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Epidemiological and laboratory profile of patients confirmed with Covid-19 and admitted to a reference hospital

Perfil epidemiológico e laboratorial de pacientes confirmados com Covid-19 e admitidos em um hospital de referência

Perfil epidemiológico y de laboratorio de pacientes confirmados con Covid-19 e ingresados en un hospital de referencia

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Humberto Carvalho Aragão Neto
ORCID: https://orcid.org/0000-0002-2264-2966
Federal University of Paraíba, Brazil
E-mail: netohumbertoo@outlook.com
Camila Medeiros Costa
ORCID: https://orcid.org/0000-0002-5952-1703
Institute René Rachou/Fiocruz Minas, Brazil
E-mail: camilamcosta2009@gmail.com
João Carlos Lima Rodrigues Pita
ORCID: https://orcid.org/0000-0002-2823-3215
University Hospital Lauro Wanderley, Brazil
E-mail: joaocpita@gmail.com
Ricardo Dias de Castro
ORCID: https://orcid.org/0000-0001-7986-7376
Federal University of Paraíba, Brazil
E-mail: ricardodiasdecastro@gmail.com
Inácio Ricardo Alves Vasconcelos
ORCID: https://orcid.org/0000-0001-7931-1415
Federal University of Paraíba, Brazil
E-mail: inacioravasconcelos@gmail.com
Rubens Batista Benedito
ORCID: https://orcid.org/0000-0002-2122-8851
University Hospital Lauro Wanderley, Brazil
E-mail: rubenssjp@gmail.com

Abstract
The new coronavirus, SARS-CoV-2, which causes COVID-19 is easily transmitted from person to person. About 15% develop severe pneumonia and of these, 6% progress to severe acute respiratory syndrome (SARS) and multiple organ failure. Identify biomarkers that can predict which individuals are likely to be affected by severe disease and are at risk of death is crucial. However, the pathophysiology of the disease is not completely elucidated and the characterization of the clinical profile of people infected with SARS-CoV-2 remains unclear. Therefore, the objective of this study was to evaluate the epidemiological and laboratory profile of patients confirmed with COVID-19 and admitted to the University Hospital Lauro Wanderley, based on the correlation of laboratory tests to the evolution of the disease, determination of the most influential variables in the worsening of the disease. Data consisted of complete blood count and serum biochemical analyzes. Overall, 74 patients met all criteria of this study and were included, 40 from the Intensive Care Unit (ICU), and 34 from the Infectious Diseases Infirmary (IDP), both exclusively for patients with COVID-19. Based on these findings, patients with increased WBC count, ALT, AST, and LDH should be closely monitored as these factors predict ICU admission and mortality. Among other laboratory parameters, patients admitted to the ICU have higher levels of D-dimer compared to IDI patients. The results suggests that higher levels of D-dimer on admission is related to a worse prognosis of the disease.
Keywords: SARS-CoV-2; D-dimer; Intensive Care Unit; Lactate dehydrogenase; Aspartate aminotransferase; Acute respiratory syndrome.

Resumo
O novo coronavírus, SARS-CoV-2, que causa o COVID-19, é facilmente transmitido de pessoa para pessoa. Cerca de 15% desenvolvem pneumonia grave e, destes, 6% evoluem para síndrome respiratória aguda grave (SARS) e falência de múltiplos órgãos. Identificar biomarcadores que podem prever quais indivíduos são susceptíveis de serem afetados por doenças graves e estão em risco de morte é crucial. No entanto, a fisiopatologia da doença não está

completamente elucidada e a caracterização do perfil clínico das pessoas infectadas com SARS-CoV-2 permanece obscura. Portanto, o objetivo deste estudo foi avaliar o perfil epidemiológico e laboratorial de pacientes confirmados com COVID-19 e internados no Hospital Universitário Lauro Wanderley, com base na correlação dos exames laboratoriais com a evolução da doença, determinação das mais influentes variáveis no agravamento da doença. Os dados consistiram em hemograma completo e análises bioquímicas séricas. Ao todo, 74 pacientes atenderam a todos os critérios deste estudo e foram incluídos, 40 da Unidade de Terapia Intensiva (UTI) e 34 da Enfermaria de Doenças Infecciosas (PDI), ambas exclusivamente para pacientes com COVID-19. Com base nesses achados, os pacientes com contagem elevada de leucócitos, ALT, AST e LDH devem ser monitorados de perto, pois esses fatores predizem admissão na UTI e mortalidade. Entre outros parâmetros laboratoriais, os pacientes internados na UTI apresentam níveis mais elevados de dímero-D em comparação com os pacientes IDI. Os resultados sugerem que níveis mais elevados de dímero-D na admissão estão relacionados a um pior prognóstico da doença.
Palavras-chave: SARS-CoV-2; D-dímero; Unidade de Tratamento Intensivo; Lactato desidrogenase; Aspartato aminotransferase; Síndrome respiratória aguda.

Resumen

El nuevo coronavirus, SARS-CoV-2, que causa el COVID-19 se transmite fácilmente de persona a persona. Aproximadamente el 15% desarrolla neumonía grave y de estos, el 6% progresa a síndrome respiratorio agudo severo (SRAS) e insuficiencia orgánica múltiple. Es fundamental identificar los biomarcadores que puedan predecir qué individuos tienen probabilidades de verse afectados por una enfermedad grave y están en riesgo de muerte. Sin embargo, la fisiopatología de la enfermedad no está completamente aclarada y la caracterización del perfil clínico de las personas infectadas con SARS-CoV-2 sigue sin estar clara. Por tanto, el objetivo de este estudio fue evaluar el perfil epidemiológico y de laboratorio de los pacientes confirmados con COVID-19 e ingresados en el Hospital Universitario Lauro Wanderley, a partir de la correlación de las pruebas de laboratorio con la evolución de la enfermedad, determinación de los más influyentes. variables en el agravamiento de la enfermedad. Los datos consistieron en hemogramas completos y análisis bioquímicos séricos. En total, 74 pacientes cumplieron con todos los criterios de este estudio y fueron incluidos, 40 de la Unidad de Cuidados Intensivos (UCI) y 34 de la Enfermería de Enfermedades Infecciosas (IDP), ambos exclusivamente para pacientes con COVID-19. Sobre la base de estos hallazgos, los pacientes con aumento del recuento de GB, ALT, AST y LDH deben ser monitoreados de cerca, ya que estos factores predicen el ingreso y la mortalidad en la UCI. Entre otros parámetros de laboratorio, los pacientes ingresados en la UCI tienen niveles más altos de dímero D en comparación con los pacientes con IDI. Los resultados sugieren que niveles más altos de dímero D al ingreso se relacionan con un peor pronóstico de la enfermedad.
Palabras clave: SARS-CoV-2; Dímero D; Unidad de Cuidados Intensivos; Lactato deshidrogenasa; Aspartato aminotransferasa; Síndrome respiratorio agudo.

1. Introduction

Coronaviruses are enveloped RNA viruses; these viruses belong to the Coronaviridae family. Among the seven species that cause respiratory infections in humans, two are responsible for causing severe acute respiratory syndrome with high mortality rates, namely SARS-CoV and MERS-CoV (Rojas et al., 2020).

The new coronavirus, SARS-CoV-2, which causes COVID-19 (Coronavirus disease) was detected on December 31, 2019 in Wuhan, China. The virus is easily transmitted from person to person, mainly through respiratory secretions, saliva droplets or fomites. With a high rate of transmissibility, WHO confirmed, by June 27, 2021, 181 million cases and 3.93 million deaths worldwide (WHO), 2021). In Brazil, in the same period, 18.4 million of cases and 514,000 deaths were reported.

Most people infected with the virus are asymptomatic or have mild to moderate respiratory disease. However, about 15% develop severe pneumonia and of these, 6% progress to severe acute respiratory syndrome (SARS) and multiple organ failure (Guan et al., 2020). It is believed that advanced age, the presence of comorbidities, such as cardiovascular diseases, diabetes, chronic respiratory diseases and cancer, besides being male are the main risk factors for the development of severe forms of the disease and the need for intensive therapy support (WHO), 2021).

Therefore, identifying biomarkers that can predict which individuals are likely to be affected by severe disease and are at risk of death is crucial (Keski, 2021). This approach can favor early diagnosis, as well as optimize the use of limited resources in the appropriate treatment and recovery of these patients (Liang et al., 2020).

However, the pathophysiology of the disease is not completely elucidated and the characterization of the clinical

profile of people infected with SARS-CoV-2 remains unclear. Recent studies suggest that these patients have hematological and biochemical changes (Ferrari et al., 2020; Lippi & Plebani, 2020). Changes in the blood count have been described in the literature (Pan et al., 2020), such as a reduction in the erythrocyte count and hemoglobin levels; in the leukogram (Ai et al., 2020), as an increase in the number of leukocytes, including neutrophilia and monocytosis and a lymphocytic reduction; and on the platelet count (Guan et al., 2020), such as thrombocytopenia and elevation of D-dimer, considered one of the main markers of mortality.

In addition, as it is considered a systemic infection, there is evidence that Covid-19 can cause liver and kidney damage. In the liver, an increase in aspartate aminotransferase (AST / TGO) enzymes was observed, alanine aminotransferase (ALT/TGP) e gamma-glutamyl transferase (GGT), and total bilirubin levels (Y. Zhang et al., 2020; Zhao et al., 2020). Authors also report elevated lactate dehydrogenase (LDH) (Miao et al., 2020), decreased levels of albumin, and elevated levels of inflammatory markers such as C-reactive protein (CRP) (Hsih et al., 2020; Mardani et al., 2020; Zhu et al., 2020), IL-6, and procalcitonin (Ai et al., 2020). On the other hand, in the kidneys, some markers also appear to vary in their levels. Among them, we can highlight an increase in creatinine and serum urea (X. Chen et al., 2020) and a reduction in the glomerular filtration rate (Cheng et al., 2020).

Thus, the deepening of clinical differences, based on laboratory parameters, is necessary for a better understanding of COVID-19, which, consequently, will assist in patient management decisions. Therefore, the objective of this study was to evaluate the epidemiological and laboratory profile of patients confirmed by Covid-19 and admitted to the University Hospital Lauro Wanderley, based on the correlation of laboratory tests to the evolution of the disease, determination of the most influential variables in the worsening of the disease.

2. Methodology

Data source

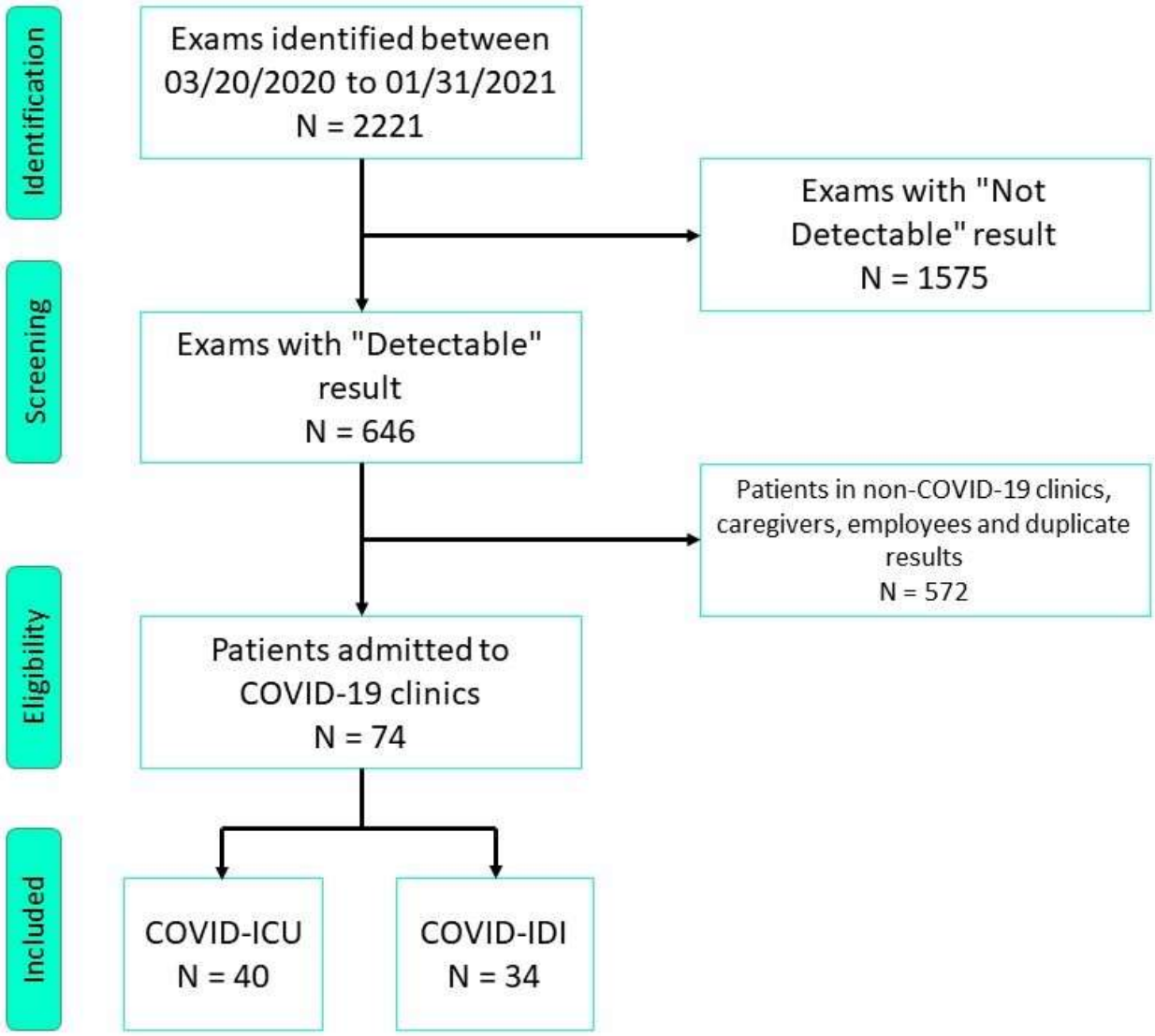
A cross-sectional observational study was developed with data collected from patients confirmed with Covid-19 admitted to the University Hospital Lauro Wanderley (HULW), located in João Pessoa, Paraíba, Brazil, covering the period from March 20, 2020, to January 31 of 2021. All data, including age, gender, length of stay and laboratory tests were extracted from the electronic system of the Clinical Analysis Laboratory Unit (ULAC). Laboratory data consisted of complete blood count (total white blood cell, lymphocyte, and platelet count) and serum biochemical analyzes (C-reactive protein, lactate dehydrogenase, d-dimer, aspartate aminotransferase and alanine aminotransferase. Finally, 74 patients met all criteria of this study and were included, 40 from the Intensive Care Unit exclusively for Covid-19, and 34 patients from the Infectious Diseases Infirmary (IDP), exclusively for patients with Covid-19. This study was previously approved by the Committee of Ethics in Research (CEP) of the University Hospital Lauro Wanderley, under opinion number 4,589,377, and followed all the recommendations provided for in the Declaration of Helsinki and Resolution 466/12 of the National Council of Ethics in Research (CONEP).

Participants

For the formation of the groups, the following eligibility criteria were used: patients with a positive result in the RT-PCR test and admitted to hospital admission in the service sector exclusively for patients with COVID-19.

The flowchart, with the total number of patients considered, until reaching the 74 patients selected for the study is shown in Figure 1.

Figure 1. Flowchart of the selection process for the 74 patients eligible for the research.



Source: Authors.

During the period from March 20, 2020, to January 31, 2021, 2221 samples were collected from nasopharyngeal/oropharyngeal swab for analysis by the RT-PCR methodology. Of these, 1575 had a “Not detectable” result, and were excluded from the survey. Inclusion and exclusion criteria were then applied to the remaining 646 patients. 572 were excluded for not being suitable for this research, as they were patients admitted to other clinics, employees, caregivers, and duplicate results. At the end, the N of 74 patients admitted to clinics dedicated to the management of Covid-19 was obtained, including COVID-ICU-Covid (n=40) and COVID-IDI (n=34).

Laboratory tests

Patients admitted to inpatient clinics for COVID-19, according to the medical protocol followed, generally underwent exams every 2 days or at every change in their health conditions.

Statistical analysis

Continuous variables were expressed as median (IQR) and compared with the t-test or Mann-Whitney test; categorical

variables were expressed as number (%) and compared by the χ^2 test or Fisher's exact test among patients who received care in the ICU and IDI (infectious diseases infirmary). Results were considered significant when the p value was less than or equal to 0.05. Statistical analyzes were performed using GraphPad Prism Software, version 6.01.

3. Results

The study sample consisted of 74 patients with COVID-19: 40 hospitalized in the ICU (intensive care unit) and 34 in the IDI (infectious diseases infirmary). The characteristics of the study participants are shown in Table 1.

Table 1. Demographic data of patients infected with SARS-CoV-2.

Variable	All patients (n=74)	ICU (n=40)	IDI (n=34)	p1	p2
Age, in years[a]	53.9 ± 19.1 (49.55-58.40)	53.9 ± 20.0 (47.50-60.30)	54.1 ± 18.3 (47.68-60.43)	0.97	0.91
< 40 (n=16)	16 (21.6%)	9 (22.5%)	7 (20.6%)		
40 – 60 (n=35)	35 (47.3%)	18 (45.0%)	17 (50.0%)		
> 60 (n=23)	23 (31.1%)	13 (32.5%)	10 (29.4%)		
Gender				0.32	0.22
Male (n=49)	49 (66.2%)	24 (60.0%)	25 (73.5%)		
Female (n=25)	25 (33.8%)	16 (40.0%)	9 (26.5%)		
Length of hospital stay, in days[b]	6.0 (2.75-10.0)	5.0 (2.25-10.0)	7.0 (2.75-10.0)	0.58	0.80
< 5 (n=30)	30 (40.5%)	15 (37.5%)	15 (44.1%)		
5 – 10 (n=29)	29 (39.2%)	17 (42.5%)	12 (35.3%)		
> 10 (n=15)	15 (20.3%)	8 (20.0%)	7 (20.6%)		

Source: Authors.

Results expressed as median ± standard deviation and 95% confidence interval (95% CI). bResults expressed as median and interquartile interval (P25% - P75%). All variables were categorized, and the results are expressed in n (%) or n / N (%), where N is the total number of patients with available data. p1 (p value referring to the independent t test or Mann-Whitney test), p2 (p value referring to the Chi-square test or Fisher's exact test), ICU (intensive care unit) and IDI (infectious diseases infirmary). *p≤0.05. Source: prepared by the author.

The results of this study demonstrate that there is no significant difference between ICU patients and IDI patients in relation to age, gender and length of hospital stay, not even when the variables were categorized. However, the majority of patients were men, aged 40-60 years (Table 1).

Regarding to laboratory parameters (Table 2), the data show that the hematological indicators, that is, leukocyte, lymphocyte and platelet count, do not differ between the groups. Leucocytes were below the normal range in six (8.1%) patients and above the normal range in 35 (47.3%) patients. Lymphocytes were below the normal range in the most of patients (68.9%). Platelets were below the normal range in 8 (10.8%) patients and above the normal range in 22 (29.7%).

On the other hand, when evaluating the biochemical parameters (Table 2), 35 patients had differing degrees of liver function abnormality, with alanine aminotransferase (ALT) or aspartate aminotransferase (AST) above the normal range. Of 40 patients, the most had abnormal myocardial zymogram, which showed the elevation of lactate dehydrogenase in 35 (87,5%) patients. 74 patients were tested for C-reactive protein and 48 were tested for D-dimer, 64 (86.5%) and 17 (35.4%) of whom, respectively, had levels above the normal range. Thus, it was observed that the levels of CRP and ALT were similar in both groups. However, D-dimer levels were significantly higher in patients in the ICU in comparison to the IDI group (p1 = 0.05). Furthermore, AST and LDH also showed statistical significance (p2 = 0.02 and p2 = 0.04, respectively), however only when these were categorized.

Table 2. Laboratory parameters of patients infected with SARS-CoV-2 during hospitalization.

Variable	All patients (n=74)	ICU (n=40)	IDI (n=34)	p1	p2
Leukocyte count, × 10⁹ por L[b]	9.8 (6.14-12.9)	10.1 (7.12-15.74)	9.5 (5.76-11.44)	0.08	0.55
<4* 10^9/L (n=6)	6 (8.1%)	2 (5.0%)	4 (11.8%)		
4-10* 10^9/L (n=33)	33 (44.6%)	18 (45.0%)	15 (44.1%)		
>10* 10^9/L (n=35)	35 (47.3%)	20 (50.0%)	15 (44.1%)		
Lymphocyte count, × 10⁹ por L[b]	1.017 (723.5-1.537)	1.020 (666.5-1.479)	1.013 (799.8-1.583)	0.31	0.18
<0.4* 10^9/L (n=7)	7 (9.46%)	6 (15.0%)	1 (2.9%)		
0.4-0.8* 10^9/L (n=16)	16 (21.62%)	9 (22.5%)	7 (20.6%)		
>0.8* 10^9/L (n=51)	51 (68.9%)	25 (62.5%)	26 (76.5%)		
Platelet count, × 10⁹ por L[b]	219.5 (149.8-324)	218.5 (147.8-273.5)	222.0 (149.8-359.3)	0.67	0.29
<100* 10^9/L (n=8)	8 (10.8%)	3 (7.5%)	5 (14.7%)		
100-300* 10^9/L (n=44)	44 (59.5%)	28 (70%)	16 (47.1%)		
>300* 10^9/L (n=22)	22 (29.7%)	11 (27.5%)	11 (32.4%)		
C-reactive protein[b]	50.5 (24.2-126.0)	79.7 (33.0-129.4)	38.4 (13.1-126.0)	0.18	0.49
<10 mg/L (n=10)	10 (13.5%)	4 (10.0%)	6 (17.6%)		
10-20 mg/L (n=7)	7 (9.5%)	2 (5.0%)	5 (14.7%)		
20-90 mg/L (n=30)	30 (40.5%)	18 (45.0%)	12 (35.3%)		
90-150 mg/L (n=13)	13 (17.6%)	8 (20.0%)	5 (14.7%)		
>150 mg/L (n=14)	14 (18.9%)	8 (20.0%)	6 (17.6%)		
D-dímer[b]	568.5 (306.5-1.597)	1.205 (368.0-2.018)	423.0 (240.0-1.019)	**0.05***	0.22
≤ 1mg/L (n=31)	31/48 (64.6%)	9/17 (52.9%)	22/31 (71.0%)		
> 1mg/L (n=17)	17/48 (35.4%)	8/17 (47.1%)	9/31 (29.0%)		
ALT[b]	36.0 (21.8-69.0)	31.0 (21.0-51.0)	41.0 (22.8-79.8)	0.28	0.65
<40 U/L (n=39)	39 (52.7%)	23 (57.5%)	16 (47.1%)		
40-80 U/L (n=20)	20 (27.0%)	10 (25.0%)	10 (29.4%)		
>80 U/L (n=15)	15 (20.3%)	7 (17.5%)	8 (23.5%)		
AST[b]	38.0 (26.5-60.0)	39.5 (24.8-91.3)	38.0 (26.5-54.8)	0.44	**0.02***
<40 U/L (n=39)	39 (52.7%)	20 (50.0%)	19 (55.9%)		
40-80 U/L (n=21)	21 (28.4%)	8 (20.0%)	13 (38.2%)		
>80 U/L (n=14)	14 (18.9%)	12 (30.0%)	2 (5.9%)		
LDH[b]	445.2 (327.3-828.8)	695.0 (317.0-1.013)	411.8 (326.0-576.3)	0.16	**0.04***

<245 U/L (n=5)	5/40 (12.5%)	1/19 (5.3%)	4/21 (19.0%)		
246-480 U/L (n=16)	16/40 (40.0%)	7/19 (36.8%)	9/21 (42.9%)		
481-720 U/L (n=8)	8/40 (20.0%)	2/19 (10.5%)	6/21 (28.6%)		
>720 U/L (n=11)	11/40 (27.5%)	9/19 (47.4%)	2/21 (9.5%)		

Source: Authors.

Results expressed as median and interquartile interval (P25% - P75%). All variables were categorized, and the results are expressed in n (%) or n / N (%), where N is the total number of patients with available data. p1 (p value referring to the independent t test or Mann-Whitney test), p2 (p value referring to the Chi-square test or Fisher's exact test), ICU (intensive care unit), IDI (infectious diseases infirmary), ALT (Alanine Aminotransferase), AST (Aspartate Aminotransferase) and LDH (Lactate Dehydrogenase). *p≤0.05. Source: prepared by the author.

4. Discussion

The results of the present study demonstrated a greater number of men than women in the 74 cases of COVID-19 infection. MERS-CoV and SARS-CoV have also been found to infect more this gender (Badawi & Ryoo, 2016). According to Jaillon, Berthenet and Garlanda (2019) (Jaillon et al., 2019) the protection of the X chromosome and sex hormones may be responsible for the reduced susceptibility of women to viral infections, as they play an important role in innate and adaptive immunity.

Furthermore, similar counts of leukocyte, lymphocyte and platelet and significantly elevated D-dimer, AST and LDH levels were found in ICU patients when compared with IDI patients. In this sense, the results suggest the presence of biochemical alterations, but not hematological in ICU patients, considering all these variables as predictors of prognosis in COVID-19.

Previous studies have shown that patients with COVID-19 have leukocyte levels in the blood. It is described that, in the severe forms compared to the mild or asymptomatic forms of the disease, the patients present leukocytosis, however a reduction in the number of circulating lymphocytes percentage (Tan et al., 2020; Chen et al., 2020) . Our findings, although there were no differences between groups, corroborate this evidence. Most patients, both in the ICU and IDI, have a leukocyte elevation rate and a lymphocytic reduction.

It is hypothesized that these changes in the white blood series may happen due to the fact that (1) the SARS-CoV-2 virus can directly infect lymphocytes, since they express the ACE2 receptor, resulting in lymphocyte death; (2) the virus can destroy directly lymphatic organs; or (3) inflammatory cytokines, as tumor necrosis factor (TNF) and interleukin (IL)-6, remained disordered, inducing apoptosis and lymphocyte deficiency (Tan et al., 2020; Liao et al., 2002; Xu et al., 2020).

Therefore, the platelet elevation present in some ICU and / or IDI patients may be related to the sustained inflammatory response, which leads to the activation of coagulation (D. Wang et al., 2020). All of these pathological mechanisms may be associated with a worse prognosis and /or death in patients with COVID-19.

In a meta-analysis, Zhang et al., 2020 identified five significant markers when it comes to the admission of patients with COVID-19 to the ICU whose result is high: leukocyte count, ALT, AST, LDH and procalcitonin.

Elevated LDH levels are predictive of the development of an acute respiratory syndrome and elevated WBC count associated with elevated LDH count has been found to predict mortality (Zhang et al., 2020). Among the biochemical markers,

LDH was the only one that significantly predicted the development of an acute respiratory syndrome, admission to the ICU, and mortality. LDH is released from cells after damage to the cytoplasmic membrane and functions as a prognostic biomarker of immune surveillance (Han et al., 2020; Kuang et al., 2020). LDH promotes the production of lactate, which leads to an increase in immunosuppressive cells and inhibition of cytolytic cells (Ding et al., 2017). These changes can weaken the immune response mounted against infection caused by SARS-CoV-2, increasing the severity of the disease in patients with elevated LDH levels.

The clinical association of higher levels of LDH with severe cases of COVID-19 indicates that an excessive inflammation is related to an unfavorable clinical outcome. Inflammasomes often participate in the induction of inflammatory processes in the host cell (Han et al., 2020). The NLRP3 inflammasome promotes inflammation through the cleavage and activation of inflammatory molecules including active caspase-1 (Casp1p20), IL-1β and IL-18. The presence of cell death and inflammasome-derived products, such as IL-1β, IL-18 and LDH in sera from patients with COVID-19, reveals the involvement of the inflammasome in the pathogenesis of the disease (Chen et al., 2020).

The increased inflammatory characteristics of COVID-19 and the correlation of disease severity with LDH, a typical marker of pyroptosis, suggest that SARS-CoV-2 triggers inflammasome activation. Rodrigues et al. (2020), found higher levels of Casp1p20 and IL-18 in the serum of COVID-19 patients, indicating active inflammasomes. In addition, SARS-CoV-2 triggered the release of LDH in monocytes in a process that is independent of priming and requires viable SARS-CoV-2. MCC950, a potent and selective inhibitor of NLRP3, did not affect LDH release, suggesting that NLRP3-independent responses operate to induce a lytic form of virus-induced cell death. Finally, positive associations of Casp1p20 and/or IL-18 levels with inflammatory markers, C-reactive protein, LDH and ferritin were detected30. Therefore, elevated LDH levels can be a valuable marker of SARS-CoV-2 infection (Rodrigues et al., 2021).

Regarding the liver biomarkers, although not significant between groups, our data show that C-reactive protein and ALT levels were increased, unlike AST, in both ICU and IDI patients. The increase in ALT and AST in severe COVID-19 may be a result of liver damage caused by direct binding of SARS-CoV-2 to ACE2 positive cholangiocytes (Chai et al., 2020). In another meta-analysis, Tian et al. (2020) found that C-reactive protein (+66.3 μg/mL) were higher in non-survivors, and regarding liver function tests, ALT (+5.7 U / L) and AST (+15.2 U / L) also were found at higher levels in this group. These results indicate impaired liver function at admission in non-survivors compared to survivors. Mortality has also been associated with lower platelet counts and elevated levels of D-dimer, suggesting a possible coagulopathy in these patients (Tian et al., 2020).

On the other hand, in severe cases of COVID-19 it has been identified that patients have infection-induced coagulopathy and secondary hyperfibrinolysis (Ji et al., 2020). Our findings reaffirm these observations and showed that patients admitted to the ICU have higher levels of D-dimer compared to IDI patients. This is corroborated by another study that demonstrates that the higher level of D-dimer on admission is related to a worse prognosis of the disease (Zhou et al., 2020). Therefore, studies indicate that pulmonary thrombosis and deep vein thrombosis in cardiovascular diseases may be responsible for the elevation of D-dimer levels (Giannitsis et al., 2017; Z. F. Wang et al., 2011). Thus, having observed that non-surviving patients have higher levels of D-dimer compared to survivors, treatment with anticoagulants may be feasible in severe cases of COVID-19.

5. Conclusion

Based on these findings, patients with increased WBC count, ALT, AST, and LDH should be closely monitored as these factors predict ICU admission and mortality. A major factor in the risk stratification of patients with COVID-19 is the initial assessment of their biochemical and hematological parameters, since these markers demonstrate organ dysfunction,

inflammation or coagulopathy and brings a higher risk of an unfavorable outcome. In general, variations in the level of D-dimer are correlated with the prognosis of the disease and the anticoagulant treatment may benefit severely ill patients with COVID-19. Further studies are needed to better understand whether abnormal baseline levels predispose an individual to a higher risk of mortality or whether virus alters marker levels directly.

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