**%**
Age distribution		
<30 years	3	2.83
30-64 years	56	52.83
65-84 years	39	36.79
≥85 years	8	7.55
Gender distribution		
Male	81	76.4
Female	25	23.6
Cardiovascular risk factors		
Hypertension	49	46.2
Diabetes	30	28.3
Obesity	30	28.3
Previous history of cardiovascular disease	16	15.1

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Table 2. Mortality associated factors.

Variable	OR_c	95%CI	OR_a	95%CI
Arterial hypertension	4.280	1.880-9.730	1.343	1.089-1.667
Myocardial injury	4.700	1.810-12.210	1.303	1.031-1.642
Mechanical ventilation	5.440	1.690-17.470	1.262	1.034-1.665
Age more than 65 years	2.760	1.220-6.200	1.070	0.848-1.354
Obesity	1.240	0.520-2.900	1.055	0.848-1.323
Male gender	1.590	0.640-3.920	0.959	0.747-1.217
Diabetes	0.850	0.360-1.980	0.879	0.691-1.097

OR_c=crude odds ratio (bivariate analysis); OR_a=adjusted odds ratio (multivariate analysis).

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Figure 1. Clinical findings at the ER income.

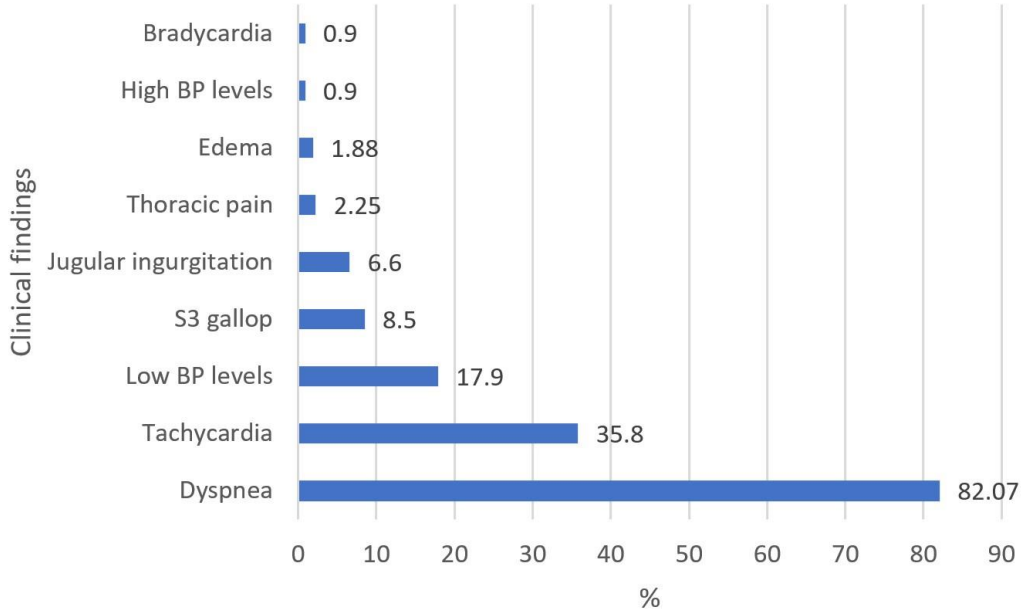

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Figure 2. Survival rates of the patients by time.