ORIGINAL ARTICLE

Profile of patients hospitalized by COVID-19: the importance of hospital epidemiological surveillance

Perfil dos pacientes internados por COVID-19: a importância da vigilância epidemiológica hospitalar

Perfil de pacientes hospitalizados por COVID-19: la importancia de la vigilancia epidemiológica hospitalaria

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ABSTRACT

Rationale: Since December 2019, the novel coronavirus SARS-Cov-2, also called COVID-19, has spread rapidly across countries, making it one of the biggest health challenges of this century. In Brazil, it was declared a public health emergency in March 2020. The aim of this study was to describe the profile of patients hospitalized by COVID-19 in an emergency hospital in the city of Rio de Janeiro, as well as the factors associated with in-hospital death. Methods: Retrospective observational study, which included patients hospitalized between March and December 2020 with a confirmed diagnosis of COVID-19. The epidemiological, clinical, and laboratory aspects were extracted from the epidemiological investigation files and the hospital chart. Results: 582 suspected cases of COVID-19 were hospitalized and 317 were confirmed, of which 182 (57.5%) were male, and most were residents in the north of Rio de Janeiro (42.5%). Main tomographic or radiological findings: ground glass (34.7%) and pulmonary infiltrate (15.4%), and more than half of those hospitalized (64.0%) had at least one comorbidity. Among hospitalized patients, the overall lethality was 53.6%, and among those admitted to the ICU, this percentage was 84.5%. Age and use of ventilatory support and ICU were the variables

that showed a statistically significant association with in-hospital mortality. Conclusion: This study reinforces the importance of epidemiological surveillance, in a hospital setting, especially for diseases in which the passive surveillance system may not be able to adequately report, as in the case of COVID-19.

Keywords**:** *Epidemiology. Severe Acute Respiratory Syndrome. COVID-19. Epidemiological surveillance.*

RESUMO

Justificativa: Desde dezembro de 2019, o novo coronavírus SARS-Cov-2, também chamado COVID-19, tem se espalhado rapidamente pelos países, tornando-se um dos maiores desafios sanitários deste século. No Brasil, ele foi declarado como uma emergência de saúde pública em março de 2020. O objetivo deste estudo foi descrever o perfil dos pacientes hospitalizados por COVID-19 em um hospital de emergência no município de Rio de Janeiro, bem como os fatores associados ao óbito hospitalar. Métodos: Estudo observacional retrospectivo, que incluiu pacientes internados entre março e dezembro de 2020 com um diagnóstico confirmado de COVID-19. Os aspectos epidemiológicos, clínicos, e laboratoriais foram extraídos das fichas de investigação epidemiológica e do prontuário hospitalar. Resultados: Foram internados 582 casos suspeitos de COVID-19 e 317 foram confirmados, dos quais 182 (57,5%) eram do sexo masculino, e a maioria era residente na zona norte do Rio de Janeiro (42,5%). Principais achados 'tomográficos ou radiológicos': vidro fosco (34,7%) e infiltrado pulmonar (15,4%), e mais da metade dos hospitalizados (64,0%) apresentava pelo menos uma comorbidade. Entre os pacientes hospitalizados, a letalidade geral foi de 53,6% sendo que entre os internados na UTI esse percentual foi de 84,5%. Idade e uso de suporte ventilatório e UTI foram as variáveis que mostraram associação estatisticamente significante com mortalidade intra-hospitalar. Conclusão: Este estudo reforça a importância da vigilância epidemiológica, em âmbito hospitalar, principalmente para as doenças em que o sistema de vigilância passivo pode não ser capaz de reportar adequadamente, como no caso da COVID-19.

Descritores: *Epidemiologia. Síndrome Respiratória Aguda Grave. COVID-19. Vigilância Epidemiológica.*

RESUMEN

Justificación: Desde diciembre de 2019, el coronavirus SARS-Cov-2, también llamado COVID-19, se ha extendido rápidamente por los países, convirtiéndose en uno de los mayores retos sanitarios de este siglo. En Brasil, se declaró una emergencia de salud pública en febrero de 2020. El objetivo de este estudio es describir el perfil de los casos hospitalizados por COVID-19 en un hospital de urgencias de la ciudad de Río de Janeiro, así como los factores asociados a la muerte hospitalaria. Métodos: Estudio observacional, retrospectivo, que incluyó pacientes hospitalizados entre marzo y diciembre de 2020 con diagnóstico confirmado de COVID-19. Los aspectos epidemiológicos, clínicos y de laboratorio fueron extraídos del formulario de investigación epidemiológica y de los registros hospitalarios. Resultados: Se hospitalizaron 582 casos sospechosos de COVID-19 y se confirmaron 317, de los cuales 203 (57,5%) eran hombres, la mayoría residentes en el norte de Río de Janeiro (42,5%). Los principales hallazgos tomográficos o

radiológicos: vidrio deslustrado (34,7%) e infiltrado pulmonar (15,4%) y más de la mitad de los hospitalizados (64%) tenían al menos 1 comorbilidad. La letalidad global entre los hospitalizados fue del 53,6% y entre los ingresados en la UCI, este porcentaje fue del 84,5%. Las variables que mostraron una asociación estadísticamente significativa con la mortalidad intrahospitalaria fueron la edad, el uso de soporte ventilatorio y el uso de la UCI. Conclusiones: El estudio refuerza la importancia de la vigilancia epidemiológica en el ámbito hospitalario, especialmente para aquellas enfermedades en las que el sistema de vigilancia pasiva puede no informar adecuadamente, como es el caso de la COVID-19.

Palabras clave: Epidemiología. Síndrome Respiratorio Agudo Severo. COVID-19. Vigilancia Epidemiológica.

INTRODUCTION

Emerging and reemerging diseases have been a public health challenge. Since December 2019, the SARS-Cov-2 coronavirus, also called COVID-19, has spread rapidly across countries, infecting thousands of people despite global efforts to prevent its spread. In March 2020, it was declared an international public health emergency by the World Health Organization[1,2].

The clinical spectrum of the disease, which has high transmissibility, with an enormous impact in terms of morbidity and mortality for the population, ranges from asymptomatic infections and mild flu-like syndromes to more severe respiratory conditions, such as severe acute respiratory syndrome (SARS), depending on the organism. and the comorbidities it presents[3,4].

As hospitals serve a large volume of patients and are considered the gateway to various unusual and emerging diseases, they assume a strategic position in the fight against diseases, mainly by helping in the timely detection and diagnosis of cases. In this context, the hospital surveillance centers (HSC) were established by the Ministry of Health (MH) in 2004, aiming to improve the coverage and effectiveness of the epidemiological surveillance system. MH's assumption was to invest in improving the identification, registration, and monitoring of the clinical and epidemiological characteristics of compulsory notification diseases, especially communicable diseases. The active search conducted by the HSC occurred mainly in places considered strategic, such as outpatient clinics, inpatient units, and laboratories[5,6].

Since the active hospital surveillance modality was implemented, it has been an important advance in the national health surveillance network; it comprehensively captures hospitalized cases, therefore, those of greater severity, helping to better understand the pathogenesis and its risks in the short and long term[6].

In 2009, with the premise of identifying and monitoring the occurrence of respiratory viruses in hospitalized patients, especially those with a severe clinical condition or in a situation of a suspicious death, the SARS surveillance was implemented by the MH. This guideline was formulated after the *influenza* A (H1N1) pandemic; from then on, the cases of patients hospitalized started to be registered in the Information System of Epidemiological Surveillance of Influenza, centralizing the notifications to the MH[7].

Concerning cases of COVID-19, hospital surveillance assumed a relevant role, given the limited knowledge of the disease, with unpredictable impacts on public health. Furthermore, as it was a disease that absorbs health system resources, an additional concern arose about the pressure it exerts on hospitals to care for people affected by severe forms of the disease[8,9]. In a study conducted by Guan *et al*. (2020), 1099 laboratory-confirmed patients with COVID-19 were investigated in 552 hospitals in China. The authors highlighted the importance of hospital surveillance in producing fast and effective responses, as being crucial to support the adoption of control measures that can interrupt the disease transmission chain in the population[10]. Therefore, the objective of this study was to describe the profile of cases hospitalized by COVID-19, as well as the factors associated with in-hospital death, in an emergency hospital in the city of Rio de Janeiro.

METHOD

Study design

This is a sectional observational study that included patients with a confirmed diagnosis of COVID-19 admitted between March and December 2020 at an emergency hospital in Rio de Janeiro. This hospital has an installed capacity of 400 inpatient beds; given its strategic location and technological complexity in the municipality, it receives patients from other regions, attending to various specialties and with various diagnostic support services. Currently, it is considered one of the sentinel hospitals for surveillance of COVID-19, being part of the Municipal Contingency Plan for Public Health Emergency.

Hospital Surveillance Center (HSC)

The HSC was implemented at the hospital in 2001 with the premise of timely detecting and investigating cases of compulsory notification, monitoring risk factors through epidemiological investigations, providing permanent technical guidance to health professionals, and supporting decision-making on measures of disease prevention and

control. To monitor COVID-19, the HSC has developed a database for recording individual SARS cases, standardized as per the recommendation of the MH, in addition to conducting notification and investigation of patients. To track the flu syndrome, clinical and epidemiological information was collected and, then, patients were classified as suggestive or not of COVID-19. In confirmed cases, patients were followed up until the hospital outcome (discharge, transfer, or death).

Information source

To describe the clinical features and the baseline predictors of mortality, the information base of the present study was extracted from the HSC database. As an eligibility criterion, all hospitalized cases were considered, laboratory-confirmed by RT-PCR (reverse transcriptase polymerase chain reaction) for SARS-CoV-2, regardless of signs and symptoms and/or the presence of a clinical-epidemiological finding, according to the criteria defined by the MH[11]. The analysis variables were as follows: demographic data (age, sex, and region of residence, categorized into areas: North, Central, West, and South Zones), presence of comorbidities (diabetes mellitus, DM; cardiovascular disease, CVD; neoplasia; obesity; respiratory disease, etc.), admission to the Intensive Care Unit (ICU), use of (invasive and non-invasive) ventilatory support, tomographic or radiological examinations (normal; interstitial infiltrate; consolidation; mixed; other; not performed), and case evolution (cure; death; transfer). In-hospital (yes or no) death was the outcome variable up to the study completion date.

Data analysis

Data were organized in a Microsoft Excel (2016) spreadsheet, and analyzes were conducted in the Stata (Stata Corporation; College Station, USA) software (v. 14.0).

Descriptive statistics were calculated, including mean, median, standard deviation (SD), frequency, and ratio. Pearson's or Fisher's chi-square tests were used for categorical variables and $p<0.05$ was considered statistically significant. The multivariate logistic regression model was applied to study factors associated with the dependent variable (hospital death), and the Odds Ratio (OD), its 95% confidence intervals ($_{95\%}$CI), and p-value were estimated, and variables with a significance level of up to 10% were included in the model.

The present study is part of the project "Epidemiological Surveillance of COVID-19 and Sequelae in patients hospitalized by SARS-COV-2", which was approved by the

Research Ethics Committee (CEP/REC) of the Municipal Health Department (Rio de Janeiro; 16/07/2021; detailed opinion: 4,862,998).

RESULTS

Clinical and epidemiological profiles of patients hospitalized by COVID-19

During the period of analysis, 582 suspected cases of COVID-19 were hospitalized and 317 (54.5%) were confirmed. Table 1 presents the demographic, clinical, and epidemiological characteristics of patients confirmed for COVID-19; 182 (57.5%) of these patients were male, and most of them resided in the north (42.5%) and west (14.1%) and downtown (14.1%) zones of Rio de Janeiro. Other municipalities contributed with 18.3% of patients. The 40-59 age group concentrated on the highest percentage of hospitalized patients (minimum age: 7 years; maximum age: 102 years; mean: 62.9 years; median: 55 years).

Among confirmed COVID-19 patients, 251 (79.2%) did not require an ICU, 101 (31.9%) received non-invasive mechanical ventilation, and 59 (18.6%) used invasive mechanical ventilation.

Based on the clinical history of the patients, the main tomographic or radiological findings of the hospitalized patients were the following: ground-glass pattern (110; 34.7%), pulmonary infiltrate (49; 15.4%), and at least one comorbidity (more than half of those hospitalized; 64.0%). Chronic cardiovascular disease (CHD; 118 patients; 38.0%), followed by diabetes mellitus (DM; 77 patients; 24.4%), chronic kidney disease (CKD; 26 patients; 8.2%), and obesity (11 patients, 3.4%) were among the most prevalent comorbidities (Table 2). Among hospitalized patients, the overall lethality was 53.6% (mean age: 61.6 years; SD=15.4).

Table1. Demographic, clinical, and epidemiological characteristics of patients confirmed for SARS-CoV-2 in an emergency hospital (Rio de Janeiro, RJ, Mar-Dec 2020)

Patient characteristics (n= 317)	n	%
Sex		
Male	182	57.5
Female	135	42.5
Age range (years)		
0-9	3	0.9
10-19	3	0.9
20-39	18	5.6
40-59	101	31.8
60-69	81	25.5

70-79	61	19.2
≥ 80	50	16.1
Areas of residence		
North Zone	135	42.5
South Zone	7	2.2
Central Zone	46	14.1
West Zone	46	14.1
Other municipalities	58	18.3
Ignored	25	8.8
Comorbidities		
Chronic cardiovascular disease	118	38
Diabetes Mellitus	77	24.4
Chronic kidney disease	26	8.2
Obesity	11	3.4
Others	33	10.4
No comorbidity	52	15.6
Tomographic findings		
Frosted glass pattern	110	34.7
Pulmonary infiltrate	49	15.4
Consolidation	20	6.1
Mixed	9	2.8
Others	129	41
Ventilatory Support		
Invasive ventilatory support	59	18.6
Non-invasive ventilatory support	101	31.9
No ventilatory support	157	49.5
Use of ICU*		
Yes	66	20.8
No	251	79.2
Hospital outcomes		
Discharge	140	44.1
Death	170	53.6
Transference	7	2.3

*Intensive Care Unit

Among the patients admitted to the ICU, the highest percentages were male (57.5%) and elderly (72.8%), showing that older age groups were more hospitalized in this sector (Table 2). About 95.5% used mechanical ventilation; in this group, 98.4% had at least one comorbidity. The main comorbidities were as follows: cardiovascular diseases (34.8%), diabetes mellitus (30.3%), and chronic kidney disease (16.6%). Among patients admitted to the ICU, lethality increased to 84.5% (mean age: 65 years; SD=16.5).

Table 2. Characteristics of patients confirmed for COVID-19 admitted to the ICU of an emergency hospital according to the selected variables (Rio de Janeiro, RJ, Mar-Dec 2020)

Patient characteristics		n	%
Sex	Male	38	57.5
	Female	28	42.5
Age range (years)	0-9	00	00
	10-19	02	3.0
	20-39	03	4.5
	40-59	13	19.7
	60-69	19	28.7
	70-79	16	24.4
	≥ 80	13	19.7
Comorbidities	Chronic cardiovascular disease	23	34.8
	Diabetes Mellitus	20	30.3
	Chronic kidney disease	11	16.6
	Obesity	04	6.1
	Others	08	12.2
Use of ventilatory	Yes	63	95.5
Support	No	03	4.5
Outcomes	Discharge	10	15.1
	Death	56	84.5

Table 3 shows the outcome of the investigated cases (death; not death) according to the variables analyzed. For males, OR=1.24 was considered statistically non-significant (p-value=0.887; 95%CI=0.930; 1,670). The presence of at least one comorbidity increased the chance of death by 1.37 among hospitalized patients. However, this association was also not statistically significant (p-value=0.3226; 95%CI=1.041; 1.820).

The variables that showed the greatest association with the study outcome (chance of death) were the older age groups, with an increasing effect with advancing age, reaching OR=3.54 for age ≥80 years (p-value=0.000; 95%CI=1.815; 6.922), taking the age group 0-9 years, use of invasive ventilatory support (OR=10.80; p-value=0.003; 95%CI=4.327; 26.997), and ICU admission (OR=5.60; p-value=0.000; 95%CI=2.857; 10.975) as references.

Table 3. Bivariate analysis between hospital outcomes of patients confirmed by COVID-19 and selected variables in an emergency hospital (Rio de Janeiro, RJ; Mar-Dec 2020).

			Hospital outcomes		
Variables	**No Death**		**Death**	*p-values*	**OR (95%CIc)**
SEX	N	%	N	%	

Male	81	44.5	101	55.5	0.887	1.24 (0.930; 1.670)
Female	59	43.7	76	56.3		1.00
AGE RANGE (years)						
0-9	03	100.0	00	0.0	0.000	1.00
10-19	02	66.7	01	33.3		0.50 (0.045; 5.514)
20-39	13	72.2	05	27.8		0.38 (0.137; 1.078)
40-59	58	57.4	43	42.6		0.74 (0.499; 1.099)
60-69	36	44.4	45	55.6		1.25 (0.806; 1.937)
70-79	17	27.9	44	72.1		2.58 (1.478; 4.529)
≥ 80	11	22.0	39	78.0		3.54 (1.815; 6.922)
PRESENCE OF COMORBIDITY (at least 1)						
Yes	85	42.1	117	57.9	0.322	1.37 (1.041; 1.820)
No	55	47.8	60	52.2		1.00
USE OF VENTILATORY SUPPORT						
Yes: invasive	05	8.5	54	91.53	0.003	10.80 (4.327; 26.997)
Yes: no invasive	40	39.6	61	60.40		1.52 (1.023; 2.272)
No use	44	78.6	12	21.43		1.00
HOSPITALIZATION IN THE ICU						
Yes	10	15.2	56	84.9	0.000	5.60 (2.857; 10.975)
No	91	55.2	74	44.9		1.00

DISCUSSION

The demographic profile of patients admitted to this hospital is consistent with that of most studies reviewed, which highlight the greater predominance of male patients in older age groups[3,4,12]. This situation can be attributed to the fact that men usually seek health services when their clinical condition becomes more serious and elderly people are more vulnerable to the severe form of COVID-19, leading to an increase in hospitalization cases. A recent study with hospitalized patients in the south of Santa Catarina also found a predominance of males[12]. Regarding age, research conducted in several countries has shown an exponential increase in the mortality of patients with COVID-19 from 60 years of age, which was also found in the present study[3,4,5,6,7].

As for the place of residence, the north and west zones were the main areas of origin of the patients, although vulnerable areas are spread throughout the municipal territory. According to the study conducted by Santos (2020) to monitor the spatial distribution of COVID-19 in Rio de Janeiro (RJ), the higher intra-household densities in these areas reflect urban complexity[13]. The results found in this present study reinforce the urgency of intensifying territorial surveillance strategies considering particular aspects of greater risk for the occurrence of COVID-19.

In the present study the expressive percentage of patients who needed ICU or used ventilatory support (the method used when the infected patient reaches a level of compromise of the lungs that causes severe respiratory weakness) shows the severity of the hospitalized cases and the dimension of technological demand in the health system. The literature highlights that in moderate to severe cases of COVID-19, hospitalization and use of ICU are required[14].

In studies conducted in Spain, Italy, and the USA, a significant demand for ICU patients was observed, and ICU complications were also higher, including respiratory and renal failure, when compared to patients admitted to the clinical sectors of these hospitals[15]. In a survey conducted in Australia (June 2020), 15% of reported cases were admitted to the hospital; of these cases, 19% were admitted to the ICU and 28% of these admissions required ventilatory support[9].

In a study conducted by Escosteguy *et al*. (Brazil, 2020), it was observed that the use of ICU and ventilatory support, in addition to findings on radiological images with a ground-glass pattern, contributed to a worse prognosis among hospitalized patients[16].

The radiological and tomographic findings of the present study are consistent with studies conducted in other hospitals in Brazil, where more common patterns in chest tomography were found, such as ground-glass opacity (84.6%) and irregular bilateral consolidations (79.5%), with ground glass being the earliest finding (0-4 days after the onset of symptoms)[17,18].

The presence of at least one comorbidity was not shown to be associated with death with statistical significance. In a study conducted in the metropolitan area of Detroit (USA), Suleyman (2020) found that the majority of hospitalized patients (94.0%) had at least one comorbidity, mainly hypertension (63.7%), chronic kidney disease (39.3 %), and diabetes (38.4%)[18]. A study conducted in Spain showed that cardiovascular factors such as arterial hypertension (44.6%), dyslipidemia (33.5%), *diabetes mellitus* (18.8%), and obesity (14.3%) were the most prevalent comorbidities, followed by respiratory

diseases (17.3%) and cancer (9.7%)[15]. Escosteguy *et al.* (2020) identified that patients with a higher chance of death had neoplasia (OR=2.58; 95%CI=1.48; 4.52) and chronic liver disease (OR=4.02; 95%CI=1.32; 12.26)[16].

Although some comorbidities and risk factors have already been identified as facilitators of disease worsening and death, few studies have described such aspects in Brazil. Cohort studies conducted in Europe and USA showed a clinical interaction between SARS and chronic diseases, especially cardiovascular disease and diabetes, which seem to facilitate the activity of the virus in the body of patients, triggering more serious clinical conditions[15].

In this study, factors such as advanced age, use of ventilatory support, and having been admitted to the ICU were shown to be more associated with worse prognosis among hospitalized patients. Galvão and Rocalli (2021) observed a higher risk of death by COVID-19 among older individuals (>80 years) with comorbidity, male gender, and non-white skin color[20].

CONCLUSIONS

Patients with COVID-19 who went to the ICU and received ventilatory support are important aspects of their prognosis. Critical patients demanding more intensive care tend to have a longer hospital stay, contributing to overloading the health system. This study made it possible to highlight that epidemiological surveillance in the hospital environment helps in the production of evidence, collaborating as a guideline, both to implement more effective preventive and therapeutic measures at distinct levels of health management and to face the current context of the SARS-CoV-2 pandemic, and strengthen expertise for future global events.

Furthermore, deepening the analysis of the average length of stay, historical series of the number of patient-days, and monthly hospital occupancy rate would be interesting, as these indicators are fundamental to prospect scenarios, assist decision-making, and improve the care provided to patients.

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Authors' contributions:

Catia Cristina Martins de Oliveira contributed to the conception, design of the analysis,

and writing of the manuscript;

Fabiane Canellas de Paula, Renata Vasconcelos and **Nadja Raquel Lustosa Lopes** contributed to the planning, design, and review of the manuscript.

All authors approved the final version to be submitted, being responsible for all aspects of the study, including its accuracy and integrity.