Complications in patients with COVID-19 in a cohort of intensive care hospitalists

Complicações em pacientes com COVID-19 em uma coorte de hospitalizados na terapia intensiva

Complicaciones en pacientes con COVID-19 en una cohorte de pacientes hospitalizados en cuidados intensivos

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Abstract
This article aims to identify the complications presented in patients with COVID-19 during their stay in intensive care. We conducted a retrospective documentary cohort study in medical records of adults admitted to an Intensive Care Unit designated for the treatment of COVID-19 patients, from September 2020 to January 2021. The sample consisted of 47 medical records of patients over 18 years old, with confirmed diagnosis for SARS-COV-219 by reverse transcription test and polymerase chain reaction. Medical records of 24 women (51,1%) and 23 men (49,9%) were included in the study, with an average of 70 years old. The main complications described involved the blood, immune and respiratory systems. Electrolyte disorder was the most frequent complication observed in 100% of the patients, followed by leukocytosis (95,7%), acid-base disorder and acute respiratory failure, present in 87,2% of the analysed cases. We conclude that COVID-19 causes damage to multiple systems, directly affecting the prognosis of patients.
Keywords: COVID-19; Intensive care unit; SARS-CoV-2.

Resumo
O presente artigo tem o objetivo de identificar as complicações apresentadas nos pacientes com COVID-19, durante a internação na terapia intensiva. Para tanto, realizou-se um estudo de coorte retrospectivo documental, em prontuários de adultos internados em uma Unidade de Terapia Intensiva designada ao tratamento de pacientes com COVID-19, entre setembro de 2020 a janeiro de 2021. A amostra consistiu em 47 prontuários de pacientes com mais de 18 anos, com diagnóstico confirmado para SARS-CoV-2 por teste de transcrição reversa e reação em cadeia da polimerase. Prontuários de 24 mulheres (51,1%) e 23 homens (49,9%) foram incluídos no estudo, com idade média de 70 anos. As principais complicações descritas envolviam os sistemas sanguíneo, imunológico e respiratório. O distúrbio eletrolítico foi a complicação mais frequente, observada em 100% dos pacientes, seguida da leucocitose (95,7%), distúrbios ácidos-básicos e insuficiência respiratória aguda, presentes em 87,2% dos casos analisados. Observou-se que a COVID-19 causa danos a diversos sistemas, afetando diretamente o prognóstico dos pacientes, e uma prevalência da hospitalização de pessoas com condições preexistentes.
Palavras-chave: COVID-19; Unidade de terapia intensiva; SARS-CoV-2.

Resumen
Este artículo pretende identificar las complicaciones que presentan los pacientes con COVID-19 durante su estancia en cuidados intensivos. Para ello, se realizó un estudio de cohorte documental retrospectivo sobre las historias clínicas de los adultos ingresados en una Unidad de Cuidados Intensivos asignados al tratamiento de pacientes con COVID-19, entre septiembre de 2020 y enero de 2021. La muestra consistió en 47 historias clínicas de pacientes mayores de 18 años, con diagnóstico confirmado de SARS-CoV-2 por prueba de transcripción inversa y reacción en cadena de la polimerasa. Se incluyeron en el estudio registros de 24 mujeres (51,1%) y 23 hombres (49,9%), con una edad media

de 70 años. Las principales complicaciones descritas afectan a los sistemas sanguíneo, inmunitario y respiratorio. La alteración electrolítica fue la complicación más frecuente, observada en el 100% de los pacientes, seguida de la leucocitosis (95,7%), la alteración ácido-base y la insuficiencia respiratoria aguda, presente en el 87,2% de los casos analizados. Se observó que el COVID-19 causaba daños en múltiples sistemas, lo que afectaba directamente al pronóstico de los pacientes, y un predominio de la hospitalización de personas con enfermedades preexistentes.
Palabras clave: COVID-19; Unidad de cuidados intensivos; SARS-CoV-2.

1. Introduction

The pandemic caused by the new coronavirus (SARS-CoV-2) has become a global health challenge due to its high transmission rate and lethality. By March 2022, there were millions of cases and deaths from COVID-19 in the world (Our World in Data, 2022). In Brazil, during the same period, about 29 million cases and more than 660,000 deaths were reported for the disease (Ritchie et al., 2022).

The clinical manifestation of the infection can vary from mild flu symptoms to severe and critical symptoms, causing complications that, in many cases, lead to hospital admission, especially in intensive care (Xiong et al., 2020). Therefore, it leads to an increase in the mortality rate, especially in individuals with advanced age and comorbidities (Chen et al., 2020).

Some of the complications common to patients with COVID-19 are: acute respiratory failure, acute respiratory distress syndrome (ARDS), sepsis, heart failure and pneumonia (Zhou et al., 2020; Guan et al., 2020). These complications may lead to the need for intubation, of which is associated with death (Sommer et al., 2020; King et al., 2020).

In view of this, the knowledge on the complications arising from COVID-19 is fundamental to health professionals and researchers, since it contributes to the proper decision-making, care planning and carrying out studies. In addition, it warns the population on the seriousness of the disease and its short and long-term impacts.

Based on this assumption, this research aimed to identify the complications of COVID-19 affecting patients during their stay in intensive care, as well as the demographic characteristics, pre-existing conditions and clinical outcome of patients. This study is expected to contribute to a better understanding of the impacts of the disease and regional reality.

2. Methodology

A retrospective documentary cohort study with a descriptive and quantitative approach (Toassi & Petry, 2021). We used medical records of adults hospitalized with a confirmed diagnosis of COVID-19 in an Intensive Care Unit (ICU) designated to treat COVID-19 patients, from public reference hospital in the southern region of Tocantins state, northern Brazil, from September 2020 to January 2021.

Managed by a third-party company, the public hospital had 20 intensive care beds available for patients infected with SARS-CoV-2, providing reference care to 18 cities in the region.

Inclusion criteria for this study were: medical charts of individuals aged 18 years or older, of both genders, with confirmed diagnosis of SARS-CoV-2 by reverse transcription followed by polymerase chain reaction (RT-PCR). Incomplete medical records and those of patients transferred to another healthcare unit during treatment were excluded from the study.

According to the established criteria, 66 medical records were considered eligible for the research, including 47 and excluding 19.

The data collection, which took place from December 2021 to January 2022, was carried out using a form developed by the researchers, considering the following variables: age, sex, comorbidities, ventilatory support, the time staying in the ICU, hospitalization outcome (hospital discharge, death or transfer to another area of the unit and complications during hospitalization). Complications were considered to be those described in the analysed medical records. The data was collected through medical records made available by the medical and statistical file service, of the aforementioned hospital.

For data analysis, it was used the SPSS Statistics version 28.0 software, applying the descriptive statistics, where the data was included in absolute frequency, relative frequency, mean and Standard Deviation (SD).

The research was conducted in compliance with Resolution No. 466/2012, of the National Health Council of Brazil, being approved by the Research Ethics Committee (CAAE: 52926121.9.0000.5518, under opinion number 5.117.708), with waiver of the consent form.

3. Results

Out of the 47 medical records analysed, 24 (51.1%) were from female patients. The data analysis revealed a minimum age of 21 and a maximum age of 99 years, with an average age of 70 years ± 17.81. Table 1 describes the demographic characteristics of the participants in this research.

Table 1 - Description of the sample's demographic profile.

Variables	n (%)
Sex	
Female	24 (51.1)
Male	23 (48.9)
Age Group	
21-30	1 (2.1)
31-40	3 (6.4)
41-50	3 (6.4)
51-60	8 (17.0)
61-70	7 (14.9)
71-80	6 (12.8)
81-90	16 (34.0)
91-100	3 (6.4)

Source: Authors (2022).

Table 2 presents the comorbidities of the patients included in the study, hypertension being the most frequent (51.0%), followed by diabetes (23.4%), chronic obstructive pulmonary disease (21.3%) and chronic renal disease (19.1%).

Table 2 - Description of comorbidities of study participants.

Variables	n (%)
Number of comorbidities	
No comorbidity	8 (17.0)
Only one	14 (29.8)
Two	14 (29.8)
Three or more	11 (23.4)
Comorbidities	
Hypertension	24 (51.1)
Diabetes	11 (23.4)
Chronic obstructive pulmonary disease	10 (21.3)
Chronic renal disease	9 (19.1)
Obesity	6 (12.8)
Neurological disorders	5 (10.6)
Thyroid diseases	5 (10.6)
Cardiopathy	4 (8.5)
Oncological diseases	3 (6.4)
Congestive heart failure	3 (6.4)
Liver diseases	2 (4.3)
Stroke sequelae	2 (4.3)
Asthma	1 (2.1)

Source: Authors (2022).

Regarding complications during hospitalization, the blood, immune and respiratory systems were the main described ones, as can be seen in Table 3. The electrolyte disorder was the main complication presented, the most frequent being hypocalcemia (78.7%) and the least frequent being hyponatremia (4.3%). The second most prevalent complication was leukocytosis, followed by acid-base disorders and acute respiratory failure. Regarding the acid-base disorder, respiratory acidosis (38.5%) was the most common, and the least common disorder was metabolic alkalosis (20.0%).

Table 3 - Complications presented during the analysed cases' hospitalization.

Complications	n (%)
Electrolyte disorders	47 (100)
Leukocytosis	45 (95.7)
Acid-base disorders	41 (87.2)
Acute respiratory failure	41 (87.2)
Pneumonia	24 (51.1)
Thrombocytopenia	20 (42.6)
Sepsis	19 (40.4)
Hyperglycemia	18 (38.3)
Acute respiratory distress syndrome	14 (29.8)
Thrombocytosis	14 (29.8)
Acute kidney failure	11 (23.4)
Cardiogenic shock	7 (14.9)
Anemia	6 (12.8)
Pleural effusion	4 (8.5)
Systemic dysfunction	3 (6.4)
Acute pulmonary edema	3 (6.4)
Pulmonary fibrosis	3 (6.4)
Hypoglycemia	3 (6.4)
Acute myocardial infarction	2 (4.3)
Pneumothorax	2 (4.3)
Ischemic stroke	1 (2.1)
Coagulation disorders	1 (2.1)
Leukopenia	1 (2.1)
Thrombosis	1 (2.1)

Source: Authors (2022).

As for ventilatory support, 85.1% (n=40) of the patients needed invasive mechanical ventilation (IMV), 10.6% (n=05) of supplementary oxygenation by low-flow system and 4.3% (n=02) non-invasive ventilation (NIV).

The time of hospital stay of the analysed cases was 1 to 33 days, with an average hospitalization time of 11.85 days (± 8.03). The information about the results is described in Table 4.

Table 4 – Hospitalization period (in days) and outcome of the participants.

Variables	n (%)
Period	
Up to 5 days	15 (31.9)
6-10	10 (21.3)
11-15	7 (14.9)
16-20	7 (14.9)
21-25	6 (12.8)
26-30	1 (2.1)
31-35	1 (2.1)
Outcome	
Death	35 (74.5)
Transfer to another area of the unit	7 (14.9)
Hospital discharge	5 (10.6)

Source: Authors (2022).

4. Discussion

Regarding the sex of the individuals, the data collected in this study do not show significant difference. A similar result was observed in a study carried out in Singapore, where 50.0% of the hospitalized patients were female (Young et al., 2020). In contrast, another study reveals that female individuals are less susceptible to SARS-COV-2 infection and its exacerbations (Bechmann et al., 2022).

The average age of the cases analyzed was 70 years, revealing that hospitalization occurred in the elderly people and this was pointed out as a risk for death by COVID-19 (Zhou et al., 2020), a different result from that observed in other studies, which describe an average age of 47 and 56 years (Guan et al., 2020; Wang et al., 2020).

Another important finding was that most patients (83.0%) had some sort of comorbidity. These results corroborate studies carried out in other countries, showing that the percentage of cases requiring hospitalization in intensive care is higher in patients with pre-existing conditions (Chow et al., 2020; The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020). The most prevalent comorbidities were hypertension and diabetes, coinciding with other studies demonstrating high hospitalization in these patients (Gentile et al., 2020; Kumar et al., 2020).

A great diversity of complications was observed, with involvement of several systems, and all patients presented at least one. As for the electrolyte disorders, which was the main complication, the changes caused by the decrease in calcium levels were more frequent. A combined analysis seeking to investigate reports of electrolyte disorders in patients with severe and non-severe COVID-19 forms, identified that the severity of the disease is related to reduced serum levels of potassium, calcium and sodium (Lippi et al., 2020). Thus, attention must be paid to these disturbances, as the clinical consequences can damage the organism.

In this study, thrombocytopenia, a common abnormality in patients with the severe form of the disease (Zhou et al., 2020; Huang et al., 2020), was the most seen platelet disorder, affecting 42.6% of the patients. This abnormality usually indicates a physiological imbalance and decompensation (Zarychanski & Houston, 2017).

Leukocytosis was present in 95.7% of the patients, while leukopenia in only 2.1%. Similar data was observed in a study where 54.0% of the patients in intensive care developed leukocytosis, compared to 8.0% who developed leukopenia (Huang et al., 2020). The study reports the presence of leukocytosis in most non-survivors, suggesting that the increase in white blood cells is associated with death (Zhou et al., 2020; Liao et al., 2020).

6

As for the acid-base balance disorders, one of the main complications found, it was detected that respiratory acidosis was more frequent. According to Nechipurenko et al. (2021), pulmonary involvement caused by infection causes interference in gas exchange, resulting in hypercapnia and may evolve to respiratory acidosis.

Also, regarding the pulmonary involvement caused by the infection, the participants of this study showed acute respiratory failure, pneumonia and ARDS, the same is observed in other studies, which reported these complications in severe and non-surviving patients (Zhou et al., 2020; Guan et al., 2020). In addition, respiratory involvement is indicated as the main marker of disease severity and morbidity (Bhatraju et al., 2020).

Considering that SARS-CoV-2 enters the body mainly through the respiratory tract, the damage to the entire pulmonary system is a frequent (Hu et al., 2021), which results in a high need for ventilatory support. The data from this study corroborate this need, since IMV was necessary in 85.1% of the patients, similar to that of an Italian study (Grasselli et al., 2020) and higher than that described in China (Wang et al., 2020). There is also evidence that advanced age, obesity and comorbidity are associated with the need for intubation in these patients (Hur et al., 2020), with high mortality rates reported in elderly patients submitted to IMV (King et al., 2020).

Regarding the clinical outcome, only 10.6% of the patients were discharged. The study also reveals that most patients' cases evolved to death, which according to Zhou et al. (2020), can be explained by the high hospitalization rate of the elderly population.

It was also observed that 14.9% were transferred to another hospital unit as they did not show SARS-CoV-2 infection through RT-PCR exams and isolation was no longer necessary. However, they still needed to continue the treatment due to the complications resulting from the disease.

The limitation of this study is the small sample size due to the short period available for data collection. In addition, due to the fact that most of the participating patients had comorbidities, the reported complications could already be present due to the underlying disease.

5. Final Considerations

The present study suggests that COVID-19 causes complications in several systems, which directly affects the prognosis of patients, leading to the need for a readjustment of health services in order to better meet the needs of this population. Moreover, this research contributes to further studies on the subject and to health professionals so that they can adopt measures aiming at minimizing and preventing the possible complications the infection may cause to patients, improving the quality of life and survival rate of patients.

Moreover, the analysis of the profile of hospitalized patients reveals a prevalence of those with pre-existing conditions. Therefore, there is a need to develop health promotion and education strategies, especially in this population, to obtain greater awareness about the severity of COVID-19 and better control of the underlying disease.

Therefore, the results presented in this study contribute to further studies on the subject, especially focusing on actions by health professionals, aiming to minimize and prevent complications that the infection can cause to patients, improving the quality of life and patient survival.

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