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COVID-19 SECOND WAVE: EXPERIENCE OF CLINIC FOR LUNG DISEASE, UNIVERSITY CLINICAL CENTER TUZLA

Original scientific paper

Sefika Umihanic[1], Sekib Umihanic[2], Rahima Jahic[3], Jasmina Smajic[4], Dzenan Halilovic[1], Jasmina Bosnjic[1], Dilista Piljic[3], Medina Bandovic- Kuduzovic[1], Lejla Nezic[1], Ena Smajic[1]

[1]Clinic for lung disease, University Clinical Center Tuzla, Bosnia and Herzegovina
[2]Clinic for Ear, Nose, Throat Disease and Head Neck Surgery, University Clinical Center Tuzla, Bosnia and Herzegovina
[3]Clinic for Infectious Disease, University Clinical Center Tuzla, Bosnia and Herzegovina
[4]Clinic for Anesthesiology and Resuscitation, University Clinical Center Tuzla, Bosnia and Herzegovina

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ABSTRACT

The objective of this paper was to present basic clinical characteristics and outcomes of treating Covid 19 patients during the second wave of the pandemic. In the retrospective study for the period from September 2020 to February 2021 it was analyzed disease history data and radiological lung changes, time from the initial start of the disease until hospitalization, parameters of blood gas analysis, comorbidities, and the outcome. The research covered 409 patients, out of which 263 (64.3%) were males. Average age was 67.07± 12.44 years (min. 20; max. 93). A high comorbidities prevalence (82.9%) was noticed out of which arterial hypertension (69.2%), diabetes mellitus (37.7%) and obesity (24.7%). On the radiological lung scan the most noticed changes were consolidation (46.2%), "ground glass" (41.3%) and interstitial changes (13%). Bilateral lung infiltration was noticed in 91.9% of the patients. Average oxygen saturation was 84.29%±10.28% (min. 35; max. 98; med. 87%). In patients with unilateral lung infiltration, average oxygen saturation was 85.09%±8.60% (med. 89%, min.61% max 98%), while in patients with bilateral lung infiltration average was 84.22%±10.42% (med. 87%, min. 35%, max. 98%). From the total all patients' death was noticed in 35.7% cases. Morbidity of patients with unilateral lung infiltration was 27.3% and in patients with unilateral infiltration 36.4%. Hospital admission in the first week of the disease indicates the severity of the clinical condition and can be a predictor of poor outcome. Bilateral pulmonary infiltration, obesity and diabetes mellitus are risk factors for high mortality.

***Keywords**: comorbidity, Covid 19, lung infiltration, outcome.*

INTRODUCTION

The first case of Corona virus disease 2019 (COVID-19) in Bosnia and Herzegovina (B&H) was reported in Banja Luka on March 5 2020, after 34 days WHO had declared the outbreak a public health emergency of international concern (WHO, 2020a). COVID 19 is an acute respiratory disease caused by corona virus 2 (SARS-CoV-2) which is responsible for the development of

Correspodence to: Sekib Umihanic, Clinic for Ear, Nose, Throat Disease and Head Neck Surgery, University Clinical Center Tuzla
Email: sekib.umihanic@gmail.com

severe acute respiratory syndrome of pandemic proportions (Zhu et al., 2019). COVID-19 is a heterogeneous disease and in most patients it has a mild form and spontaneous recovery, while another subgroup of patients requires hospitalization due to pneumonia and other complications. In initial reports from Wuhan, China, it was reported that one third of patients developed a severe clinical picture with the development of acute respiratory distress syndrome (ARDS) (Huang et al., 2020). In patients with a severe form of Covid-19, the most common comorbidities are arterial hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), obesity, and cardiovascular diseases. About 70% of patients requiring intensive care had comorbidities (Gasmi et al., 2021). Covid19 spread rapidly throughout the world and was declared a pandemic by the World Health Organization (WHO) on March 11. 2020 (WHO, 2020b). As of June 13. 2020, there have been nearly 8 million confirmed cases and more than 425.000 confirmed deaths due to COVID-19 worldwide (He et al., 2020). Globally, as of July 29. 2022, there have been 572.239.451 confirmed cases of COVID-19, including 6.390.401 deaths, reported to WHO. The gold standard for diagnosing patients with COVID-19 is the reverse transcription-polymerase chain reaction (RT-PCR) test with a sensitivity of 79% and a specificity of 100% (Kanne et al., 2020). The lungs are primarily affected in COVID-19, so it is common practice to perform a chest radiograph (CXR) as the initial imaging examination in suspected cases. The diagnostic value of CXR in the early stages of COVID-19 is limited and pathologic findings may not be detected on radiographs that can be identified on chest CT (Wu & McGoogan, 2020). Although less sensitive, CXR is available in emergency centers, clinics, and hospitals and can help diagnose COVID-19 (Hansell et al., 2008). Radiographic characteristics were diagnosed according to the type of infiltration as opaque glass shadow, ground glass opatificatio (GGO), consolidation type shadow and interstitial infiltration. One of the most common abnormalities seen on CXR in patients with COVID-19 is consolidation. Consolidation is one of the most common abnormalities seen on CXR in COVID-19 patients. It refers to the phenomenon where the pathological products such as water, pus and blood fill the alveolar spaces in the lungs. Consolidation homogenously increases the attenuation in lung parenchyma (increased density) by obscuring the edges of the blood vessels and walls of the airways. Air bronchogram, a visualization of air bronchial lumens within the parenchymal opacity of the lungs and, therefore, showing the airway patency (Jacobi et al, 2020), is a demonstration of consolidation. Patients with this type of infiltration had more severe clinical symptoms and more often ended up with the need for respiratory support. The opacification of lung parenchyma that produces slight increase in attenuation for consolidation is described by ground glass-type infiltrates (GGO). The walls of the bronchi and pulmonary vessels remain differentiated from the involved parenchyma despite the increased density. GGOs may potentially precede the appearance of consolidation and they are common in earlier presentations.There are no published data on the second wave of the Covid 19 pandemic in Bosnia and Herzegovina. Our study aimed to show the clinical and radiological characteristics of patients, the outcome of treatment, from the area of Tuzla Canton suffering from Covid-19 during the second wave of the pandemic, who were hospitalized in the Clinic for lung disease, UCC Tuzla. Furthermore, we discussed the possible reasons for the high mortality rate in the second wave of the Covid 19 pandemic.

PATIENTS AND METHODS

A retrospective study analyzed the data from disease history of patients that were hospitalized at the Covid hospital for the period 1st September 2020 until 28th February. Inclusion criteria were positive PCR test for Covid 19, age older than 18 years, patients with moderate and severe clinical presentation of the disease. Exclusion criteria were patients on invasive mechanical ventilation, psychiatric and surgical patients suffering from Covid 19. It was analyzed radiological changes on lungs, time from the begging of the disease until hospitalization, gas analysis of blood, comorbidities, and the outcome of treatment for 409 hospitalized patients in the second wave of the Covid 19 pandemic. The study was carried out with the consent of the Ethics Committee our institution, number: 02-09/2-17/21. 14.04.2021.

Methods

The diagnostic RT-PCR method for detecting SARS-CoV-2 virus from the respiratory tract (by nasal and/or oropharyngeal swab) was used in order to confirm COVID-19. The following analyses were performed in all patients: complete blood count (CBC), C-reactive protein (CRP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), ferritin, urea, creatinine, blood gas analysis, electrolytes, D-dimer, creatin kinase (CK), creatin kinase-MB (CK-MB), troponin).

All the chest x-rays were acquired as a digital radiograph in the anteroposterior projection. The radiographic features were diagnosed according to the Fleischner society glossary (Hansell et al., 2008). The definitions were as follows: Ground glass opacity (GGO) - increase in lung opacification which does not obscure the blood vessels and airways; consolidation - a homogenous opacification obscuring the blood vessels and airway walls; reticulation - a collection of innumerable small opacities in a linear pattern. The distribution of the lung lesions was classified into: unilateral or bilateral. All comorbidities as well as length of hospitalization and outcome were recorded. The patients were treated with oxygen, corticosteroids, low weight molecular heparin and therapy for comorbidities.

Statistical analysis

Descriptive analysis is applied to all data. $\chi 2$ test was applied to check the independence or association of the variables. To determine the relationship between the type of infiltration and the blood O2 saturation value, the point-biserial correlation coefficient was calculated. The $p < .05$ was considered statistically significant.

RESULTS

The research included 409 patients, of which 263 (64.3%) were male patients, 146 (35.7%) were female. The youngest patient was 20, and the oldest 93 years of age. The average age was 67.07 12.44 years. The largest number of patients were hospitalized in the first week from the onset of the disease 259 (63.3%), then in the second week 143 (35%), and in the third week 7 (1.7%) of patients. In the observed period, there was a high overall prevalence of comorbidities of 82.9% in patients suffering from Covid 19 (Table 1).

Table 1. Comorbidities of hospitalized patients

Comorbidity	No (**%) of patients**	
Hypertensio arterialis	283	(69.2)
Diabetes mellitus	154	(37.7)
Obesity	101	(24.7)
COPD	23	(5.6)
Cardiac disease	93	(22.7)
Malignancy	21	(5.1)
Fibrillatio atriorum	10	(2.4)
Asthma	6	(1.5)
ICV	5	(1.2)

The largest number of patients, of them 127 (31.1%), had, in addition to COVID 19, two other diseases. Out of the total number of patients, 107 (26.2%) of them had one more, and 73 (17.8%) three diseases. On a conventional lung scan (X-ray scan), interstitial changes were present in 53 (13%) patients, while “ground glass” was more significant, i.e. in 169 (41.3%), while consolidation-type changes were present in the largest number, 189 (46.2%) patients. Bilateral lung infiltration was present in a total of 376 (91.9%), and unilateral in 33 (8.1%) patients. In the study, an extremely significant overall representation of bilateral infiltration, compared to unilateral infiltration, is observed, both in total and by week. The lowest value of blood O2 (sO2) saturation in all patients was 35%, and the highest was 98%, while the average value was 84.29%±10.28%, and the median was 87% (Table 2).

Table 2. Blood O_2 saturation values

sO_2 (%) (No of patients)	**Xmin-Xmax**	**$\bar{X}$**	**M_{ed}**	**SD**
Unilateral lung lesions (33)	61 – 98	85.09	89	8.60
Bilateral lung lesions (376)	35 – 98	84.22	87	10.42
Total (409)	35 – 98	84.29	87	10.28

Xmin-Xmax - minimum – maximum; $\bar{X}$ (mean); SD (standard deviation); M_e (median)

Correlation analysis, based on the calculated point-biserial correlation coefficient (rrb = -.02), did not establish a statistically significant connection between the type of infiltration and sO2 at the level of statistical significance $p < .05$ It can be concluded that, regardless of the type of infiltration, sO2 values were on average equally represented. Out of 409 hospitalized patients, 146 (35.7%) died. Mortality rate was about 9.1% higher with bilateral, compared to unilateral infiltration 27.3% vs 36.4%, but without statistical significance (p = .37) (Table 3).

Table 3. Relationship between the type of lung infiltration and the outcome

Infiltration type	**No (%) of patients outcome**		
	Death	**Survival**	**Total**
Unilateral infiltrate	9 (27.3)	24 (72.7)	33 (100.0)
Bilateral infiltrate	137 (36.4)	239 (63.6)	376 (100.0)
Total	146 (35.7)	263 (64.3)	409 (100.0)

DISCUSSION

In our study, we analyzed 409 patients who were hospitalized in the "second wave" of the Covid19 pandemic. The largest number of patients were hospitalized in the first week from the onset of the disease, suggesting the high prevalence of severe clinical forms of Covid19 from the beginning of the disease, which is one of the characteristics of the second wave of the Covid19 pandemic. Identical results were published by Bhatraju et al. (2020) found that seriously ill patients who required intensive care reported in the first week of illness, i.e. 4 to 7 days before admission to the hospital. In our study, males predominated among hospitalized patients, as well as patients older than 60 years. We also observed a significant association between patient age and time from initial symptoms to death. N. Chen et al. (2020) reported in a study on patients from Wuhan at the beginning of the Covid 19 pandemic that older patients had more severe forms of the disease. Bienvenu et al. (2020) reported that male patients with COVID-19 had a more severe clinical conditions, higher complication rates, and higher mortality. Contrary to them, Ruan et al. (2020) found no difference between the representation of hospitalized males and females; the authors pointed out that the largest number of patients who ended fatally belonged to an older age group, being over 60 years old. By analyzing the clinical status of our patients, a high overall prevalence of comorbidities of 82.9% was found of which arterial hypertension diabetes mellitus obesity and heart disease was the most prevalent these diseases also accompanied the deaths of patients suffering from Covid 19. Wang et al. (2020) reported similar results indicating that patients with comorbidities (including diabetes mellitus, cardiovascular disease, respiratory disease, hyperlipidemia, obesity, and chronic kidney and liver disease) will develop more severe forms of Covid19. Cardiovascular diseases were present in 2.5-16% of patients with COVID-19 (R. Chen et al., 2020; J. Yang et al., 2020). Some of the most common complications of the cardiovascular system are acute myocardial damage, myocarditis, myocardial infarction, heart failure, rhythm disorder and thromboembolism.

And there are interactions with cardiovascular drugs that should also be considered (Long et al., 2020). One of the studies, that included more than 44,000 patients with COVID-19 who suffered from cardiovascular system diseases, showed a fivefold increase in mortality compared to initially healthy patients. Berrill et al. (2021) indicated a high prevalence of hypertension and diabetes in patients suffering from Covid19. Obesity is a risk factor for poor disease outcome in patients with COVID 19. Data show that obese people stayed longer in the hospital and had a 5 times higher risk of death (Rossi et al., 2021). There is a lot of evidence in the USA, the country with the highest obesity rate, and their data highlighted obesity as a risk factor (Hur et al., 2020). The facts that SARS-Cov-2 infection results in lung tissue damage, that obese people have reduced lung function, and that, in comparison with patients of normal weight, it is difficult to compensate for the lack of oxygen with invasive mechanical ventilation (IMV) are already known. Peng et al. (2020) pointed out the association between increased body mass index (BMI) and survival. Patients who ended fatally, had a BMI > 25, which is significantly higher than those who survived. Diabetes mellitus as a comorbidity has a higher risk of harmful effects due to infection (Bode et al., 2020). According to N. Chen et al. (2020) and Bienvenu et al. (2020), the prevalence of diabetes among hospitalized patients with COVID-19 fluctuated in the range of 10-34% and even more according to some other studies. There have been numerous studies in China and Italy that shown a more severe clinical course of SARS-Cov-2 infection that required transfer to the intensive care unit and mechanical ventilation in patients with diabetes (J. K. Yang et al., 2010; Fadini et al., 2020; Xie et al., 2020). On conventional lung imaging (X-ray imaging), consolidation-type changes were the most prevalent (46.2%), "ground glass" was present in 41.3%, while interstitial changes were present in 13% of our patients. Bilateral lung infiltration was present in 91.9%. Similar data were published by Wong et al. (2020), and indicated that the most common changes in the lungs are consolidation (in 36–47% of patients) and ground glass type changes (in 20–33%), typical peripheral localization. Colman et al. (2021) and Cao et al. (2020), have indicated that ground-glass type infiltration is strongly associated with death. Fu et al. (2020) in a meta-analysis of 43 studies that included data obtained from 3,600 hospitalized patients reported that the largest number of hospitalized oxygen-dependent patients had ground glass-type infiltrates (80.0%) and bilateral pneumonia (73.2%). A particularly interesting phenomenon relates to the very similar results for the average sO2 values in patients with unilateral and bilateral lung infiltration in our study. Regardless of the type of infiltration, sO2 values were on average equally represented in both groups. If a resting oxygen saturation is < 95%, then it is considered abnormal. It has been established by Karimi et al. (2020) that an oxygen saturation < 93% with assisted oxygen or < 90% on room air as a sign of severe pneumonia. Some other studies also depended on oxygen saturation ≤ 90% by pulse oximetry to define hypoxia in the pneumonia severity index. In the study by Maha et al., ground glass opatificatio (GGO) and consolidation had no significant relationship with oxygen saturation and patients' condition. The study observed an extremely high mortality rate of hospitalized patients with COVID-19, However, no statistically significant difference was found in the distribution of mortality in relation to the type of infiltration. In the analyzed literature from the period from the beginning of the Covid19 pandemic to the end of February 2021, there are different data on the mortality rate, which ranges from 21.9% published by Wu et al. (2020) to 61.5% in the study by X. Yang et al. (2020).

In our study prehospital pulmonary function tests and radiological imaging were not available, therefore patients who had severe/critical illness may have had predisposing undiagnosed lung disease and consequently worse lung function at follow-up.

CONCLUSION

The largest number of patients were hospitalized in the first week from the onset of the disease, suggesting the high prevalence of severe clinical forms of Covid19 from the beginning of the disease, which is one of the characteristics of the second wave of the Covid19 pandemic and can be a predictor of poor outcome. Bilateral pulmonary infiltration, obesity and diabetes mellitus are risk factors for high mortality.

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TRANSPARENCY DECLARATION

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