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Original Research Paper

Biochemistry

BIOCHEMICAL ANALYSIS IN COVID 19 INFECTION AND THEIR ROLE IN MORTALITY- A RECORD BASED RETROSPECTIVE STUDY

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ABSTRACT

Background- As blood biochemical changes are helpful in assessing the prognosis and evaluating the efficacy of treatment being given, the present study was conducted at tertiary care centre to assess the biochemical alterations in blood of patients with COVID-19 infection.

Methodology-The study was conducted as a record based retrospective study on patients with confirmed COVID 19 infection by RTPCR, who were admitted in ICU, HDU and Covid Care Centre during the period of 1st March 2020 to 30th June 2020. A total of 219 records could be accessed. Detailed and outcome in the form of discharge or death was documented from the records of patients. All the investigations findings were noted in questionnaire.

Results-Mean age of patients with COVID 19 infection was 56.7±12.8 years and majority of them belonged to age range of more than 60 years. Amongst various parameters, mean potassium as well as mean HDL were significantly lower at admission in patients who succumbed to death as compared to patients who were discharged ($p<0.05$). However, mean bilirubin, SGOT, SGPT, alkaline phosphate, D dimer, LDH, ESR, CRP as well as procalcitonin levels were significantly higher in cases with adverse outcome i.e. death ($p<0.05$).

Conclusion-Biochemical abnormalities are observed in COVID 19 infected patients and several biochemical markers such as hypokalemia, low HDL cholesterol, hyperbilirubinemia or liver dysfunction, raised inflammatory markers (D dimer, LDH, ESR, CRP as well as procalcitonin levels) have been linked with adverse outcome.

KEYWORDS : biochemical analysis, mortality, outcome, severity, markers

INTRODUCTION

The COVID 19 pandemic caused by SARS Co-V virus is one of the dreadful pandemic, which not only increased morbidity and mortality, but caused significant burden to health care system. It is associated with varied clinical spectrum, which may range from mild illness presenting as asymptomatic infection or with mild symptoms such as fever, cough etc. to severe disease in the form of severe pneumonia progressing toacute respiratory distress syndrome, ultimately leading to death.[1,2]Alterations in biochemical parameters have been documented in the COVID 19 patients, which has been correlated with the severity of infection as well as with the prognosis and outcome. The role of various inflammatory markers such as C reactive protein, serum ferritin and procalcitonin as well as markers of tissue damage such as lactate dehydrogenase (LDH), creatinine kinase (CK), troponinmyoglobin etc. have been suggested in determining the prognosis of patients with COVID 19 infection.[3,4]Apart from this, renal and liver abnormalities along with electrolyte imbalancehave also been reported in COVID patients.[5]

Though previous studies have documented the biochemical abnormalities in patients with COVID 19 infection,[6-8]but all the biochemical changes have not been documented in a single study and there have been several differences in the findings of these studies, which is mainly attributed to insufficient sample size. As blood biochemical changes are helpful in assessing the prognosis and evaluating the efficacy of treatment being given, the present study was conducted at tertiary care centre to assess the biochemical alterations in blood of patients with COVID-19 infection.

METHODOLOGY

The study was conducted as a record based retrospective study on patients with confirmed COVID 19 infection by RTPCR, who were admitted in ICU, HDU and Covid Care Centre or General wards during the period of 1st March 2020 to 30th June 2020. All the patients whose biochemical profile was done were included in the study irrespective of their sociodemographic variables or comorbid conditions. However, patients who were admitted but whose biochemical investigations were not done due to any reason were excluded.

After obtaining ethical clearance from Institute's ethical committee, all the reports available in Biochemistry department were assessed with due permission from MRD Department. The file of patients were traced from the MRD Department as IPD number was documented in the reports. A total of 219 records could be accessed. Detailed history pertaining to sociodemographic variables, clinical history, comorbid conditions, treatment given, length of hospital stay and outcome in the form of discharge or death was documented from the records of patients. All the investigations findings were noted in questionnaire.

Statistical Analysis-

Data thus obtained was entered in MsExcel and analysis was performed with the of IBM SPSS software version 20. Categorical variables were expressed as frequency and proportions whereas continuous variables were expressed as mean and standard deviation. Patients were divided into two groups based upon their outcome and comparison in mean biochemical variables was assessed using independent t test. P value less than 0.05 was considered as statistically significant.

RESULTS

A record of total of 219 patients with complete biochemical analysis. The findings are tabulated as under.

Table 1- Distribution according to Baseline variables

Baseline variables		Frequency (n=219)	Percentage
Age	≤20	24	11.0
	21-40	34	15.5
	41-60	72	32.9
	>60	89	40.6
Gender	Male	127	58.0
	Female	92	42.0
Comorbidity	Diabetes	51	23.3
	Hypertension	39	17.8
	Obesity	6	2.7
	None	164	74.9
Outcome	Death	18	8.2
	Discharged	201	91.8

Mean age of patients with COVID 19 infection was 56.7±12.8 years and majority of them belonged to age range of more than 60 years. About 58% of the patients were males and most common comorbid condition among them was diabetes (23.3%), followed by hypertension (17.8%). Mortality was observed in 8.2% cases in our study.

Table 2- Distribution according to biochemical analysis

Biochemical parameters	Mean	SD
Calcium (mmol/L)	2.56	0.17
Sodium (mmol/L)	143.35	2.16
Potassium (mmol/L)	4.16	0.19
Chloride (mmol/L)	99.89	1.58
Magnesium (mmol/L)	1.87	0.21
Phosphorous (mmol/L)	3.1	0.49
Urea (mg/dL)	33.9	6.34
Creatinine (mg/dL)	0.89	0.24
Uric acid (mg/dL)	4.76	0.81
Serum cholesterol (mg/dL)	182.3	25.9
Triglycerides (mg/dL)	191.3	33.2
HDL (mg/dL)	41.3	6.7
SGOT (U/L)	33.31	12.78
SGPT (U/L)	36.1	16.02
Serum bilirubin (mg/dL)	0.36	0.19
Alkaline phosphate (U/L)	193.81	88.66
CK MB (U/L)	12.4	3.6
D-Dimer (ug/mL)	0.56	0.21
LDH (U/L)	259.23	61.34
Procalcitonin (ng/ml)	0.09	0.01
ESR (mm/h)	41.6	12.9
CRP (mg/L)	19.23	3.7

Above table reveal biochemical parameters observed in COVID 19 infection patients irrespective of their severity and outcome.

Table 3- Univariate and Multivariate analysis of factors predicting mortality

Biochemical parameters	Discharged (n=201)		Death (n=18)		P value
	Mean	SD	Mean	SD	
Calcium (mmol/L)	2.55	0.16	2.57	0.18	0.32
Sodium (mmol/L)	143.21	2.11	143.7	2.26	0.57
Potassium (mmol/L)	4.27	0.13	3.66	0.21	0.001*
Chloride (mmol/L)	99.9	1.7	100.1	1.32	0.63
Magnesium (mmol/L)	1.83	0.20	1.90	0.22	0.87
Phosphorous (mmol/L)	2.9	0.5	3.3	0.4	0.33
Urea (mg/dL)	33.5	5.6	34.3	7.2	0.57
Creatinine (mg/dL)	0.87	0.22	0.91	0.26	0.56
Uric acid (mg/dL)	4.70	0.80	4.82	0.82	0.39
Serum cholesterol (mg/dL)	181.3	25.1	183.2	26.7	0.45
Triglycerides (mg/dL)	190.2	30.2	194.5	32.4	0.56
HDL (mg/dL)	44.01	3.1	38.21	7.2	0.001*
SGOT (U/L)	28.11	11.9	39.1	14.5	0.001*
SGPT (U/L)	26.91	10.01	44.72	22.03	0.001*
Serum bilirubin (mg/dL)	0.21	0.02	0.41	0.28	0.001*
Alkaline phosphate (U/L)	181.78	58.91	202.42	99.12	0.001*
D-Dimer (ug/mL)	0.41	0.16	1.3	0.31	0.001*
LDH (U/L)	214.2	50.9	379.5	81.2	0.001*
Procalcitonin (ng/ml)	0.08	0.01	1.1	0.01	0.001*
ESR (mm/h)	39.4	5.91	48.6	15.8	0.001*
CRP (mg/L)	9.9	2.4	29.8	4.7	0.001*

Amongst various parameters, mean potassium as well as mean HDL were significantly lower at admission in patients who succumbed to death as compared to patients who were discharged ($p<0.05$). However, mean bilirubin, SGOT, SGPT, alkaline phosphate, D dimer, LDH, ESR, CRP as well as procalcitonin levels were significantly higher in cases with adverse outcome i.e. death ($p<0.05$).

DISCUSSIONS

Patients with COVID 19 infections may present with varying severity and outcome may depend upon their clinical conditions, level of infection, comorbid conditions etc. Previous studies have clearly reported the role of various clinical parameters such as age and comorbidities, and biochemical alterations in assessing the severity of disease.[9,10]The present study aimed to assess the biochemical alterations in patients with COVID 19 infections and to assess the association of these alterations with mortality. Mean age of patients in our study was 56.7±12.8 years and 58% of the patients were males. Advanced age has been linked with poor outcome, which is attributed to severe ARDS, a fundamental pathophysiology in elderly patents, responsible for poor prognosis.[11,12]Also, the immune response to infection is much stronger in elderly age group as compared to younger adults, leading to increase in expression of pro-inflammatory markers and reduced expression of anti-inflammatory markers such as type I interferon beta was reduced.[13]The cytokine storm has also been documented to be much stronger and higher in elderly group due to age dependent changes in T-cell and B-cell function.[14] Presence of comorbidities such as diabetes, hypertension and obesity have been linked with higher mortality, which were observed in 23.3%, 17.8% and 2.7% cases respectively in our study. Chilimuri et al and Singh et al reported significantly higher risk of mortality in presence of comorbidities.[15,16]

In our study, serum electrolytes, renal function tests, liver function tests, lipid profile, inflammatory markers etc. were observed and among them mortality was associated with low mean potassium and HDL levels and raised levels of bilirubin, SGOT, SGPT, alkaline phosphate, D dimer, LDH, ESR, CRP as well as procalcitonin levels ($p<0.05$). Wang et al assessed the biochemical variables with respect to severity and not the mortality, and they observed significantly higher levels of total bilirubin (TBIL), AST, ALT, lactate dehydrogenase, ESR, D-dimer and procalcitonin in cases belonging to severe or critical group supporting the findings of our study. The authors also documented significant negative correlation of serum potassium and HDL-C with disease severity supporting our study.[17]Liet al also observed significantly higher incidence of hypokalemia in cases with severe infection, correction of which was considered as challenging due to continuous loss of potassium due to degradation of ACE2.[18]Decreased serum HDL and increased cholesterol has been linked with antagonistic action of SRS Co-V to HDL receptor-Scavenger receptor.[19]

Increased D-dimer suggest the inflammatory activity in patients with COVID 19 infection which is associated with increased coagulation activity and cytokine responses predisposing the patients to ischaemia and thrombosis.[20-22]Similarly, raised CRP, ESR and procalcitonin and reflects level of inflammation and underlying inflammatory process which is linked with cytokine storm and adverse outcomes.[23] LDH however is an intracellular enzyme suggesting cardiac damage and is particularly a feature of ARDS and interstitial pneumonia due to any etiology.[24]These findings were also supported by findings of Tang et al, where higher D DIMER and fibrin degradation product levels were documented to be linked with increased mortality and adverse outcome.[25]

CONCLUSION

Biochemical abnormalities are observed in COVID 19 infected patients and several biochemical markers such as hypokalemia, low HDL cholesterol, hyperbilirubinemia or liver dysfunction, raised inflammatory markers (D dimer, LDH, ESR, CRP as well as procalcitonin levels) have been linked with adverse outcome.

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