

Role Of Common Laboratory Markers In Estimating The Duration Of Hospital Stay In COVID-19 Patients

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ABSTRACT

Background: COVID-19 pandemic hit the world in 2019 and its successive waves have created high alerts periodically across many nations including India. At the time of successive waves of the COVID-19 pandemic, one of the key concerns among developing nations was to manage the patient burden in hospitals with limited available infrastructure.

Objective: In the present study we have analysed the role of common laboratory markers as a predictor of hospital stay in COVID-19-positive patients so that hospital resources can be managed efficiently.

Methods: We studied the data of 200 COVID-19-positive patients for TLC, LDH, D-dimer, and serum ferritin and analysed their correlation with hospital stay

Results: TLC and LDH exhibit a positive correlation with hospital stay whereas D-dimer and serum ferritin showed a negative correlation with hospital stay among COVID-19 patients. Patients with a negative CRP showed a longer duration of hospital stay with a median stay of 9 days.

Conclusion: Being a developing nation, healthcare centres in India have limited resources. In such a scenario, common laboratory markers can prove to be a promising tool in managing hospital resources by estimating the hospital stay of patients.

Keywords: D-Dimer, COVID-19, hospital stay, ferritin, pandemic

Introduction

Globally, the COVID-19 pandemic has grown considerably. According to data released by John Hopkins University, more than 13 million individuals had contracted COVID-19 by July 13, 2020, and over 500,000 had died as a result ^[1]. According to official data published by the Union Ministry of Health and Family Welfare, 10.7 million confirmed cases have been recorded in India, out of which 10.3 million persons have recovered. Additionally, over 154,428 fatalities have been documented. On January 30, 2020, India reported its first COVID-19 case ^[2]. Despite being better controlled in India, COVID-19 prevalence is still growing globally.

To stratify high-risk patients, the scientific community urgently needs trustworthy COVID-19 biomarkers. To guarantee the best use of available resources, patients must be immediately

divided into risk categories after being diagnosed due to the rapid spread of this disease. To risk stratify those individuals having a more severe progression of the disease with a higher incidence of morbidity and mortality, novel biomarkers are required. Utilizing efficient biomarkers might enable hospitals to better manage their limited resources^[3].

Hospital stay is an important parameter in decision-making regarding the limited hospital resources in low-income countries. By estimating the hospital stay of a patient, the planning of further resource allocation to other patients could be made. For now, there is a lack of biomarkers that can decide the hospital stay of COVID-19 patients. Also, the biomarkers need to be cost-effective as the huge cost cannot be afforded by the patients and hospitals in low-income countries. In the present study, we performed a retrospective analysis of COVID-19 cases from a designated tertiary care hospital in the northern region of India to investigate the association between common laboratory indicators and the duration of hospital stay in COVID-19 patients admitted there.

Material and Methods

It was a retrospective study of 200 patients admitted to the host institute with Covid, with 100 subjects from the period of August 2020 to December 2020 in the first wave of Covid and 100 subjects from March 2021 to July 2021 in the second wave of Covid. We obtained clinical and laboratory information, including that of certain important laboratory markers like C-reactive protein (CRP), D-dimer, lactate dehydrogenase (LDH), serum ferritin, and total leukocyte count (TLC), and their progress from hospital records. Patients in the vicinity of the host institute with more than 18 years of age and either sex were included in this retrospective research. According to the WHO interim recommendations, a real-time RT-PCR assay was used to confirm the diagnosis in all cases using samples from nasal and pharyngeal swabs^[4]. Patients admitted and positive for Covid by RT-PCR and who were symptomatic or asymptomatic were included in the study whereas immune-compromised patients were excluded from the study.

Data collection

We gathered data on demographics, epidemiology, clinical care, laboratory testing, and hospital stays. To retrieve medical information, a standardized case report form was employed. Electronic medical records were used to extract the epidemiological traits, clinical symptoms and signs, and laboratory findings at the time of the initial hospital admission. TLC, LDH, D-dimer, serum ferritin, and CRP were among the laboratory tests performed.

Statistical analysis

Mean and standard deviation were used to analyse the age of patients. Pearson correlation was used to analyse the correlation between a hospital stay and TLC, LDH, D-dimer, and serum ferritin. Kaplan survival curve was used to analyse the association of CRP with hospital stay.

Results

The mean age of the patients was 52.41 ± 16.10 years with a male-to-female ratio of 1.50. The mean TLC was 8561 ± 3988 , the mean D-dimer was 2049 ± 1706 , the mean LDH was 584.6 ± 344.5 , and the mean serum ferritin was 418.3 ± 375.8 . The mean hospital stay was 9.729 ± 7.594 days. Correlation analysis of the hospital stay with TLC revealed a positive correlation with $r=0.10$ and a p-value of 0.174 (Table 1 and Figure 1). LDH also exhibited a positive correlation with hospital stay with $r=0.02$ and p value 0.894 (Table 1 and Figure 2). A negative correlation was found between the hospital stay and D-dimer with $r=-0.20$ and a

p-value of 0.111 (Table 1 and Figure 3). Serum ferritin also exhibited a negative correlation with the hospital stay with $r=-0.06$ and a p-value of 0.890 (table and Figure 4). Patients with a negative CRP exhibited a longer duration of hospital stay with a median duration of 9 days (Figure 5).

Table 1: Correlation of hospital stay with TLC, LDH, D-Dimer and serum ferritin

Correlation Groups	Correlation coefficient (r)	P value
Hospital stay Vs TLC	0.10	0.174
Hospital stay Vs LDH	0.02	0.892
Hospital stay Vs D-Dimer	-0.20	0.111
Hospital stay Vs Serum Ferritin	-0.06	0.890

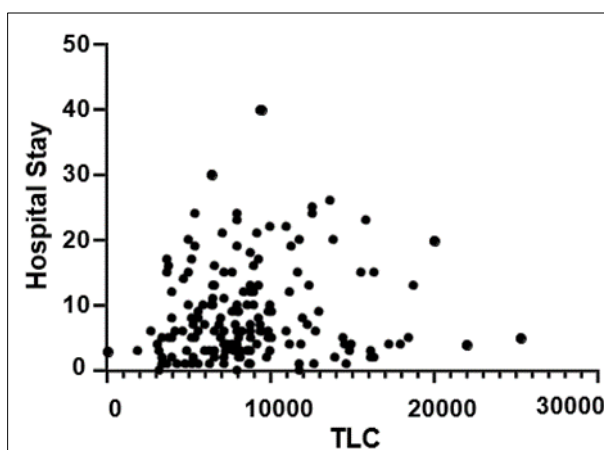


Fig 1: Correlation of hospital stay with TLC.

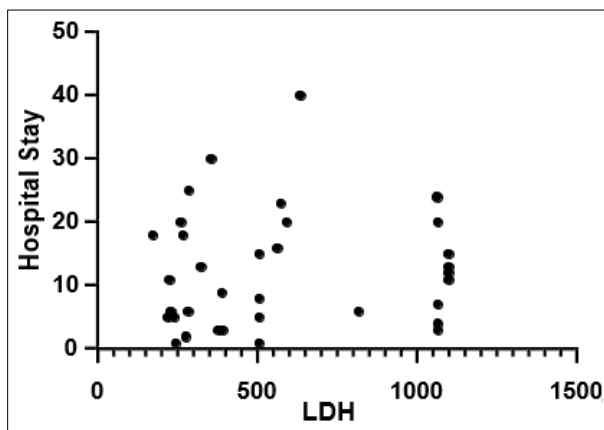


Fig 2: Correlation of hospital stay with LDH.

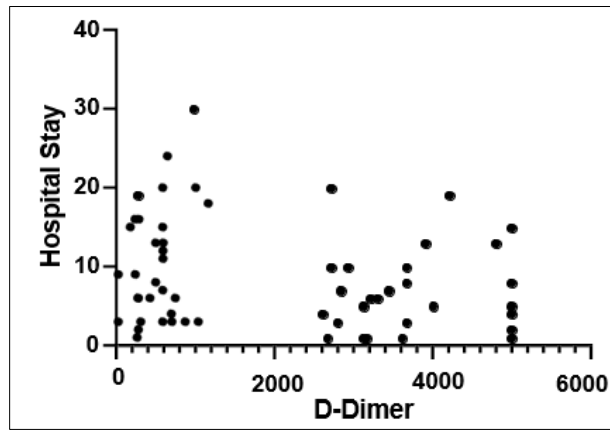


Fig 3: Correlation of hospital stay with D-Dimer.

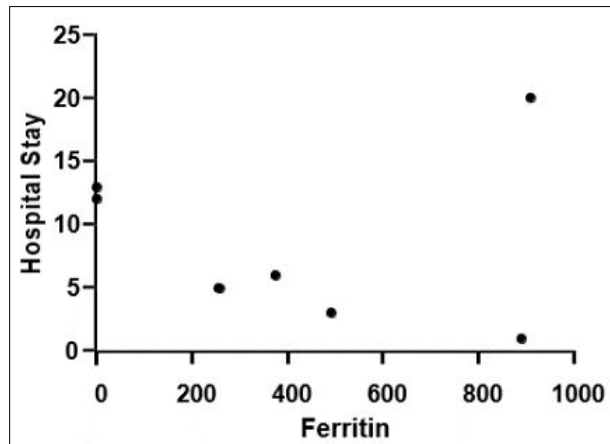


Fig 4: Correlation of hospital stay with serum ferritin.

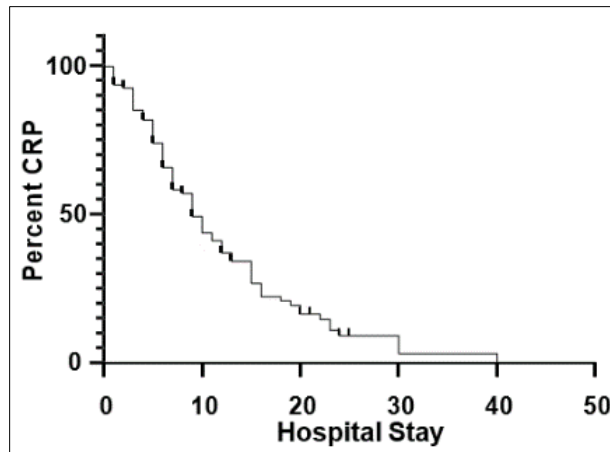


Fig 5: Correlation of hospital stay with CRP.

Discussion

This study showed that the laboratory indicators upon admission were related to the number of days COVID-19 patients spent in the hospital. LDH was discovered to be a reliable predictor of severity and mortality of COVID-19 individuals with various medical problems in a prior investigation ^[1]. In individuals with hypertension, the inflammatory marker CRP has previously been reported to be a risk factor for short-term mortality, but not liver disease. In patients with liver disorders, the coagulation system marker D-dimer has previously been proven to be an independent risk factor for mortality ^[1]. These findings imply the existence of

numerous pathophysiological processes following COVID-19 infection and the necessity of individualized care based on each patient-specific medical need to lower the mortality risk.

Patients with various medical disorders, such as hypertension, diabetes, and liver illnesses, had a bad prognosis when high levels of LDH were present. Patients with COVID-19 in China and Iran showed increased LDH, which has been linked to disease severity^[5, 6]. Additionally, both Chinese and North American patients with COVID-19 infection had bad prognoses when their prealbumin levels were low. Because patients with severe COVID-19 infection had low prealbumin levels, nutritional supplementation may be crucial for supportive care during COVID-19 infection^[7].

Previous research has shown a relationship between CRP and D-dimer and disease severity or mortality^[8-12]. D-dimer elevation was linked to disease severity and death in COVID-19 patients because it enhanced the possibility of pulmonary embolism^[8, 13-16]. The information showing that higher D-dimer levels were concurrent with an increase in inflammatory indicators (such as CRP), supported the theory that a serious inflammatory response eventually stimulated coagulation and thrombin production. Since the liver is where most coagulation factors, anticoagulants, and fibrinolytic proteins are produced, hepatic dysfunction may make the thrombotic microangiopathy and microcirculatory impairment brought on by the endothelial cell damage worse. Contrary to cytokine storm, coagulation problems may play a significant role in COVID-19 patients with liver disease^[11]. In our study, D-dimer was found to be negatively related to the hospital stay and patients with a negative CRP exhibited a longer duration of hospital stay with a median duration of 9 days. These results indicated that the comorbidities might aggravate the inflammatory response to COVID-19 infection, leading to a longer hospital stay.

In early studies from India, the mean length of hospital stay was seen to be 17 to 24 days^[17, 18]. In the study by Thiruvengadam *et al.* from south India, the existence of more than two comorbidities, oxygen saturation, LDH, ferritin, D-dimer, and neutrophil-lymphocyte ratio were the most significant variables that affected the length of hospital stay^[8].

This study has some drawbacks. We lacked information on the qPCR Ct value to determine the viral loads to evaluate the severity of the condition. Future research should clarify the connection between the markers and viral loads to better comprehend this. With the limited sample size, the results of the present study cannot be generalized. A machine learning model which uses a multivariate approach by combining all-laboratory markers could be useful in predicting the hospital stay among COVID-19 patients.

Conclusion

In the present study, we found that TLC and LDH exhibit a positive correlation whereas D-dimer and serum ferritin showed a negative correlation with hospital stay among COVID-19 patients. Although the laboratory indicators are non-specific, the use of certain biomarkers in COVID-19 could be helpful in estimating the hospital stay for efficient management of hospital resources. Being a developing nation, the healthcare centres in India have limited resources. In such a scenario, common laboratory markers can prove to be promising in managing hospital resources by estimating the hospital stay of patients.

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Declarations

Ethics approval and consent to participate: All procedures were performed strictly according to the standard protocol of the department. Written informed consent was obtained from the patient or their relatives. The present study has been approved by the institute ethics committee of Maharishi Markandeshwar Medical College and Hospital (MMMC & H), Kumarhatti-Solan, HP.

Consent for publication: Written informed consent was obtained from all the authors to publish this case research article.

Availability of data and material: The manuscript has no additional data.

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