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The use of CRP / albumin ratio as an indicator of severe COVID-19 disease in intensive care units

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Abstract

COVID-19 disease is an infectious disease that has been spriding worldwide. The effect of this disease is more severe in some people and as scuh coushing many deaths. CRP and albumin are biomarkers known to be associated with mortality in COVID-19 patients. In addition, it has many advantages such as its usage in many hospitals and providing relatively quick results. We aimed to test the diagnostic power of the CRP / Albumin ratio in indicating severe disease in this patient group. 174 patients hospitalized between March 30 and December 31 , 2020, were included in the study. The demographic data of the patients and CRP , albumin and CRP/Albumin ratio other laboratory results were recorded by scanning the patient files. Follow-up patients with and without invasive mechanical ventilation were grouped. In comparing between the groups, the rate of two or more comorbidities was higher in the patient group who received invasive mechanical ventilation support. While the CRP value was higher in these patients, the albumin value was lower. There is a statistically significant correlation between the CRP / albumin ratio and the application of invasive mechanical ventilation support. CRP and albumin are parameters that are widely considered in the COVID-19 patient group and evaluated in the laboratory in many hospitals. The test is relatively inexpensive and easy to apply.Serum levels can change for various reasons. As these biomarkers are used alone as indicators of mortality, the CPR / albumin ratio can be considered one of the early indicators of the need for invasive mechanical ventilation in the covid-19 patient group.

Keywords: Covid-19,CRP/albumin ratio,mechanical ventilation

Introduction

Coronavirus disease (COVID-19) is a highly contagious disease with a more severe clinical course in some patients and has a high mortality rate [1]. Covid-19 patients may develop acute inflammation, cytokine storm, septic shock, metabolic acidosis, hypoxia, and multiorgan failure, and these conditions can be life-threatening [2].Therefore, there is a need to detect new biomarkers to predict the severity of COVID-19 cases. The fact that these biomarkers are easy and accessible has an important place in the treatment of hospitals.

C Reactive protein (CRP) is an acute-phase reactant synthesized from the liver, and its very high levels are associated with inflammatory reactions. Besides, it has prognostic significance according to the underlying disease causes [3].

High levels of CPR are thought to be associated with respiratory distress or mortality in patients with covid 19 [4].

Albumin is a negative acute-phase reactant that makes up more than half of serum proteins [5]. The decrease in albumin level has prognostic importance in liver diseases and infections [6]. The CRP/Albumin ratio (CAR) is associated with severe illness and death in COVID-19 patients. The CRP/albumin ratio is more accurate than CRP alone in predicting 28-day mortality in people in critical conditions. [7].

Our study, we aimed to evaluate the diagnostic power of the CRP / albumin ratio in showing the need for invasive mechanical ventilation support in critically ill COVID 19 patients. This way, early differentiation of severe covid-19 patients hospitalized can be achieved.

Materials and Methods

The files of patients treated in our hospital's anesthesia intensive care units due to COVID 19 between 30 March and 31 December 2020 were reviewed. Patients with missing data were excluded

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from the study, and a total of 174 studies aged 18 years and over were included. Demographic data of the patients were obtained from the patient file. Afterward the patients were admitted to the intensive care unit, the results of laboratory examinations were recorded. Patients who did not receive IMV support were classified as Group 1 and patients who received IMV support as Group 2. The groups were compared statistically in terms of demographic data and laboratory results. Our study is retrospective, and Ordu University ethics committee approval (committee numbered 2021/52) was obtained.

The presence of compatible radiological findings for Covid 19 infection in the patients was reported by a radiologist. The diagnosis of covid 19 was made by detecting the polymerase chain reaction of the nucleic acid in the sample obtained from the respiratory tract of the patients.

The patients whose respiratory distress continued (with the respiratory rate (SS) >20 and oxygen saturation (spo2) <90) despite 5 lt/min 100% oxygen support (with a reservoir oxygen mask) were taken to the intensive care unit. Apart from this, patients who underwent emergency endotracheal intubation and received invasive mechanical ventilation support when they came to the emergency room were also taken to the intensive care unit.

Invasive mechanical ventilation practice criteria

Despite non-invasive assisted respiratory support therapies (HFNO or CPAP), IMV support was applied to patients with spo2<90 and SS>20. In addition, IMV support was applied to hemodynamically unstable patients.

Statistical analysis

SPSS v20 program was used in the analysis of the data collected. Categorical variables were presented as numbers and percentages, and numerical variables as mean and standard deviation. The distribution of categorical variables between groups was analyzed with the KI-Square test. The suitability of numerical variables to the normal distribution was investigated using the Kolmogorov-smirnov test and graphing method. Mann Whitney-U was used for comparisons of non-normally distributed numerical variables, and t-test was performed for those with normal distribution and homogeneous data. P<0.05 was considered statistically significant. Pearson correlation analysis was performed to examine the correlation of the data.

Results

50 of 174 patients in total are in group 1 and 124 of them are group 2 patients. 21 of the patients in group 1 were female, and this number was 49in group 2. The mean age was 69±10 in group 1 patients and 71±14 in group 2 ,and there was no statistical difference between the ages of the patients in the comparison between the groups. (p:0,59 (Table 1)). It was observed that 13 of 124 patients in group 2 were taken to the intensive care unit while under IVM support. All of the patients in Group 1 were discharged from the intensive care unit. Only 7 (5.6%) patients in group 2 were discharged from the intensive care unit. Other patients have lost their lives. Comorbidity features were similar in group 1 and group 2 patients. However, it was observed that the presence of two or more comorbidities was statistically higher in Group 2 patients (p:,0.01) (Table 1).

Table 1. Demographic characteristics and comorbid conditions of patients

	GROUP 1	GROUP 2	TOTAL	N	P
AGE	69±10	71±14	174	174	0.59
F/M	21/29	49/75	174	174	0.76
DURATİON AT THE HOSPİTAL (DAY)	14±18	11±9	174	174	0.78
DM	17	47	64	174	0.62
HT	34	94	128	174	0.29
CARDIOVASCULAR DISEASE	11	35	46	174	0.39
PULMONARY DİSEASE	8	31	39	174	0.19
CEREBROVASCULAR DISEASE	9	17	26	174	0.47
CHRONIC KIDNEY'S DISEASE	3	12	15	174	0.43
2 AND OVER DISEASES	25	86	111	174	0.01*

*parameters found to be statistically significant
F:Female M:Male DM:Diabetes Mellitu HT:Hypertensio

The albumin level was found to be statistically higher in Group 1 patients who did not receive IMV (p:0.01), and the ratio of CRP and CRP/Albumin was found to be statistically higher in Group 2 patients who received IMV support. (CRP, p:0.00) (CRP/Albumin ratio: p:0.00) (Table 2).

A positive correlation was observed between discharge from the intensive care unit and hospitalization duration (p: 0.032, r: 0.163). A positive correlation was observed between age and the presence of two or more diseases and IVM support administration. (P:0.008, r:0.202) and (p:0.016, r:0.182), respectively. A positive correlation was found between death and administration of IVM support (p:0.000, r:0.910).

The correlation relationship between parameters differing between groups and IVM support is shown in Table 3.

Table 2. Comparison of the laboratory results of the groups

	GROUP 1		GROUP 2		P
	Mean±SD	**N**	**Mean±SD**	**N**	
Albumin g/dl	3.2±0.3	50	3.0±0.4	122	0.01*
ALT IU/l	41±61	50	43±26	124	0.00*
AST IU/l	40±68	50	28±16	124	0.41
GGT IU/l	35±22	35	67±69	79	0.16
ALP IU/l	66±	26	92±45	56	0.08
T Protein mg/dl	6±0.6	34	7±0.8	86	0.02*
LDH IU/l	331±145	40	432±188	95	0.00*
Lökositcells/mm³	11±4	50	11±5.6	124	0.53
Nötrofilcells/mm³	9.7±4.4	50	10±4.9	124	0.13
Lenfositcells/mm³	0.8±0.3	50	0.7±0.4	124	0.04*
Hgb gr/dl	11.6±1.4	50	12.0±1.6	124	0.59
Rbcfl	4.1±0.6	50	4.1±0.5	123	0.69
Pltcells/µl	291±119	50	212±82	124	0.04*
MPVfl	10.1±0.8	50	10.5±1.3	122	0.00*
D-Dimerng/ml	1958±2067	50	1634±1849	124	0.07
CRP mg/l	91±64	50	146±87	124	0.00*
CRP/albümin	2.8±2.1	50	4.9±3.1	122	0.00*
Ferritin ng/ml	613±631	49	753±503	122	0.01*
Prokalsitonin ng/ml	0.84±2.4	47	3.2±1.3	116	0.00*
IGA ng/ml	2.5±0.9	44	2.6±1.2	113	0.30
IL 6 ng/ml	154±487	46	213±301	119	0.00*

*parameters found to be statistically significant
ALT: Alanine aminotransferase, AST: Aspartate Aminotransferase, GGT: Gamma Glutamyl Transferase, ALP: Alkaline phosphatase, T Protein: Total protein, LDH: Lactate dehydrogenase, Hgb: Hemoglobin, Rbc: Red blood cell, Plt: Platelet, Mpv: Mean platelet volume, CRP: C Reactive Protein, IGA: immunoglobulin A, IL6: Interleukin-6

A positive correlation was found between CRP and death (p:0.00; r:0.21). There was no correlation between albumin and death (p:0.14; r:0.11). A positive correlation was found between CRP/ albumin ratio and death (p:0.00; r:0.21).

Table3. Comparison of the laboratory results of the groups

	Person's correlation coefficient	P value
Albumin	**-0.150**	**0.05**
Total protein	0.074	0.42
LDH	0.285	0.00
PLTCELLS	-0.176	0.02
MPV	-0.08	0.29
CRP	0.234	0.00
CRP/albümin	0.242	0.00
Ferritine	0.159	0.03
Procalsitonin	0.166	0.03
IL6	0.109	0.16

Discussion

Considering the prevalence of Covid-19 disease and the number of deaths, it is of great importance to identify mortality-related factors and biomarkers , even more ,to recognize them early. In addition to being influential in determining the factors associated with mortality, there must be parameters that are easily accessible and do not cause waste of resources. CRP and albumin are tests that can be studied in many hospitals while being easily accessible. Apart from this, with the covid 19 pandemics, the need for mechanical ventilation has increased in many parts of the world. It may be helpful to anticipate the patients who may need a mechanical ventilator in advance procure and prepare the mechanical ventilator.

It is known that CRP increases mainly secondary to bacterial infections. However, it can also increase viral infections [8]. Previous studies have shown that patients with severe COVID-19 are more likely to have higher levels of CRP [9-14]. Symptoms of lung infection were more severe in patients with high CRP levels. In addition, the possibility of developing acute kidney injury and cardiac damage was found to increase in patients with high CRP levels. Along with these indicators, the CRP level has been identified as a biomarker for mortality [15]. In our study, similar to these studies, CRP levels in Group 2 patients were found to be high.

The albumin level was thought to be lower in individuals with COVID-19 infection [9]. Also some studies show that albumin levels are low in individuals with severe Covid-19 disease [9-16]. In our study, similar to these studies, it was found that the albumin level in Group 2 patients was low.

CRP / albumin ratio has been used as an indicator of prognosis in various diseases [17,18]. Xueve et al. They grouped 114 covid 19 patients as mild, moderate, and severe disease and showed that the high-sensitivity CRP / albumin ratio correlated with the risk of severe disease [19]. Shabrawy et al. In their study, 116 patients were divided into two groups as severe and severe patients, and the CRP / albumin ratio was shown to be an independent risk factor for the 30-day mortality rate in COVID-19 patients [20].

The CRP/albumin ratio in individuals with COVID-19 infection is considered a risk factor for mortality along with previous studies [20]. In our study, the CRP / albumin ratio was higher in patients who received IVM support than in the other group. Critical intensive care patients were evaluated in this study , and a relationship was found between CRP, CRP / albumin and albumin and IVM support. However, the superiority of CRP / albumin ratio to CRP and albumin could not be demonstrated. This may be because that we only included critical intensive care patients in our study.

A positive correlation was found between CRP and CRP / albumin ratio and death. No correlation was found between albumin and death. CRP and CRP/albumin ratio can be used as an early warning parameter for the need for IMV support as well as a mortality indicator.

Conclusion

Our study found a relationship between CRP, CRP / albumin, albumin and IVM support in critical ICU errors infected with covid. We think that CRP, CRP / albumin, and albumin may effectively predict the need for IVM support. Apart from that, we found a positive correlation between CRP and CRP / albumin ratio and death. CRP and CRP / albumin ratio may indicate mortality in critical intensive care patients infected with covid. More studies are needed.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Ordu University ethics committee (committee number 2021/52).

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