CHARACTERISTICS OF HOSPITALIZED COVID-19 PATIENTS IN SUMADIJA DISTRICT IN 2020

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ABSTRACT

The number of hospitalized COVID patients varies in accordance with the waves of the pandemic. The aim of the study was to examine the characteristics of hospitalized COVID-19 patients and predictors of in-hospital died with special reference to the importance of comorbidity. A retrospective cohort study that included all COVID patients hospitalized at the Clinical Center Kragujevac in 2020. The data contained in the Hospitalization Report are described, and the predictors of hospital mortality are defined by binary logistic regression. 1336 COVID patients were hospitalized. The average age of the hospitalized patients was 58.1 ± 16.5 years, 2/3 of them were males. The largest number of hospitalized patients live in Kragujevac - 62.8%. During hospitalization, 19.4% (n = 206) of patients died, who were on average 13 years older (t = 14.13, df = 504.3, p <0.01), and stayed in the hospital 2 days shorter (Z = -5.36, p <0.01) when compared to discharged patients. 86.5% (n = 1155) of hospitalized patients had comorbidities, most often hypertension and other heart diseases, diabetes mellitus and renal failure. Statistically significant predictors of the lethal outcome of hospitalization were patients' age (OR = 0.94 95% CI = 0.93-0.95), residence (OR = 0.84, 95% CI = 0.75-0.95), length of hospitalization (OR = 1.06, 95% CI = 1.04-1.09) and the presence of comorbidity as the strongest predictor (OR = 5.31, 95% CI = 2.37-11.89). COVID Patients with comorbidities require special attention because comorbidities affect the outcome of hospitalization.

Keywords: *SARS-CoV-2 infection, comorbidities, intrahospital mortality.*

INTRODUCTION

At the end of 2019, in the city of Wuhan, in the Republic of China, several cases of respiratory infections in humans were recorded, and on January 7th, 2020. a causative agent called the new corona virus, SARS-Cov-2 was isolated, and the disease was named Covid-19. The new coronavirus is a highly contagious strain of coronavirus that is spread by droplets and airborne particles, so the epidemic quickly grew into a pandemic. The first registered case of coronavirus in Serbia was reported on March 6, 2020. From then until today, the pandemic lasts with its variations and peaks called epidemiological waves (1).

Covid-19 disease most commonly causes upper respiratory tract problems and flu-like symptoms (2). Typical symptoms are fever, chills, runny nose, sore throat, cough and malaise. Most of those infected have a mild clinical picture. However, in 5-10% of cases, most often in elderly, immunocompromised patients and patients with comorbidities, the disease can spread to the lower respiratory tract. These patients usually require hospitalization, and a number of them develop a very severe clinical picture, with pneumonia, worsening of gas parameters, the need for oxygen therapy and mechanical ventilation. The outcomes of such hospitalizations are often fatal (3). The most common health disorders encountered in covid patients requiring hospitalization are cardiovascular diseases, primarily hypertension, diabetes mellitus, lung and kidney diseases (4). Treating patients with comorbidities is more complex and challenging, and mortality is higher (5).

The scientists around the world are facing with the COVID pandemic for the first time and it leaves many questions open. One is questions directly related to infection, the association with comorbidities, the impact of regular therapy that patients take on the course and outcome of covid infection, while the other group of questions is related to the health care system (6). COVID-19 has further increased the challenges that health systems around the world have long faced. Managing the health system and providing sufficient funds for the operation and modernization of medical services in order to increase efficiency and effectiveness, with 100% coverage of the population with health care for many years is a challenge for all countries. In 2018, the Republic of Serbia allocated 8.5% of gross domestic product (GDP) for health, according to the World Bank, which is a significantly higher percentage compared to most other European countries. However, the value of GDP per capita in the Republic of Serbia in 2020 is almost 7 times lower than the average of the European Union (7,666.24 vs. 47,095 USD) (7). Therefore, the question of the readiness of the health system, in terms of capacity to treat patients, spatial and technical, but also human resources to respond to such a great challenge remains open.

The aim of the study was to analyze the predictors of the lethal outcome within the hospitalization of covid patients, with special reference to the influence of comorbidities.

METHODS

The University Clinical Center of Kragujevac is a regional clinical center where the population of Sumadija and Western Serbia is treated -about 2 million people and where more than 50,000 hospitalizations are done, annually. The databases on hospitalization reports, which the University Clinical Center of Kragujevac submits to the Institute of Public Health in Kragujevac, are part of the Integrated Health Information System of the Republic of Serbia.

This is a retrospective cohort study, which includes all hospitalized patients at the Clinical Center Kragujevac in the period 1.1. - December 31, 2020 with confirmed, or probable pneumonia caused by SARS-CoV-2 infection as the final diagnosis. Hospitalizations due to SARS-CoV-2 infection were identified by the ICD-10 codes B34.2, B34.9, U07.1 and U07.2. The dataset included patient characteristics such as: sex, age, secondary diagnoses based on International Classification of Diseases-10 (ICD-10) codes, hospital stay and type of hospital discharge. After their discharge, patients were not further monitored.

Statistical Analysis

Continuous data are described by arithmetic mean and by the measure of variability, whereas categorical data are presented in the form of percentages. Continuous data that had a normal data distribution were tested with the Student's t test, or the Mann Whitney U test when the distribution was not normal. Categorical data were tested by Chi-square test. Binary logistic regression was applied to observe the predictors of the lethal outcome of hospitalization.

For the purposes of the research, the following variables were transformed:

1. Address of the place of residence - patients living in the territory of the City of Kragujevac were in the category of Kragujevac, patients living in the municipalities of Batocina, Lapovo, Raca, Topola and Knic were classified in the category of Sumadija district, and all others were classified in the category of Western Serbia.
2. Admission/discharge ward-patients admitted /discharged from the Emergency Center and Intensive Care Unit are classified in one category - ER Center. Hospitalized in wards outside the Emergency Center, Infectious and Pulmonology Clinic and Day Hospital are classified in the Other category.

SPSS statistical software for Windows, Version 19 were used (IBM, Armonk, NY, USA). A p-value ≤ 0.05 was considered significant.

RESULTS

In 2020, 1336 covid patients were treated at the University Clinical Center Kragujevac. The mean age of the hospitalized patients was 58.1 ± 16.5 years. Two/thirds of the hospitalized patients were male patients (n = 860, 64.4%). Hospitalized female patients are on average 2.5 years older than hospitalized male patients (t = -2.48, df = 868.8, p <0.05). The largest number of hospitalized patients lives in the territory of the City of Kragujevac, 62.7% (n = 838). At the UCC, patients were most often admitted and discharged from the Clinic for Infectious Diseases. Patients stayed in CC Kragujevac for an average of 12.1 ± 7.8 days and had 16.4 ± 85.6 hours of ventilatory support.

19.4% (n = 206) of patients died during hospitalization. The deceased patients were 13 years older (t = 14.13, df = 504.3, p <0.01). Mortality is similar in both sexes (χ^2 = 0.01, df = 1, p> 0.05). There is a significant difference in the outcome of hospitalization of covid patients in relation to residence (χ^2 = 9.47, df = 2, p <0.05). Every fourth patient from Western Serbia, every seventh from Šumadija and every sixth from the territory of the City of Kragujevac died during hospitalization. The largest number of deceased covid patients were admitted to the Emergency Center, 60% of the total admitted to the Emergency Center and the Pulmonology Clinic, 57.3% of the total admitted to it (χ^2 = 141.1, df = 4, p <0.01). Analysis of the outcomes of hospitalization and of the ward on discharge shows that the largest number of patients died in the Emergency Center, 91.8% of the total discharged covid patients from the same ward, and at the Clinic of Pulmonology every fourth of the total discharged covid positive patients (χ^2 = 463.4, df = 4 , p <0.01). Before the lethal outcome, patients spent 10.5 ± 8.6 days in the hospital, which is statistically significantly shorter compared to discharged patients (Z = -5.47, p <0.01). Deceased covid patients had 4 times more hours of ventilatory support compared to discharged patients (Z = -7.88, p <0.01) (Table 1.).

In addition to the underlying cause of hospitalization, 86.5% (n = 1155) of covid patients had other health disorders. The most common comorbidities in hospitalized patients were diseases of the circulatory system, endocrine system and genitourinary system, among them hypertension, diabetes mellitus and renal failure. Of the total hospitalized patients who had diseases of the circulatory system as comorbidity, 38.1% of them died during hospitalization, i.e. 41.4% of patients who had endocrine system disorders. Almost every other patient who had genutourinary tract diseases as a comorbidity died during hospitalization caused by covid infection (Figure 1.).

The lethal outcome of hospitalization is influenced by various factors. In our study, statistically significant predictors of the lethal outcome of hospitalization were age of patients (OR = 0.94 95% CI = 0.93-0.95), their place of residence (OR = 0.84, 95% CI = 0.75-0.95), length of hospitalization (OR = 1.06, 95%). CI = 1.04-1.09) and the presence of comorbidity (OR = 5.31, 95% CI = 2.37-11.89). The strongest predictor was the presence of accompanying health disorders. Hospitalizations of covid-positive patients who had comorbidities 5 times more often ended in lethal outcome compared with hospitalizations of patients who did not have associated diseases (Table 2.).

DISCUSSION

A pandemic caused by SARS-Cov-2 infection with a mortality rate of 2% is a serious threat to public health, causing major socio-economic changes whose impact on the global level will be felt long after it is over. In the first phase, the system under the greatest load, the health system (8.9), suffers the greatest changes. During the pandemic, the University Clinical Center of Kragujevac underwent organizational and structural changes. At first, COVID-positive patients were admitted based on the severity of the clinical picture at the Emergency Center, Infectious Diseases and Pulmonology Clinic. However, as the need for hospitalization grew, other clinics also switched to the so-called covid regime. This meant that non-covid patients were transferred from that clinic to an adequate other clinic, in order to receive covid-positive patients. This was most often the case with clinics that had the technical capacity for oxygen support, such as the Neurology Clinic.

Similar to the results of our study and in a study conducted in China and the United States, the largest number of hospitalized COVID-19 patients were male patients of older age (10,11). A study of nearly 4,000 COVID-19 patients treated in intensive care units in northern Italy shows that these are mostly elderly men, with additional health disorders required by invasive mechanical ventilation. Predictors of hospitalization lethal outcome similar to our study were age, gender (male), hours of mechanical support, and the presence of certain comorbidities (COPD, hypercholesterolemia, type 2 diabetes) (12). Numerous other studies also point to the importance of gender, age, and comorbidity. Chronic health disorders that are most common in the general population are also found in hospitalized Covid patients, cardiovascular disease and diabetes mellitus. Among cardiovascular diseases, hypertension predominates. In our study, the prevalence of hospitalized COVID patients with comorbidities was 86.5%, which coincides with a study conducted in Spain in which the prevalence was 81.9% (13).

Chronic health disorders require the application of appropriate therapy, so doctors are concerned that there could be drug interactions and further deterioration of the clinical picture. So, Angiotensin-Converting Enzyme Inhibitor and Angiotensin II Receptor Blocker, as the most commonly used groups of drugs in the treatment of hypertension, can increase the mRNA expression of cardiac angiotensin-converting enzyme. This is particularly significant given the fact that the meta-analysis showed that cardiovascular health disorders were associated with a more frequent lethal outcome of Covid infection, while kidney, cerebrovascular, cardiovascular and respiratory diseases and diabetes were associated with a higher risk of developing severe COVID-19 (14-16).

Table 1. Characteristics of hospitalized covid patients

Variables	Discharged		In-hospital died		p
	n	%	n	%	
Age	55.5±16.4		68.4±12.3		<0.01*
Sex					
Men	692	80.5	168	19.5	>0.05
Femen	385	80.9	91	19.1	
Place of residence					
Kragujevac	687	82	151	18	
Šumadijski okrug	152	84.4	28	15.6	<0.05*
Zapadna Srbija	238	74.8	80	25.2	
Admission ward					
ER	22	40	33	60	
Infectious Diseases Clinic	873	85	154	15	
Pulmonology Clinic	32	42.7	43	57.3	<0.01*
Day hospital	118	84.3	22	15.7	
Other	32	82.1	7	17.9	
Discharge ward					
ER	9	8.2	101	91.8	
Infectious Diseases Clinic	603	92.9	46	7.1	
Pulmonology Clinic	359	76.2	112	23.8	<0.01*
Day hospital	90	100	/	/	
Other	16	100	/	/	
Stay in hospital	12.47±7.5		10.48±8.6		<0.01*
Hours of ventilatory support	10.34±73.8		41.81±119.9		<0.01*

Figure 1. The most common comorbidities in discharged and deceased patients

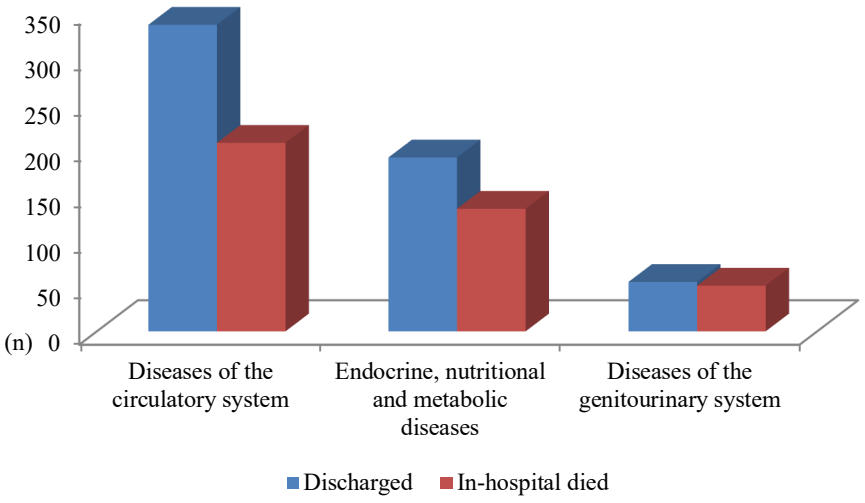


Table 2. Predictors of hospital mortality in patients

Predictors	Exp(B)	95%CI	p
Age	0.94	0.93-0.95	<0.01*
Place of residence			
Kragujevac (ref)	1		<0.05*
Other	0.84	0.75-0.95	
Hospital stay	1.06	1.04-1.09	<0.01*
Comorbidities			
No (ref)	1		<0.01*
Yes	5.31	2.37-11.89	

LIMITATIONS

This study has several limitations. First, the study population included patients hospitalisated only in Clinical Centre Kragujevac. Second, the data were collected from the electronic hospital database Institute of Public Health Kragujevac, so it has only the general data.

CONCLUSION

The lethal outcome of hospitalization is influenced by various factors. In addition to the severity of the underlying disease(s) and the patient's age, the most significant risk factors for the fatal outcome of hospitalization are comorbidities. However, hospitalized elderly patients with SARS-CoV-2 infection and comorbidities require special care.

CONFLICT OF INTEREST

None.

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REFERENCES

1. She J, Jiang J, Ye L Hu L, Bai C, Song Y. 2019 novel coronavirus of pneumonia in Wuhan, China: emerging attack and management strategies. Clin Transl Med. 2020; 9: 19.
2. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. JAMA. 2020; 323(13): 1239-1242.
3. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Respir Med. 2020; 8(5): 475-481.
4. Mehra M, Desai SS, Kuy SR, Henry TD, Patel AN. Cardiovascular disease, drug therapy, and mortality in Covid-19. N Engl J Med 2020; 382: e102.
5. Biswas M, Rahaman S, Biswas TK, Haque Z, Ibrahim B. Association of Sex, Age, and Comorbidities with Mortality in COVID-19 Patients: A Systematic Review and Meta-Analysis. Intervirology 2021; 64: 36-47.
6. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? Lancet Respir Med 2020; 8(4): e21-e21.
7. THE WORLD BANK. Health expenditure, total (% of GDP) data. Доступно на: https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS?locations=RS.
8. Li H, Liu SM, Yu XH, Tang SL, Tang CK. Coronavirus disease 2019 (COVID-19): current status and future perspectives. Int J Antimicrob Agents. 2020; 55(5): 105951
9. Gavriatopoulou M, Ntanasis-Stathopoulos I, Korompoki E, Fotiou D, Migkou M, Tzanninis IG, et al. Emerging treatment strategies for COVID-19 infection. Clin Exp Med. 2021; 21(2): 167-179.
10. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City Area. JAMA 2020; 323: 2052.
11. Grasselli G, Greco M, Zanella A, Albano G, Antonelli M, Bellani G, et al. Risk Factors Associated With Mortality Among Patients With COVID-19 in Intensive Care Units in Lombardy, Italy. JAMA Intern Med. 2020; 180(10): 1345-1355.
12. Sommerstein R, Kochen MM, Messerli FH, Gräni C. Coronavirus disease 2019 (COVID-19): do angiotensin-converting enzyme inhibitors/angiotensin receptor blockers have a biphasic effect. J Am Heart Assoc. 2020; 9(7): e016509.

13. Posso M, Comas M, Román M, Domingo L, Louro J, González C et al. Comorbidities and Mortality in Patients With COVID-19 Aged 60 Years and Older in a University Hospital in Spain. Arch Bronconeumol. 2020; 56(11): 756-758.
14. Derington CG, King JB, Herrick JS, Shimbo D, Kronish IM, Saseen JJ, et al. Trends in antihypertensive medication monotherapy and combination use among US adults, National Health and Nutrition Examination Survey 2005-2016. Hypertension. 2020; 75(4): 973-981.
15. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020; 395(10229): 1054-1062.
16. Biswas M, Rahaman S, Biswas TK, Haque Z, Ibrahim B. Association of Sex, Age, and Comorbidities with Mortality in COVID-19 Patients: A Systematic Review and Meta-Analysis. Intervirology 2021; 64: 36-47.
17. Shaikh FS, Aldhafferi N, Buker A, Alqahtani A, Dey S, Abdulhamid S, et al. Comorbidities and Risk Factors for Severe Outcomes in COVID-19 Patients in Saudi Arabia: A Retrospective Cohort Study. J Multidiscip Healthc. 2021; 14: 2169-2183.