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Comparison of the clinical and laboratory characteristics of patients with COVID-19 and community-acquired pneumonia

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Abstract

Background/Aim: It is challenging to discriminate between COVID-19 and community-acquired pneumonia due to similar clinical features, albeit of great importance. This study aimed to compare the clinical and laboratory characteristics between patients hospitalized due to COVID-19 pneumonia and those with community-acquired pneumonia (CAP).

Methods: This retrospective cohort study included cases who were hospitalized with the diagnosis of COVID-19 between April and December 2020 and those hospitalized with the diagnosis of CAP during the same months in 2019. Statistical differences were investigated by comparing the clinical and laboratory characteristics of the two groups.

Results: The study included 882 cases, comprising 755 with COVID-19 and 127 with CAP. In the COVID-19 pneumonia group, the mean age was lower, there were more women, the hospitalization period was longer, and the rates of hypertension and diabetes mellitus were higher compared to the CAP group ($P<0.05$). The white blood cell (WBC), urea, creatinine, albumin and platelet values were higher in the CAP group ($P<0.05$). The patients who died due to COVID-19 pneumonia had higher mean age, length of hospital stay, C-reactive protein, WBC, urea and creatinine values and lower albumin and platelet levels ($P<0.05$). The rates of hypertension, stroke history, coronary artery disease, congestive heart failure, diabetes mellitus and chronic kidney disease were higher among the patients that died in the COVID-19 group ($P<0.001$ for all).

Conclusion: COVID-19 and community-acquired pneumonia differed from each other in terms of many clinical and laboratory characteristics.

Keywords: COVID-19, Pneumonia, Mortality, Diagnosis, Pulmonary complication

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Introduction

COVID-19 disease, which quickly spread worldwide, affects many parts of the body, especially the respiratory system, and can result in death [1]. According to the data of the World Health Organization published in April 2021, more than 130 million people have been infected with the disease, and globally, nearly 3 million people died. In the USA, where the highest number of cases is seen, over 30 million people were affected by the disease to date. In Turkey, the virus has been reported in 4 million cases, of which 34,000 have resulted in mortality. The COVID-19 pandemic remains a serious problem threatening the human health worldwide [2]. The COVID-19 disease causes pneumonia by affecting the respiratory system. Although COVID-19 pneumonia and community-acquired pneumonia (CAP) have some clinical similarities, their causative agents and treatments differ. Severe respiratory failure and clinical conditions related to infection are observed in both diseases [3]. SARS-CoV-2, the agent of COVID-19 pneumonia, is highly contagious; therefore, patients with this disease are treated in isolation. In addition, admitting patients with CAP to the isolated area reserved for COVID-19 cases should be totally avoided due to the risk of super-infection. Thus, it is very important to differentiate between COVID-19 pneumonia and CAP for the effective treatment and management of these diseases [4, 5].

The diagnosis of COVID-19 disease is confirmed using the reverse-transcription polymerase chain reaction (RT-PCR) test. However, RT-PCR alone is not sufficient to diagnose COVID-19 pneumonia [6, 7], as additional laboratory tests are valuable in PCR-negative patients and those that cannot undergo radiological imaging. In patients with COVID-19, there may be an increase in C-reactive protein (CRP) and an increase or decrease in white blood cell (WBC) count. It has been suggested that changes in laboratory values are associated with the severity of the disease which can be accompanied by bacterial infections [8, 9].

The number of studies comparing the characteristics of CAP and COVID-19 pneumonia is limited. Our aim in this study was to compare the clinical and laboratory characteristics of patients diagnosed with COVID-19 pneumonia and those with CAP to determine the differences between the two groups.

Materials and methods

Study design and population

The study was conducted retrospectively by screening patient files in a tertiary hospital and initiated after obtaining approval from the clinical research Ethics Committee of the Adıyaman University (no: 2021/03-7 date: 16/03/2021). No informed consent forms were obtained due to its retrospective nature.

The study started in April 2020 considering that the first case of COVID-19 pneumonia in Turkey was reported in March 2020 [2]. The study included patients that presented to the emergency department and were hospitalized with the diagnosis of COVID-19 pneumonia over a nine-month period from April to December 2020. Then, patients that were hospitalized due to CAP over the same period in 2019 were identified. Age, gender, length of hospital stay, clinical outcome (mortality and recovery), comorbidities [chronic obstructive pulmonary disease (COPD), hypertension, stroke history, coronary artery disease (CAD), congestive heart failure (CHF), diabetes mellitus (DM), chronic kidney disease (CKD), and malignancy history, laboratory data, including WBC, CRP, platelet, albumin, urea and creatinine values were obtained from the hospital archive and recorded in a form prepared by the researchers. The patients were evaluated in two groups, as those with COVID-19 pneumonia and CAP. The differences were investigated by statistically comparing the characteristics of the patients. In addition, the patients in the COVID-19 pneumonia group were further divided into two subgroups as those that died (mortality) and those that recovered (recovery). The clinical and laboratory characteristics of these patients, which had been recorded previously, were examined to explore factors affecting mortality.

Outpatients were not included in the study. COVID-19 pneumonia group included patients whose diagnoses were confirmed by a PCR test only. The scientific committee suggests hospitalization for patients with COVID-19 based on the presence of one or more of the following criteria: Fingertip oxygen saturation <92%, CRP >10 mg/dL, D-dimer >1,000 ng/ml, and bilateral diffuse involvement (>50%) in radiological imaging. These are the basic hospitalization criteria included in the COVID-19 guidelines, which are constantly updated with additions and omissions when necessary [10]. Our study included patients hospitalized based on any one or more of these criteria. The CAP group included all patients hospitalized with a diagnosis of CAP between April to December 2019, and microbiological agents were not investigated.

To avoid selection bias, the patients were recruited consecutively. Additionally, the diagnoses of all patients were already standardized and definitively determined by quantitative criteria. All patients with specified diagnoses (ICD-10 codes: U07.3, J15, J17.0, J18.0, J18.1, J18.8, J18.9) within the specified period were included in the study. The data collection and analysis were performed by different persons.

Statistical analysis

SPSS software program was used for data analysis (Version 17). Kolmogorov-Smirnov test was used to assess the suitability of continuous data to normal distribution. Student's t-test was used to assess normally distributed data, while the Mann-Whitney U test was used for non-normally distributed data. Qualitative data were compared by the Chi-square test. Normally distributed numerical data were shown as mean (standard deviation), and non-normally distributed data were presented as median (min-max). Categorical variables were expressed as numbers and percentages. $P<0.05$ was considered statistically significant.

Results

A total of 882 cases comprising 755 with COVID-19 pneumonia and 127 with CAP were included in the study over a nine-month period. The mean age of all patients was 68.8 (15.9) years, 64.5% were over 65 years. While 26.6% of all patients died at the hospital, the rest were discharged with recovery. Hypertension, chronic arterial disease, DM, and COPD were the most common comorbidities (Table 1).

The mortality rate was 12.6% in the CAP group and 29% in the COVID-19 pneumonia group (P<0.001). The median age was 72 years in the COVID-19 group and 75 years in the CAP group (P=0.04). The ratio of females was higher (P=0.07) and the length of hospital stay was longer (P<0.001) in the COVID-19 group. The CRP level did not significantly differ between the two groups (P=0.113) while WBC, urea, creatinine, and platelet levels were significantly higher in the CAP group (P<0.001). The median albumin value was 3.2 in patients with COVID-19 pneumonia and 3.3 in those with CAP, indicating a statistically significant difference (P=0.049) (Table 1).

While the rate of COPD history was 52% among the patients in the CAP group, it was significantly lower (25%) in the COVID-19 pneumonia group (P<0.001). Stroke history was higher in the patients with CAP (P<0.001). Hypertension was present in 374 patients in the COVID-19 pneumonia group and 48 patients in the CAP group (P=0.014). Similarly, the rate of DM history was significantly higher among patients with COVID-19 (P=0.06). There was no significant difference between the two groups in terms of the rates of CAD, CHF, CKD, and malignancy history (Table 1).

Table 1: Comparison of the baseline characteristics, laboratory findings and comorbidities of the patients

Variables	All n=882	COVID-19 n=755	CAP n=127	*P*-value
Age	68.8 (16)	68.4 (15.5)	71.2 (18)	0.04
Female gender	396 (44.9%)	353 (46.8%)	43 (33.9%)	0.07
Died	235 (26.6%)	219 (29%)	16 (12.6%)	<0.001
Length of hospital stay	8 (1-68)	8 (1-68)	6 (1-38)	<0.001
Laboratory findings				
CRP (mg/dL)	8.1 (0.1-44.7)	7.9 (0.2-28.4)	9.2 (0.1-44.7)	0.113
WBC($\times10^9$/L)	8.4 (1.5-49)	8 (2.7-23.7)	12.6 (1.5-49)	<0.001
Albumin (g/dL)	3.2 (1.2-4.9)	3.2 (1.2-4.4)	3.3 (1.7-4.9)	0.049
Urea (mg/dL)	39 (11-280)	38 (13-128)	51 (11-280)	<0.001
Creatinine (mg/dL)	0.9 (0.4-8.7)	0.9 (0.5-8.7)	1.1 (0.4-3.8)	<0.001
Platelet ($\times10^9$/L)	202 (2-697)	196 (2-697)	246 (48-635)	<0.001
Comorbidities				
Chronic obstructive pulmonary disease	255 (28.9%)	189 (25%)	66 (52%)	<0.001
Hypertension	422 (47.8%)	374 (49.5%)	48 (37.8%)	0.014
Stroke history	121 (13.7%)	89 (11.8%)	32 (25.2%)	<0.001
Malignancy history	73 (8.3%)	60 (7.9%)	13 (10.2%)	0.386
Coronary artery disease	293 (33.2%)	254 (33.6%)	39 (30.7%)	0.516
Congestive heart failure	91 (10.3%)	72 (9.5%)	19 (15%)	0.063
Diabetes mellitus	281 (31.9%)	254 (33.6%)	27 (21.3%)	0.006
Chronic kidney disease	83 (9.4%)	71 (9.4%)	12 (9.4%)	0.987

CAP: community-acquired pneumonia, CRP: C-reactive protein, WBC: while blood cell

Among patients with COVID-19 pneumonia, age, length of hospital stays, and CRP, WBC, urea and creatinine levels were higher while the albumin and platelet levels were lower in the mortality subgroup (P<0.05). In addition, the mortality subgroup of COVID-19 pneumonia had higher rates of hypertension, stroke history, CAD, CHF, DM and CRF compared to the recovery subgroup (P<0.001) (Table 2).

Table 2: Characteristics of the patients with COVID-19 pneumonia according to patient outcome

Variables	Died (n=219)	Recovery (n=536)	*P*-value
Age	76 (40-92)	66 (23-104)	<0.001
Female gender	96 (43.8%)	257 (47.9%)	0.304
Length of hospital stay	10 (1-45)	8 (1-68)	0.002
Laboratory findings			
CRP (mg/dL)	9.5 (0.6-28.4)	7.5 (0.2-23.5)	<0.001
WBC($\times10^9$/L)	8.4(2.9-22.1)	7.6 (2.7-23.7)	0.003
Albumin (g/dL)	3 (1.2-4.4)	3.3 (1.4-4.4)	<0.001
Urea (mg/dL)	48 (19-125)	35 (13-128)	<0.001
Creatinine (mg/dL)	1.1 (0.5-8.7)	0.85 (0.5-7.4)	<0.001
Platelet ($\times10^9$/L)	186 (35-697)	201(2-688)	0.007
Comorbidities			
Chronic obstructive pulmonary disease	63 (28.8%)	126 (23.5%)	0.13
Hypertension	156 (71.2%)	218(40.7%)	<0.001
Stroke history	57 (26%)	32(6%)	<0.001
Malignancy history	21 (9.6%)	39 (7.3%)	0.286
Coronary artery disease	114 (52.1%)	140(26.1%)	<0.001
Congestive heart failure	51 (23.3%)	21(3.9%)	<0.001
Diabetes mellitus	99 (45.2%)	155(28.9%)	<0.001
Chronic kidney disease	42 (19.2%)	29 (5.4%)	<0.001

CRP: C-reactive protein, WBC: white blood cell

Discussion

The COVID-19 disease, which continues to spread unabated across the world, has highly infectious properties that can affect all parts of the body, especially the respiratory system [11]. There are not many studies in the literature on the differentiation of COVID-19 pneumonia and CAP [12, 13]. In the current study, in which we compared the clinical characteristics of COVID-19 pneumonia and CAP, we determined the mortality rate as 29% in the former, which was lower compared to the latter. Richardson et al. [14] reported that the mortality rate of patients hospitalized due to COVID-19 was 21%. In another study, Ciceri et al. [15] determined the mortality rate as 34% in COVID-19 pneumonia. In patients with CAP, the mortality rate is lower [16]. In contrast, there is also research showing no statistically significant difference in mortality rates between COVID-19 pneumonia and CAP [17]. Our results clearly revealed that COVID-19 pneumonia was more mortal, but we consider that the reason for the high mortality rates in both groups is that all patients had the severe form of pneumonia that required hospitalization.

There are not many studies comparing laboratory tests between CAP and COVID-19 pneumonia. Han et al. [18] found normal WBC values in 97% of the patients with COVID-19 pneumonia and high CRP levels in 99%. Zhou et al. [19] found no significant difference in albumin, urea, creatinine, and platelet counts between the two groups, while the patients with CAP were shown to have higher WBC and CRP counts. Tian et al. [17] reported that the patients with COVID-19 had lower WBC and CRP values compared to those with CAP. Similarly, Lin et al. [20] found that the WBC and CRP values were lower in the COVID-19 group compared to the CAP cases. This is in agreement with our finding indicating a higher increase in the number of WBC among the patients with CAP. However, in our study, no difference was observed in the CRP levels between the groups. In addition, unlike the study conducted by Zhou et al., we determined that the urea and creatinine levels and platelet counts were higher in the CAP group and the albumin level was lower in the COVID-19 pneumonia group. The high levels of urea and creatinine in CAP may be due to the use of CURB-65 criteria, which is based on urea and creatinine levels to determine hospitalization indication in this disease.

In a study conducted by Du et al. [21], a history of cerebrovascular disease and that of cardiovascular disease were emphasized as predictors of mortality and hospitalization in COVID-19 pneumonia. Zhou et al. [19] determined that the diseases accompanying COVID-19 pneumonia were mostly hypertension, CAD and DM in hospitalized patients while the rates of COPD and malignancy were higher in CAP. In contrast, they did not detect any difference between COVID-19 and CAP in terms of concomitant chronic diseases. Similarly, Lin et al. [20] found no difference in the comorbidities of the two types of pneumonia. In our study, while hypertension and DM were more common in the COVID-19 group, stroke history and COPD were more frequent among those with CAP.

In studies examining the relationship between COVID-19 pneumonia and mortality, the mortality rate is higher in COVID-19 pneumonia cases with comorbidities [22-24]. The rates of a history of HT, DM, CAD and CRF were significantly higher in the group that did not survive among the patients with COVID-19. In the same study, the WBC, urea and creatinine values were higher, and the albumin and platelet levels were lower in the mortality group [25]. Similarly, in our study, we observed that the rates of HT, stroke history, CAD, CHF, CRF and DM were higher in the mortality subgroup of COVID-19 pneumonia. In addition, age, length of hospital stays, and the WBC, CRP, urea and creatinine values were higher in the mortality subgroup compared to the recovery subgroup.

Limitations

The main limitation of this study concerns its retrospective and single-center design. In addition, all cases hospitalized with a diagnosis of pneumonia in 2019 were considered to be community-acquired without investigating of the possibility of a viral origin. All patients within the specified period were included in the study retrospectively. Therefore, an equality between the genders could not be ensured.

Conclusion

COVID-19 pneumonia has higher rates of mortality, female gender, hypertension and DM, and longer hospitalization period than CAP. Many laboratory values and the presence of comorbidities affected mortality among the patients with COVID-19 pneumonia. These results reveal that the mortality rate is high in patients with COVID-19 pneumonia, especially among those with more comorbidities; therefore, a detailed evaluation and close follow-up is required in this patient group.

References

1. Zhai P, Ding Y, Wu X, Long J, Zhong Y, Li Y. The epidemiology, diagnosis and treatment of COVID-19. Int J Antimicrob Agents. 2020;55(5):105955. doi: 10.1016/j.ijantimicag.2020.105955.
2. WHO Coronavirus (COVID-19) Dashboard. https://covid19.who.int/
3. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, et al. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST.
4. Olson G, Davis AM. Diagnosis and Treatment of Adults With Community-Acquired Pneumonia. JAMA. 2020;323(9):885-6. doi: 10.1001/jama.2019.21118.
5. Cellina M, Orsi M, Bombaci F, Sala M, Marino P, Oliva G. Favorable changes of CT findings in a patient with COVID-19 pneumonia after treatment with tocilizumab. Diagn Interv Imaging. 2020;101(5):323-4. doi: 10.1016/j.diii.2020.03.010.
6. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology. 2020;296(2):E32-E40. doi: 10.1148/radiol.2020200642.
7. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P et al. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. Radiology. 2020;296(2):E115-E117. doi: 10.1148/radiol.2020200432.
8. Zhang W. Imaging changes in severe COVID-19 pneumonia. Intensive Care Med. 2020;46:583–5. doi: 10.1007/s00134-020-05976-w
9. Cao W. Clinical features and laboratory inspection of novel coronavirus pneumonia (COVID-19) in Xiangyang, Hubei. MedRxiv (2020). doi: 10.1101/2020.02.23.20026963
10. https://covid19.saglik.gov.tr/TR-66301/covid-19-rehberi.html
11. Umakanthan S, Sahu P, Ranade AV, Bukelo MM, Rao JS, et al. Origin, transmission, diagnosis and management of coronavirus disease 2019 (COVID-19). Postgrad Med J. 2020;96(1142):753-8. doi: 10.1136/postgradmedj-2020-138234.
12. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-9. doi: 10.1001/jama.2020.1585.
13. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239-42. doi: 10.1001/jama.2020.2648.
14. 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(20):2052-9. doi: 10.1001/jama.2020.6775.
15. Ciceri F, Castagna A, Rovere-Querini P, De Cobelli F, Ruggeri A, Galli L, et al. Early predictors of clinical outcomes of COVID-19 outbreak in Milan, Italy. Clin Immunol. 2020;217:108509. doi: 10.1016/j.clim.2020.108509.
16. Lanks CW, Musani AI, Hsia DW. Community-acquired Pneumonia and Hospital-acquired Pneumonia. Med Clin North Am. 2019;103(3):487-501. doi: 10.1016/j.mcna.2018.12.008..
17. Tian J, Xu Q, Liu S, Mao L, Wang M, Hou X. Comparison of clinical characteristics between coronavirus disease 2019 pneumonia and community-acquired pneumonia. Curr Med Res Opin. 2020;36(11):1747-52. doi: 10.1080/03007995.2020.1830050.
18. Han R, Huang L, Jiang H, Dong J, Peng H, Zhang D. Early Clinical and CT Manifestations of Coronavirus Disease 2019 (COVID-19) Pneumonia. AJR Am J Roentgenol. 2020;215(2):338-43. doi: 10.2214/AJR.20.22961.
19. Zhou Y, Guo S, He Y, Zuo Q, Liu D, Xiao M, Fan J, Li X. COVID-19 Is Distinct From SARS-CoV-2-Negative Community-Acquired Pneumonia. Front Cell Infect Microbiol. 2020;10:322. doi: 10.3389/fcimb.2020.00322.
20. Lin YH, Luo W, Wu DH, Lu F, Hu SX, Yao XY, et al. Comparison of clinical, laboratory, and radiological characteristics between SARS-CoV-2 infection and community-acquired pneumonia caused by influenza virus: A cross-sectional retrospective study. Medicine (Baltimore). 2020;99(44):e23064. doi: 10.1097/MD.0000000000023064.
21. Yang HJ, Zhang YM, Yang M, Huang X. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2. Eur Respir J. 2020;56(3):2002439. doi: 10.1183/13993003.02439-2020.
22. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, et al. Diabetes is a risk factor for the progression and prognosis of COVID-19. Diabetes Metab Res Rev. 2020:e3319. doi:10.1002/dmrr.3319.
23. Yan Y, Yang Y, Wang F, Ren H, Zhang S, Shi X, et al. Clinical characteristics and outcomes of patients with severe covid-19 with diabetes. BMJ Open Diabetes Res Care. 2020;8(1):e001343. doi: 10.1136/bmjdrc-2020-001343.
24. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. China Medical Treatment Expert Group for Covid-19. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020;382(18):1708-20. doi: 10.1056/NEJMoa2002032.
25. 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):1054-62. doi: 10.1016/S0140-6736(20)30566-3.

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