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Original Research Article

Beyond Symptoms: Unraveling the Biochemical Variations in Mild and Severe COVID-19 Patients

Neelam Patil[1], Vibha Sakhare[2]

[1]Department of Biochemistry, Topiwala National Medical College & B.Y.L Nair Ch. Hospital, Mumbai
[2]Department of Biochemistry, All India Institute of Medical Sciences, Nagpur

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Corresponding author: Dr. Neelam Patil
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Abstract:

Background: The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has presented an unprecedented global health challenge. While the spectrum of clinical manifestations ranges from asymptomatic to severe and life-threatening, understanding the factors that drive disease severity remains a critical and complex problem. The identification of reliable biochemical markers that can distinguish between mild and severe cases of COVID-19 is essential for early intervention, risk stratification, and informed clinical decision-making. This research seeks to address the following key research problem.

Objective: To study biochemical parameters in mild and severe patients of COVID-19 infection. Material and Methods: This retrospective study was conducted using data collected from a tertiary care hospital in Mumbai, India, during the period of March to June 2021. The study population consisted of 100 adult patients (≥18 years of age) who tested positive for COVID-19 using Reverse Transcription Polymerase Chain Reaction (RT-PCR). Patients who did not require hospital admission were excluded from the study. Patients were grouped into 2 groups; mild (n=50) and severe (n= 50).

Results: The biochemical parameters were compared in group-1 and group-2. Group-2 patients showed significantly higher levels of total bilirubin (< 0.0001), aspartate transaminase (p< 0.0001), alanine transaminase (p< 0.0001), alkaline phosphatase (p< 0.03) total proteins (p< 0.02), serum albumin (p< 0.005), serum urea (p< 0.007), serum creatinine (p< 0.0001), lactate dehydrogenase (p< 0.0001) and random blood sugar (p< 0.007).

Conclusion: Our study's findings provide valuable insights into the biochemical markers associated with COVID-19 severity. These markers can help clinicians identify severe cases early, tailor treatment strategies, and monitor organ functions during the course of the disease.

Keywords: COVID-19, total bilirubin, Aspartate transaminase, Alanine transaminase, Lactate dehydrogenase.

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Introduction

In the wake of the 21st century's most formidable global health crisis, the COVID-19 pandemic has left an indelible mark on the world. Since its emergence in late 2019, this novel coronavirus, SARS-CoV-2, has relentlessly challenged the resilience of nations, healthcare systems, and individuals alike. With its rapid transmission, debilitating symptoms, and persistent mutations, COVID-19 has prompted an unprecedented level of scientific inquiry, public health response, and societal adaptation. Amidst the relentless waves of the COVID-19 pandemic, a critical question has emerged: what biochemical markers distinguish mild cases from severe ones? As we grapple with the far-reaching impact of the virus, identifying these markers could provide vital insights into early intervention and risk stratification.

In this article, we embark on a comprehensive exploration of biochemical markers that shed light on COVID-19 severity, drawing comparisons between mild and severe cases. By scrutinizing the intricate interplay of molecules within the human body, we aim to uncover potential predictive indicators of disease progression. Our investigation delves into the intricate world of biomolecules, offering a glimpse into the scientific frontiers that may hold the key to managing and combating the pandemic's most severe outcomes.

Materials & Methods

Study Design: This retrospective study was conducted using data collected from a tertiary care hospital in Mumbai, India, during the period of March to June 2021.

The study population consisted of 100 adult patients (≥18 years of age) who tested positive for COVID-19 using Reverse Transcription Polymerase Chain Reaction (RT-PCR). Patients

who did not require hospital admission were excluded from the study. The remaining patients, stratified based on the severity of their illness, were categorized into two groups: those with mild to moderate illness requiring ward hospitalization and those with severe illness necessitating intensive care unit (ICU) care.

Data Collection: Patient data, including demographic information, clinical characteristics, and laboratory results, were collected from the hospital's Laboratory Information System (LIS) database. The following data were obtained:

Demographic Information: Age, gender, and other relevant demographic details were recorded to characterize the study population.

Clinical Data: Clinical information, including symptoms and clinical presentations, was collected from patient records. Details of hospitalization, including duration and ICU admission, were documented.

COVID-19 Testing: Oropharyngeal and nasopharyngeal samples were collected from all patients upon their first day of hospitalization.

These samples were subjected to RT-PCR analysis for the diagnosis of COVID-19.

Laboratory Investigations:

Laboratory data of random blood sugar, total bilirubin, aspartate transaminase, alanine transaminase, total proteins, serum albumin, serum urea, serum creatinine, Lactate dehydrogenase were extracted from the LIS. The investigations were performed on Beckman Coulter AU680 Clinical Chemistry Analyzer.

Statistical Analysis:

Statistical analysis was performed using IBM SPSS v.16.0 statistical software to analyze the collected data. P value was calculated.

Results

Table 1: Demographic profile of patients with COVID 19 (n=100)

Demographic profile	Group I (mild cases)	Group II (severe cases)	P value
	n=50	n=50	
Age	42 + 8.4	56 + 12.6	< 0.0001***
Gender (Males)	23(46%)	29(58)	

Table 2: Laboratory parameters of patients with COVID 19 (n=100)

Laboratory Parameters	Group I (mild cases)	Group II (severe cases)	P value
	n=50	n=50	
Total Bilirubin	0.9 + 0.1	1.6 + 0.4	< 0.0001***
Aspartate Transaminase	52 + 0.4	112 + 0.6	< 0.0001***
Alanine Transaminase	64 + 0.9	109 + 1.2	< 0.0001***
Alkaline Phosphatase	143 + 97.3	183+ 84.9	< 0.03*
Total Proteins	6.2 + 0.9	5.6 + 1.6	< 0.02*
Serum Albumin	3.8+ 1.9	2.7+ 1.6	< 0.005**
Blood Urea Nitrogen	18 + 0.7	18.5+ 1.1	< 0.007**
Serum Creatinine	1.6 + 0.7	2.8 + 1.1	< 0.0001***
Lactate Dehydrogenase (U/L)	312 + 114.2	516 + 97.2	< 0.0001***
Random Blood Sugar (mg/dl)	162 + 83.7	201+ 56.7	< 0.007**

*p< 0.05(statistically significant); **p < 0.01 (statistically more significant); ***p < 0.001 (statistically most significant)

Discussion

The comprehensive analysis of biochemical markers in mild and severe COVID-19 patients provides valuable insights into the pathophysiological mechanisms and clinical implications of the disease. This study's findings reveal significant differences in several key biochemical parameters between these two patient groups. We discuss the implications of these differences and reference other relevant studies to provide a broader context for our results. Elevated total bilirubin levels in severe COVID-19 cases are consistent with observations of liver involvement in the disease. The liver is a crucial site for bilirubin metabolism. Increased bilirubin levels in severe cases might result from direct viral damage to hepatocytes, systemic inflammation, or drug-induced liver injury. Studies by Bangash et al. and Zhang et al. support our findings, highlighting the relationship between elevated total bilirubin levels and COVID-19 severity [1,2]. The significant elevation of AST and ALT in severe cases is indicative of liver damage, consistent with previous research. Liver injury in COVID-19 may result from viral replication in liver cells, systemic inflammation, or drug hepatotoxicity [3,4]. A study by Zhang C et al. reported similar elevations in AST and ALT in severe COVID-19 patients. Although ALP levels are elevated in severe cases, the difference did not reach statistical significance ($p < 0.03$). ALP is a marker of liver and bone conditions, and the modest increase might be

related to hepatic dysfunction or other underlying factors. Further investigation is needed to explore the role of ALP in COVID-19 severity. A study by Zhang et al. found a similar trend in ALP levels. The lower total protein and serum albumin levels in severe cases suggest malnutrition and decreased protein synthesis. COVID-19's hyper inflammatory state and increased metabolic demands might contribute to these changes. Studies by Li et al. and Wu et al. reported analogous decreases in total protein and albumin in severe COVID-19 patients [4,5]. Elevated BUN and serum creatinine levels in severe cases are indicative of kidney impairment, a common feature of severe COVID-19 [8]. Kidney dysfunction might result from direct viral effects, cytokine storm, or microvascular thrombosis. Similar results were reported by Cheng et al. and Hirsch et al., linking kidney dysfunction with severe COVID-19 [6,7]. The significant elevation of LDH in severe cases underscores tissue damage and correlates with disease severity, as reported in previous studies. LDH is a marker of cell injury, and its increase might reflect widespread tissue damage in severe COVID-19. A study by Qin et al. also found higher LDH levels in severe COVID-19 patients [8,9]. Elevated RBS in severe cases is in line with stress-induced hyperglycemia observed in severe illnesses. High blood sugar levels can worsen outcomes in COVID-19 patients.

A study by Zhu et al. reported a similar association between RBS and COVID-19 severity [10]. The observed biochemical changes in severe COVID-19 can be attributed to the virus's multi-organ effects and the host's inflammatory response. Direct viral invasion of liver and kidney cells, cytokine storm, and microthrombosis contribute to organ dysfunction [11]. Additionally, systemic inflammation can lead to malnutrition, affecting protein synthesis and glucose metabolism. The data clearly demonstrates that several biochemical markers show significant differences between mild and severe COVID-19 cases. Total Bilirubin, Aspartate Transaminase (AST), and Alanine Transaminase (ALT) are substantially elevated in severe cases. Alkaline Phosphatase (ALP) shows a moderate increase. These markers can serve as early indicators of severe disease. Health care providers can use these markers to identify patients at risk of deterioration, allowing for timely intervention and monitoring. The study's findings provide a basis for risk stratification. This stratification can guide triage and resource allocation in healthcare settings, ensuring that severe cases receive appropriate care. The observed differences in Serum Creatinine, Blood Urea Nitrogen, and Lactate Dehydrogenase (LDH) levels between mild and severe cases emphasize the importance of monitoring organ function during treatment. Elevated levels of these markers may indicate worsening kidney and lung function. Continuous monitoring can help healthcare teams adjust treatment strategies as needed. This study opens avenues for further research. Investigating the mechanisms underlying these biochemical changes in COVID-19 can provide insights into the disease's pathophysiology. Additionally, exploring the predictive value of these markers for long-term outcomes, such as post-COVID complications, is essential.

Conclusion

In conclusion, the biochemical markers identified in this study offer a valuable tool for early identification, risk stratification, and personalized management of COVID-19 cases. They can improve patient outcomes, guide treatment decisions, and contribute to public health efforts in controlling the pandemic. However, cautious interpretation and further research are crucial to maximize their clinical utility.

Limitations: While the study provides valuable insights, it's essential to acknowledge its limitations. The data represents a snapshot in time and may not capture the dynamic nature of COVID-19. The study's sample size and population demographics should be considered. Additionally, the findings should be validated in diverse populations and settings before widespread clinical implementation.

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