

Association of Lactate Dehydrogenase and C-reactive Protein Levels as Predictors of Respiratory Failure in Covid-19

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Abstract

Background and Aim: Inflammatory markers reproduce amount of disease development or revival. They are used to assess improvement or worsening of the illness. Hence the aim of the study was to determine the correlation of laboratory markers (LDH and CRP) and oxygen requirement with clinical severity in Covid 19 subjects.

Materials and Methods: There were 216 subjects admitted to the emergency department of the hospital. The incorporated subjects were divided into two groups: group I subjects had covid19 pneumonia and in group 2 subjects did not have covid 19 pneumonia. Blood count and serum values of lactate dehydrogenase (LDH) and C-reactive protein (CRP) were quantified in all subjects enrolled in the research. An automated hematology analyzer was utilized to perform blood count according to the manufacturer's protocol. Serum samples were analyzed on a fully automated clinical chemistry Instrument.

Results: LDH was amplified in 82% of subjects, CRP resulted elevated in 98% of subjects, only 21% of subjects presented pathological values of white blood cell (WBC), but 18% had a neutrophils count above the upper normal range value, while 89% of subjects had lymphocytes count below the lower normal range value, as formerly reported.

Conclusion: LDH and CRP could be helpful for the premature identification of subjects who are at elevated risk for acute respiratory failure. They should be considered a helpful test for the early recognition of subjects who need closer respiratory monitoring and more aggressive supportive therapies to avoid poor prognosis. These subjects could be benefited from a quick hospitalization, a closer observation and correct treatments.

Keywords: Coronavirus 2019, Acute Respiratory Syndrome, Biomarkers, CRP, laboratory investigations, LDH

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Introduction

In December 2019, the outbreak of a disease consequently termed COVID-19 occurred in Wuhan, China. The number of cases augmented quickly and extend to six continents. The infection arose from severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) infections, which has become a public health emergency of international distress. COVID-19 has contributed to an enormous difficult impact worldwide [1,2].

Infection by COVID-19 can effect in a range of clinical outcomes, from asymptomatic to severe serious course or death. Increased serum LDH and CRP values are one of the diagnostic parameters in COVID-19 subjects with a severe or fatal course of disease. Potential clinical and biological significance of elevated LDH and CRP values are pulmonary injury, as well as widespread organ damage [3,4].

The real test for the clinicians is to rapidly identify CoVID-19 subjects at high risk for ARDS. Old age, comorbidities (hypertension, diabetes), lymphocytopenia, elevated inflammatory indices (C-reactive protein, serum ferritin), and organ dysfunction (aspartateaminotransferase, creatinine, lactate dehydrogenase) are risk factors for ARDS in CoVID-19 subjects. Unfortunately, the pathogenesis of CoVID-19 has not been entirely understood. Surely, inflammatory cytokine storm and viral avoidance of cellular immune response play a central role in disease progression and severity[5,6].

Numerous laboratory abnormalities have been describe to be linked to an adverse outcome in COVID-19 subjects. In a meta-analysis by Henry *et al.*, biomarkers of inflammation, cardiac and muscle injury, liver and kidney function and coagulation measures were significantly eminent in subjects with both severe and fatal COVID-19, in particular Interleukin (IL) -6, IL-10 and serum ferritin were strong discriminators for severe disease [7,8].

Inflammatory markers reproduce amount of disease progression or recovery. They are utilized to calculate development or deterioration of the illness. The dramatic global CoVID-19 infection requires the recognition of a consistent and economical tool to rapidly distinguish subjects with a more unfavorable outcome [9,10].

Given the random clinical course, numerous researches have focused on criteria that may associate with a poor prognosis. Radiological findings point to COVID-19 patterns and extension as of prognostic value [11]. Additionally, serum biomarkers, such as leukocyte and lymphocyte counts, lactate dehydrogenase (LDH), D-dimer, troponin I, and ferritin levels seem to designate the severity of the procedure and therefore the need for ICU admission or may even forecast mortality. The aim of the study was to decide the correlation of laboratory markers (LDH and CRP) and oxygen requirement with clinical severity in Covid 19 subjects.

Materials and Methods

The current retrospective observational comparative research carry out in 216 subjects admitted to the emergency department of the hospital at the Tertiary care institute of Gujarat. The incorporated subjects were divided into two groups: Group 1, subjects had covid 19 pneumonia and in Group 2, subjects did not have covid 19 pneumonia. The ethical committee was informed about the research and the ethical clearance certificate was obtained earlier to the begin of the research.

Inclusion Criteria

- Subjects with covid 19 positive status following 2 swab rtpcr testing
- Subject admitted to the hospital with negative covid 19 status
- Subjects who had LDH and CRP laboratory investigations done.

Exclusion Criteria

- Subject age fewer than 18 years

- Subjects with LDH and CRP reports not accessible with them.

All the subjects resulted positive for 2019-nCoV by Real Time-Polymerase Chain Reaction from the nasopharyngeal swab and were investigated at admission with lung US and chest CT scan that documented interstitial pneumonia at diverse stages.

Severity of ARDS was recognized according to PaO₂/FiO₂ value:

mild (PaO₂/FiO₂ 200–300 mmHg),

moderate (PaO₂/FiO₂ 100–200 mmHg),

severe (PaO₂/FiO₂ < 100 mmHg).

Blood count and serum values of lactate dehydrogenase (LDH) and C-reactive protein (CRP) were quantified in all subjects registered in the research. A automated hematology analyzer was utilized to carry out blood count according to the manufacturer's practice. Serum samples were analyzed on a fully automated clinical chemistry Instrument. Particularly CRP was noticed by a turbidimetric reaction and LDH by an

enzymatic reaction, based on advice of IFCC. Statistical analysis was performed using SPSS 26.0.0.1.

Results

In the present study total of 216 subjects were included in the study. All the included subjects were selected from the OPD of the department, later on admitted in the hospital and meet the inclusion and exclusion criteria. The included subjects were divided equally into two groups: group 1 subjects had covid 19 pneumonia and group 2 subjects did not have covid 19 pneumonia.

In the current research; 118 (54.62%) were men and 98 (45.3%) were women. No significant dissimilarity were observed in the male to female ratio among the research groups. The mean age of the subjects was 42.07 years. The mean age of the subjects in the group 1 was significantly elevated compared to the subjects in the group 2 ($p < 0.005$)

The blood samples of the incorporated subjects were collected. Details of their Comorbidities are presented in Table 1.

Table 1: Comparison of the laboratory parameters between Non Covid and Covid Subjects (Mean±SD)

Parameters	Category	Non Covid subjects (n = 108) Mean±SD	Covid Subjects (n = 108) Mean±SD
CRP	Females	40.79 ± 35.23	49.51 ± 54.65
	Males	48.88 ± 65.22	56.25 ± 14.56
	Total	44.24 ± 90.75	54.80 ± 16.34
LDH	Females	378.99 ± 54.18	442.38 ± 87.40
	Males	403.78 ± 35.22	493.22 ± 47.34
	Total	390.20 ± 35.44	476.88 ± 36.42

The comparison was performed for characteristics analysis of the subjects incorporated in both the groups. At admission, 52% of subjects had a PaO₂/FiO₂ value ranging among 200 and 300 mmHg (mild ARDS), 21% had a PaO₂/FiO₂ value among 100 and 200 mmHg (moderate ARDS), 9% a PaO₂/FiO₂ lower than 100 mmHg (severe ARDS).

LDH was augmented in 82% of subjects, AST in 72%, ALT in 51%, creatinine in 55%. CRP resulted high in 98% of subjects, only 21% of subjects presented pathological values of white blood cell (WBC), but 18% had a neutrophil count higher than the upper normal range value, while 89% of subjects had lymphocytes count below the lower normal range value, as before reported.

Discussion

Given that the discovery of severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) in China in December 2019, over 180 million cases have been reported globally, of which over 3.9 million have resulted in death. The ongoing pandemic of severe acute respiratory syndrome by coronavirus 2 (SARS-CoV-2) continues to pose numerous diagnostic and therapeutic challenges [12].

In adults, although SARS-CoV-2 typically causes pneumonia and acute respiratory distress syndrome (ARDS), it is now being documented as a multisystem disease. On the contrary, most children are asymptomatic or have mild to moderate illness. Severe or critical illness is rare [13]

Direct detection of SARS-CoV-2 nucleic acids in the respiratory tract specimen collected from the incorporated subjects was the diagnostic tool for the COVID-19. The polymerase chain reaction was done for the confirmatory analysis of COVID-19. A rapid and precise diagnosis has wide implications for the subject, healthcare institution, and the public health and administrative personnel [14].

In the present pandemic, healthcare systems are pugnacious to meet rising strain of the quickly growing infected population. Successful use of accessible resources is dominant to saving the maximum number of lives. Clinical evaluation is indispensable, but laboratory markers, or biomarkers, can give extra, objective information which can considerably impact many apparatus of subject care.

The most motivating findings were the strong opposite association between LDH and PaO₂/FiO₂ values and among CRP and PaO₂/FiO₂ values. PaO₂/FiO₂ values too showed a significant opposite correlation with: age, neutrophils counts; a trend of a slight direct correlation with lymphocytes count were established.

In COVID-19 subjects, LDH and CRP might represent an appearance of lung damage and might reproduce the

respiratory distress consequential to the abnormal inflammation status. In all subjects, CRP linked with CT findings and resulted significantly augmented at the premature stage of severe COVID-19 before changes in the CT score.

Conclusion

LDH and CRP could be helpful for the premature recognition of subjects who are at elevated risk for acute respiratory failure. They should be measured a helpful test for the premature identification of subjects who necessitate closer respiratory monitoring and more aggressive supportive therapies to evade poor prognosis. These subjects could be benefited from a quick hospitalization, a closer observation and accurate treatments.

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