

Original Research Article

Blood biochemical abnormalities of intensive care unit patients with SARS-CoV-2 infection, single center experience in Bangladesh

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ABSTRACT

Background: Since its emergence, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread worldwide, and led to ever-increasing mortality. SARS-CoV-2 infection perturbs the function of the body's vital organs, making patients of all ages susceptible to the disease. Nevertheless, individuals developing critical illness with poor outcomes were mostly the elderly and people with co-morbid conditions, who constituted the vast majority of coronavirus disease 2019 (COVID-19) fatalities. Complications of COVID-19 mostly involve the respiratory, renal and cardiovascular systems, and in severe cases secondary infections leading to pneumonia and acute respiratory distress syndrome, which may precede the death of the patient. Multi-organ failure in individuals with COVID-19 could be a consequence of their co-morbidities. It is hoped that the review will lead to more comprehensive understanding of this complex disease. The aim of the study was to evaluate biochemical abnormalities during SARS-CoV-2 infection of ICU patients.

Methods: This observational study was conducted in Square Hospital Limited, Dhaka, Bangladesh, on 50 patients received ICU treatment with moderate to severe COVID-19 symptoms admitted to this hospital from 15 July to 15 September 2020.

Results: Among the participants most of them were 19 (38%) belongs to 65-74 years age group male 38 (78.00%) were dominating the gender distribution. IL6, CRP, creatinine and troponin were found the most significant in biochemical blood parameters. The maximum level of comorbidity was observed due to diabetes mellitus, ischemic heart disease, and hypertension.

Conclusions: Biochemical parameters may be used as an indicator of COVID-19 infections and the severity of ICU patients. For the consistency of the course of patients, the markers could be used.

Keywords: Biochemical, SARS-CoV-2, ICU, COVID-19

INTRODUCTION

The severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2), which belongs to the Coronaviridae family, causes a highly transmittable acute respiratory disease, defined by the WHO as Coronavirus disease 2019 (COVID-19). The first cases of COVID-19 were detected in Wuhan, Hubei Province, People's Republic of China, at the end of 2019. Since then, the illness spread rapidly

around the country and the world reaching a pandemic level.¹ On 30 January 2020, the WHO declared the outbreak of COVID-19 to be a "public health emergency of international concern". The Coronaviridae family consists of enveloped, single positive-strand RNA viruses classified in four sub-groups: α -coronavirus (α -COV), β -coronavirus (β -COV), δ -coronavirus (δ -COV) and γ -coronavirus (γ -COV); SARS-CoV-2 is a β COV.² Among β -COV, SARS-CoV and the Middle East Respiratory

Syndrome Coronavirus (MERS-CoV) are highly pathogenic viruses, which represented a public concern over the past two decades causing lethal human illness. The SARSCoV (now named SARS-CoV-1) was discovered in November 2002 in Guangdong, China, and subsequently spread rapidly worldwide to 29 countries.³ Only a decade later (June 2012), MERS-CoV caused an endemic in Middle Eastern countries.⁴ Coronaviruses can infect animals and/or humans, with some strains being zoonotic. The SARS-CoV outbreak in 2002 originated from bats in China and the MERS-CoV outbreak in 2012 from dromedary camels, though also likely transmitted from bats, in the Middle East.^{5,6} It has been hypothesized that SARS-CoV-2 might be transmitted by bats, snakes, or pangolins.⁷⁻⁹ It is a virus highly transmissible from human to human through respiratory droplets and aerosols. The incubation period of COVID-19 could vary from 1 to 14 days and results in respiratory tract infection characterized by a broad spectrum of clinical manifestations with a different degree of severity, from asymptomatic patients to pneumonia evolving into acute respiratory distress syndrome (ARDS) and multiple organ failure (MOF), leading to death.¹⁰ Elderly (>65 years) and individuals with associated comorbidities, such as diabetes, hypertension, and chronic obstructive pulmonary disease, are more susceptible to severe disease. The laboratory provides critical support for the appropriate clinical management of COVID-19, from screening to diagnosis, prognosis, and monitoring.¹¹ In this review, we provide an overview of the biochemical alterations associated with COVID-19.

The objective of this study was to observe the abnormalities of biochemical blood parameters on the course of COVID-19 patients admitted in ICU and to detect the correlation with comorbidity of SARS-COV-2 patients.

METHODS

This observational study was conducted in Square Hospital Limited, Dhaka, Bangladesh, on 50 patients received ICU treatment with severe COVID-19 symptoms

admitted to this hospital from 15 July to 15 September 2020. We obtained the compiled data from LIS of the patients admitted to the hospital.

Inclusion criteria

The sampling technique was purposive sampling. The patients presenting with blood biochemical abnormalities of ICU patients with SARS-CoV-2 Infection were included in this study. Inclusion criteria were as follows COVID-19 infection PCR positive cases, received ICU treatment and more than 10 days from onset of symptoms.

Exclusion criteria

It was a prospective observational study. Exclusion criteria were as follows patient with pregnancy or surgical procedure.

Collected data was collated and appropriate statistical analysis was done using SPSS (Statistical Program for scientific study) version 25 statistical package. P value 0.05 was considered significant in our study. Sample inclusion criteria were COVID-19 infection PCR positive cases, received ICU treatment.

RESULTS

The study population was fifty (50). Male 38 (78%) were dominating the gender distribution the highest 19 (38%) were age group between 65 years to 74 years, 5 (10%) were 35 years to 44 years, 8(16%) were 45 years to 54 years, 14 (28%) were 55 years to 64 years, and 5 (10%) were >75 years. Table 1 demonstrated the distribution mean±SD of study patients according to blood parameters. Mean±SD of C-reactive protein (CRP) was 169.644±11.6, interleukin 6 (IL-6) was 320.04±23.8, procalcitonin was 0.666±0.92, lactate dehydrogenase (LDH) was 445.38±20.5, creatinine was 1.502±1.23, serum glutamic pyruvic transaminase (SGPT) was 43.86±27.5, troponin was 0.425±0.29 and S. ferritin was 1025.83±23.7.

Table 1: Biochemical blood parameters of the study participants (N=50).

Blood parameters	Mean±SD	Normal value	Unit	P value	Result
CRP	169.644±11.6	<5.0	mg/l	0.021	▲
IL-6	320.04±23.8	Up to 7.0	Pg/ml	0.027	▲
Procalcitonin	0.666±0.92	≤0.046		0.088	▲
LDH	445.38±20.5	120-246	U/l	0.091	▲
Creatinine	1.502±1.23	Male: 0.66-1.25; female: 0.52-1.04	mg/dl	0.015	▲
SGPT	43.86±27.5	Male: <50; female: <35	U/l	0.046	▲
Troponin I	0.425±0.29	<0.034	ng/ml	0.019	▲
S. ferritin	1025.83±23.7	Males: 17.9-464; females: <17.9-464 <50 years: 6.24-137, >50 years: 11.1-264	ng/ml	0.037	▲

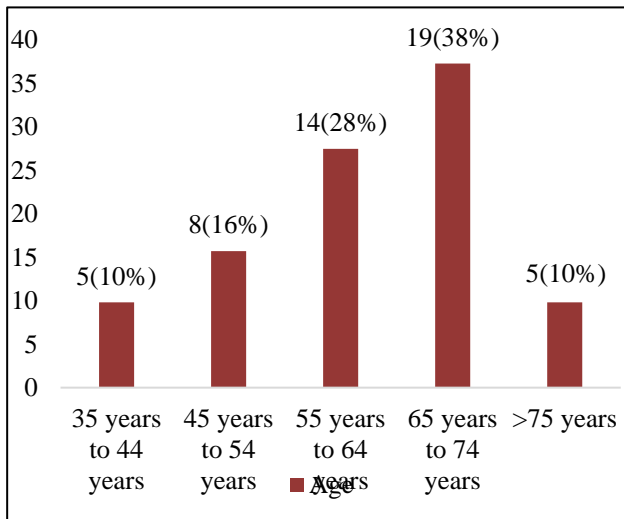


Figure 1: Distribution of study population by age (N=50).

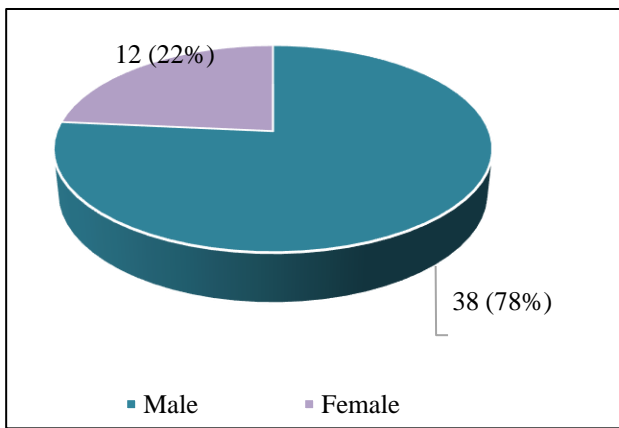


Figure 2: Distribution of study population by sex male 38 (78%) and female 12 (22%) (N=50).

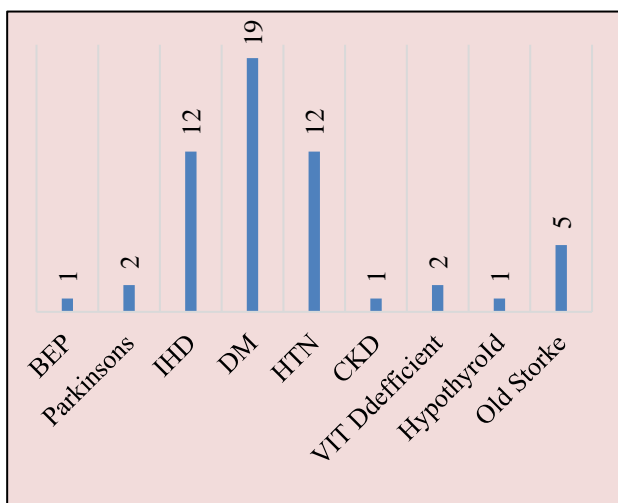


Figure 3: Shows the comorbidity of the patients. The maximum level of comorbidity was observed due to diabetes mellitus (DM), ischemic heart disease (IHD), and hypertension (HTN).

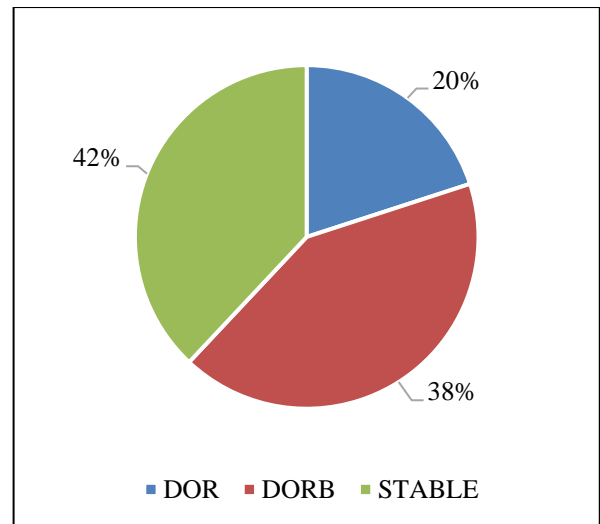


Figure 4: Distribution of study population among all ICU patients, 42% of patients had stable outcomes, 38% were DORB and 20% were DOR.

Creatinine, troponin, CRP, IL-6, serum ferritin and SGPT were found significant ($p < 0.05$) in biochemical blood parameters. The study population with comorbidities DM was 19 patients, HTN was 12 patients, IHD was 12 patients, old stroke was 5 patients, CKD was 1 patient, vitamin D deficiency was 2 patients, hypothyroid was 1 patient and, BEP was 1 patient, Parkinson was 2 patients. Figure 3 demonstrated the distribution number of study patients according to comorbidity. Outcome the study population 42% of patients had stable outcomes, 38% were DORB and 20% were DOR.

DISCUSSION

Evidence shows that pro-inflammatory cytokines play a pivotal role in the pathophysiology of lung and causes ‘cytokine storm’ damage in patients affected by COVID-19.¹² In a meta-analysis including nine studies reporting on IL-6 and outcome in COVID-19, mean IL-6 levels were more than three times higher in patients with complicated COVID-19 compared with those with non-complicated disease, and IL-6 levels were associated with mortality risk.¹³ Patients with severe disease courses had a far elevated level of CRP than mild or non-severe patients. For example, a study reported that patients with more severe symptoms had on average CRP concentration of 39.4 mg/l and patients with mild symptoms CRP concentration of 18.8 mg/l.¹⁴ LDH is an intracellular enzyme found in cells in almost all organ systems, which catalyzes the inter-conversion of pyruvate and lactate, with concomitant inter-conversion of NADH and NAD⁺. Lactate dehydrogenase (LDH) has been associated with worse outcomes in patients with viral infections. Severe infections may cause cytokine-mediated tissue damage and LDH release. Since LDH is present in lung tissue (isozyme 3), patients with severe COVID-19 infections can be expected to release greater amounts of LDH in the circulation, as a severe form of interstitial pneumonia, often evolving into acute

respiratory distress syndrome, is the hallmark of the disease. LDH levels were also found to be elevated in patients with Middle East Respiratory Syndrome (MERS). Elevated LDH levels seem to reflect that the multiple organ injury and failure may play a more prominent role in this pathology in influencing the clinical outcomes in patients with COVID-19.^{15,16}

Since laboratory medicine provides an essential contribution to the clinical decision making in many other infectious diseases, we aim to investigate here whether procalcitonin, whose values are not substantially modified in patients with viral infections, may play a role in distinguishing patients with or without severe COVID-19. Although the overall number of COVID-19 patients with increased procalcitonin values seems limited, as highlighted in a recent article, the results of this concise meta-analysis of the literature would suggest that serial procalcitonin measurement may play a role for predicting evolution towards a more severe form of disease.¹⁷⁻¹⁹

Myocardial injury is present in a significant proportion of hospitalized COVID-19 patients. Even though respiratory symptoms are the most common presentation, cTnI is a relatively cheap test to risk-stratify patients based on their cTnI level which has prognostic value and is independently associated with higher mortality as shown in this study. Future studies should explore the etiology as well as best management strategies in COVID-19 patients with evidence of myocardial injury. A recent study from New York showed a similar prevalence of myocardial injury in hospitalized COVID-19 patients. There is evidence to suggest acute myocardial injury at hospital admission is also associated with increased in-hospital mortality in COVID-19.^{20,21}

In our sample, the proportion of gender is included in the Figure 2. Males were more likely than females to be infected with coronaviruses. During the incubation period, SARS-CoV-2 transmission is possible and the carrier cannot be identified.¹¹ Patients in our sample had different co-morbidities that included DM, HTN, CKD, IHD, COPD, BEP, old stroke, etc. One of the most urgent priorities of the scientific community is to select and encourage the best therapies and preventions to resolve the SARS-CoV-2 pandemic head-on. While there was no clear therapy against this virus, in this study group of patients were treated with hospital-based treatment protocol. Some patients were healthy and prematurely released. We are subsequently reminded that infection prevention and control are important. Both basic but significant preventive measures are respiratory isolation, hand hygiene, and surface disinfection.

Limitation

This study was conducted in a limited of patients which could not represent the total population effectively. Duration of study was short and single center. So, present study was not comparing other local study.

CONCLUSION

Biochemical parameters of the ICU patients with COVID-19 are utilized for researching the relationship of the course of COVID-19 patients. In the wake of assessing the consequences of the patients, we assessed a significant relationship between the seriousness of the cases and the degrees of CRP, IL6, Procalcitonin, LDH, S. ferritin, creatinine, SGPT and troponin I. Expanded degrees of boundaries were discovered to be in a much typical reach among the patients that were followed up in assistance. Subsequently, we inferred that these markers could be utilized for the consistency of the course of patients. Along these lines, early measures can be taken for the patients and by these safety measures, mortality and grimness rates for COVID-19 could be diminished.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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