Original Article

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# Clinical Outcome of Hospitalized COVID-19 Patients with Abnorma Liver Functions: A Prospective Cohort Study

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## Abstract

**Background:** COVID-19 is a viral illness caused by SARS-CoV2 coronavirus. The prognosis and outcome of the disease is mainly affected by the involvement of the respiratory system but involvement of other organ systems including liver have impact on patient morbidity and mortality. Several recent studies have suggested that patient with altered liver functions were associated with more severe disease with worse outcomes in comparison with patients with normal liver functions.

**Objective:** This study aim to assess the impact of altered liver functions on the clinical course of COVID-19.

**Materials & Methods:** This was a prospective cohort study conducted in the Dhaka medical college hospital, Dhaka during the period of August 2020 to July 2021. One hundred and seventy four patients were enrolled as the study subjects. After discharge from hospital, they were followed up by clinically and by ALT level (over phone or face to face interview at follow up clinic) at 1 month and 6 month to see abnormal ALT was due to COVID-19 infection or other cause. Among them eighty seven patients have abnormal LFT and eighty seven patients have normal LFT. They were matched for demographic characteristics. They were assessed clinically for severity of the disease and outcomes during hospitalization period.

**Results:** Raised ALT was the most common LFT abnormality (69%) among abnormal LFT group of study patients. Both COVID-19 severity and the use of glucocorticoids were independent risk factors for abnormal LFT in study populations. LFT abnormality in COVID-19 was transient and tended to resolve over time. ALT normalizations was gradual in severe to critical COVID-19 than mild to moderate illness. In almost all of the patients, ALT became normal at 6th months of follow up in both groups. Abnormal LFT in COVID-19 was associated with more severe disease (RR 1.31, 95% CI, 1.00- 1.72; p=0.047). Oxygen requirement was more in COVID-19 patients who had abnormal LFT than in patients with normal LFT (RR 1.47, 95% CI, 1.16-1.86; p=0.001). Regarding outcome in terms of death, mechanical ventilation and recovery, we didn't find any significant difference between abnormal and normal LFT group.

**Conclusion:** Raised ALT was the most common LFT abnormality among abnormal LFT group. Pattern of LFT abnormality was predominantly hepatitic. Abnormal LFT was associated with more severe COVID-19. Oxygen requirement was more in abnormal LFT group. Regarding outcome in terms of death, mechanical ventilation and recovery, we didn't find any significant difference between abnormal and normal LFT group.

**Keywords:** Covid-19, SARS COV2. Abnormal liver functions, ALT, AST, LFT.

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## Introduction:

In December 2019, unexplained pneumonia cases emerged in Wuhan, Hubei province, China, [1, 2] which spread rapidly throughout the country and became a public health emergency of international concern. On January 7, a novel coronavirus was detected in a swab sample of a patient by the China Centre for Disease control and prevention (CDC). The disease was subsequently named as coronavirus disease 2019 (COVID-19).[3] The pathogen of COVID-19 pneumonia is severe acute respiratory syndrome coronavirus 2 (SARS-CoV- 2);[4] (Shi, et al., 2020).[5]

Due to its rapid worldwide exposure and the challenges it bought the world health organization (WHO) had to declare it to be a pandemic in early march 2020. The SARS-CoV-2 pandemic now includes over 19.7 million confirmed cases till date with an average mortality rate approaching 4.3%.[6] Bangladesh reported the first COVID-19 case on March 8, 2020 by country's epidemiology institute IEDCR. Since then the pandemic has spread over the whole nation day by day. The target organs of this coronavirus is mainly respiratory system. However, there is also evidence of damage to other organs such as intestine, liver and nervous system which significantly increases their morbidity and mortality.[7, 8] The pathophysiology of multi-organ damage may be due to organ specific immune response to SARS-CoV-2 or secondary to hypoxemia, systemic cytokine storm and medications.[9]

A new study found that the SARS-CoV-2 virus may bind to angiotensin-converting enzyme 2 (ACE2) on cholangiocytes, leading to cholangiocyte dysfunction and inducing a systemic inflammatory response leading to liver injury.

Liver function abnormalities have been documented in COVID-19 patients and elevations of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were reported in some studies, ranging from 14 to 53%.[7,10,11] Liver injury is also related to the severity and mortality of COVID-19.[12] Patients with severe illness and particularly those requiring intensive care unit (ICU) admissions, tend to have higher rate of transaminase elevation than those with mild to moderate illness.[13]

Little data exists on liver function alterations among COVID-19 patients and its relation to the outcome and disease severity especially in Bangladesh. Hence the aim of this study is to analyze liver function abnormalities and its relation to the clinical outcome and severity among confirmed COVID-19 patients admitted in Dhaka medical college hospital.

## Materials & Methods:

This prospective cohort study was conducted in the Dhaka medical college hospital, Dhaka during the period of August 2020 to July 2021. Ethical approval was obtained from the institutional review board of Dhaka medical college hospital. Written informed consent was obtained from each patient before enrollment. After conducting purposive sampling methods, all adult patients (aged 18 years and above) of both sex who are SARS-CoV-2 RT PCR positive admitted at DMCH and willingly gave written informed consent were included in the study and those who did not perform any LFT on admission day were excluded. Total one hundred and seventy four (174) patients were enrolled as the study subjects. Among them eighty seven (87) patients have abnormal LFT and eighty seven (87) patients have normal LFT. They were matched for demographic characteristics. They were assessed clinically for severity of the disease and outcomes during hospitalization period. After discharge from hospital, they were followed up by clinically and by ALT level (over phone or face to face interview at follow up clinic) at 1 month and 6 month for long term outcome of the illness.. Statistical analyses were carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean and median values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test with Yates correction was used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

## Results:

A total of 174 patients with covid 19 positive were included in this study. More than one third (43%) patients belonged to age 51-70 years in both normal and abnormal liver function groups. The mean age was 54.1±15 years in abnormal LFT group and 55±15.8 years in normal LFT group. About 46 (52.9%) of patients were male in abnormal LFT group and 47 (54.0%) in normal LFT group. The difference was statistically not significant (p>0.05) between two group. Total 14 patients were found to have chronic liver disease (CLD) among abnormal LFT group where only 3 patients had chronic liver disease (CLD) in normal LFT group. Raised ALT was the most common liver function abnormality with a frequency of 69% followed by raised AST (58.65%) and reduced serum albumin (35.6%).

Hepatitic pattern was the most common type of liver injury observed with a frequency of about 60.6%. Patients who had abnormal LFT were suffering from more severe disease with a p value 0.047 and RR of 1.31(1.00- 1.72). Eleven patients suffered from critical illness in abnormal LFT group in contrast to only 4 critical patients in normal LFT group. But the difference was not statistically significant.

More patients in the abnormal LFT group required oxygen in comparison with normal LFT group with a p value of 0.001 and RR value of 1.47(1.16-1.86) which was statistically significant. Total 5 patients require ICU/ mechanical ventilation in abnormal LFT group in comparison to only 1 patient in normal LFT group. Seven patients were died in abnormal LFT group, where only 2 patients were died in normal LFT group. These differences were not significant statistically.

**Table I: Demographic and clinical profiles of the study populations (N=174)**

| Variables | Abnormal liverfunction (n=87) n (%) | Normal liver Function (n=87) n (%) | p-value |
|---|---|---|---|
| Age(years) | | | |
| ≤30 | 7 (8.0) | 7 (8.0) | |
| 31-50 | 29 (33.3) | 27 (31.0) | |
| 51-70 | 43 (49.4) | 43 (49.4) | |
| 71-90 | 8 (9.2) | 10 (11.5) | |
| Mean±SD | 54±15.0 | 55±15.8 | [a]0.709[ns] |
| Sex | | | |
| Male | 46 (52.9) | 47 (54.0) | [b]0.879[ns] |
| Female | 41 (47.1) | 40 (46.0) | |
| **Pre-existing chronidiver Diseases** | | | |
| NAFLD | 5 (5.7) | 1 (1.1) | [b]0.105[ns] |
| HBVrelated | 2 (2.3) | 1 (1.1) | [b]0.500[ns] |
| Others | 4 (4.6) | 1 (1.1) | [b]0.184[ns] |
| **Time interval from symptom onsett hospitalization (days)** | 8.5±7.3 | 7.6±5.7 | [a]0.387[ns] |

S= significant, NS= not significant
[a]P value reached from unpaired t-test
[b]P value reached from chi square test

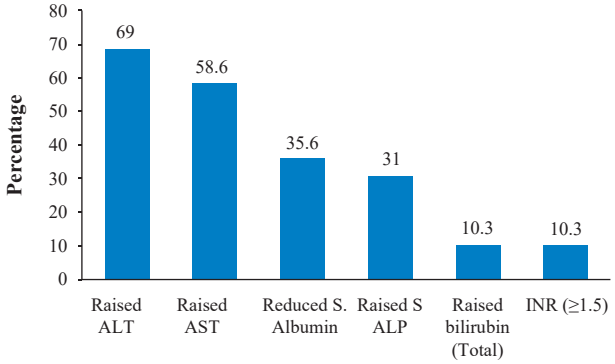


**Figure 1:** Frequency of different LFT alterations at hospital admission among study populations with abnormal LFT (n=87)

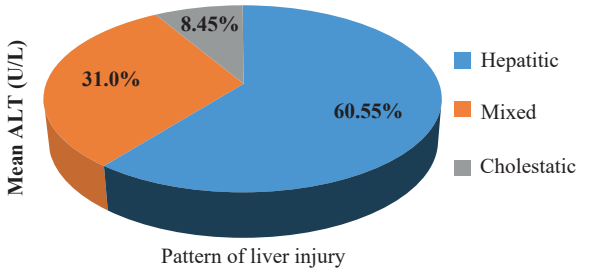


**Figure 2:** Pattern of liver injury among the study populations with altered liver functions (n=71)

**Table II: Association of liver function tests with severity of COVID-19 (N=174)**

| Severity of COVID-19 | Abnormal liver function (n=87) | | Normal liver function (n=87) | | Relative risk (RR) (95% CI) | p-value |
|---|---|---|---|---|---|---|
| | n | (%) | n | (%) | | |
| Mild | 17 | (19.5) | 28 | (32.2) | 0.61 (0.36-1.03) | 0.057[ns] |
| Moderate | 4 | (4.6) | 13 | (14.9) | 0.31 (0.10-0.91) | **0.022[s]** |
| Severe | 55 | (63.2) | 42 | (48.3) | 1.31 (1.00-1.72) | **0.047[s]** |
| Critical | 11 | (12.6) | 4 | (4.6) | 2.75 (0.91-8.30) | 0.059[ns] |

S= significant, NS= not significant
P value reached from chi square test

**Table III: Outcomes of the study populations at hospital (N=174)**

| Outcomes | Abnormal liver function (n=87) | Normal liver function (n=87) | RR (95% CI) | p-value |
|---|---|---|---|---|
| | n (%) | n (%) | | |
| **Requirement of oxygen** | | | | |
| Low flow O2 (≤15 L/min) | 60 (90.9) | 44 (97.8) | 0.93 (0.85-1.02) | [a]0.143[ns] |
| High flow O2 (>15 L/min) | 6 (9.1) | 1 (2.2) | 4.09 (0.51-32.84) | [a]0.143[ns] |
| **Total number** | 66 (75.9) | 45 (51.7) | 1.47 (1.16-1.86) | [a]0.001[s] |
| **Days of oxygen requirement** | 14.1±10.8 | 14.8±11.1 | | [b]0.750[ns] |
| **Requirement (ICU/ mechanical ventilation)** | | | | |
| Number of patients | 5 (5.7) | 1 (1.1) | 5.00 (0.60-41.92) | [a]0.105[ns] |
| **Days of requirement of ICU/mechanical ventilation** | 8.6±4.6 | 2.0±0.0 | | [b]0.262[ns] |
| **Recovery** | | | | |
| Complete recovery from acute illness | 78 (89.7) | 81 (93.1) | 0.96 (0.88-1.06) | [a]0.418[ns] |
| Days required for complete Recovery | 41.4±27.1 | 34.1±23.2 | | [b]0.071[ns] |
| **Death** | 7 (8.0) | 2 (2.3) | 3.50 (0.75-16.38) | [a]0.084[ns] |
| **Death after days of onset of illness** | 28.3±28.6 | 43.5±22.3 | | [b]0.518[ns] |

S= significant, NS= not significant
[a]P value reached from chi square test
[b]P value reached from unpaired t-test

## Discussion:

This was a prospective cohort study conducted in the Dhaka medical college hospital, Dhaka with an objective to find an association between altered liver function tests (ALTs) with clinical outcome and severity of COVID-19 among admitted patients. Total 174 confirmed COVID-19 patients who were admitted in DMCH were enrolled in this study. Among the study patients, 87 has abnormal ALTs and 87 has normal ALTs. This study was done during the period of august 2020 to July 2021. As it was a cohort study we matched certain characteristics of the patients like age, sex, smoking habit etc. Majority of the patients were in age 51-70 years in both groups with a mean age of 58 in abnormal ALTs group and 55 in normal ALTs group which was matched with a study done by.[4]

COVID-19 is a systemic disease that has diverse clinical symptoms. Most common symptoms encountered in our study was fever, cough and shortness of breath in both groups, which matched with the study done by Huang, et al. 2020 1 except the frequency of the shortness of breath was 70.1% in abnormal ALTs group and 62.1% in normal ALTs group which didn't match with these Chinese study. A possible explanation is that, as we had include only hospitalized COVID-19 patients and majority of hospitalized patients were in severe category, so one of the most frequent symptoms in our study was shortness of breath. Main comorbidities were diabetes mellitus (43.7%), hypertension (38.5%) and ischemic heart disease. It has similarity with a study done by Chen, et al. 2020[14] but a lower prevalence of diabetes mellitus (20.9%) in this Chinese study.

Different study defines liver function abnormalities in different ways. In some studies, only liver enzyme levels were studied ALT or AST and ALT. In most study liver injury was defined as elevated ALT or AST level. Some studies defined the timing of elevated liver enzymes at first presentation, while others studies used elevated liver enzyme levels during disease progression. In our study raised ALT was the most common liver function abnormality with a frequency of 69% followed by raised AST (58.6%), which doesn't match with an Italian study in which raised AST was the most frequent LFT abnormality (44%) followed by raised ALT (32%). Pattern of ALT abnormality was hepatitis among 60.55% patients followed by mixed (31%) and cholestatic (8.45%), these results is also different from the study done by Piano, et al., 2020[15]. Time trend analysis of changes in ALT level at different periods of follow up showed that in most of the patients. ALT level became normal at 1st month of follow up, whereas in some patients it took 6 months and in some patients, ALT did not come to normal level even after 6 months.

Different factors can contribute to liver injury during the course of COVID-19. It may be directly caused by the virus, mediated via ACE-2 receptor in cholangiocytes. It might be due to liver injury caused by inflammatory cytokine storm and also due to drug hepatotoxicity especially steroids.

In some patients, presence of unidentified pre-existing liver disease can also contribute to the abnormal liver functions. In our study the incidence rate of pre-existing chronic liver disease was higher in the abnormal ALT group which is 12.6% in comparison with only 3.3% in normal ALT group which doesn't match with the study done by Hao, et al. 2020.[16] However presence of chronic liver diseases was not significantly associated with severity of COVID-19 or adverse clinical outcomes. Multivariate analysis of the factors severe-critical COVID-19 disease, use of glucocorticoids and pre-existing liver diseases found that all of these factors were responsible for abnormal liver functions in COVID-19 patients.

Our studies have found a correlation between altered liver functions and disease severity among COVID-19 patients. It showed that abnormal liver function was associated with more severe disease with a relative risk of 1.31(1.00-1.72) which has similarity with other studies done by Huang, et al., 2020)[4]; (Chaibi, et al., 2020);[17] (Phipps, et al, 2020).[18] But there was no significant association between abnormal liver functions and critical COVID-19. It might be due to small number of patients in the critical COVID-19 category. In terms of outcome, oxygen requirement was more in among abnormal LFT group which was statistically significant. This result is consistent with the study done by Lv, et al., 2021.[19] But in other parameters of outcome such as length of illness, length of hospital stay, requirement of ICU/ mechanical ventilation, recovery and death; we didn't find any significant difference between the two groups was consistent with the study done by Hao, et al., 2020 16 and Sikkema, et al., 2020.[20]

## Limitations:

Single center study and study on only admitted patient may limit its representativeness. Lack of universal definitions of liver function abnormality and liver injury

## Conclusions:

Raised ALT was the most common LFT abnormality among study patients. Pattern of LFT abnormality was predominantly hepatitis. Abnormal LFT was associated with more severe COVID-19. Oxygen requirement was more in abnormal LFT group. Regarding outcome in terms of death, mechanical ventilation and recovery, we didn't find any significant difference between abnormal and normal LFT group.

## Recommendations:

As abnormal LFT was associated with development of more severe disease and more oxygen requirement, we recommend doing baseline LFT in all hospitalized COVID-19 patients. As ALT remained abnormal after 6 months in some study populations, long term follow up of liver functions are necessary.

## Conflicts of interest:

There is no conflict of interest.

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### References:

1. Huang C., Wang Y. & Li X. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The *Lancet*, 2020 Jan 395, 497-506.

2. Wu F., Zhao S. & Yu B. A new coronavirus associated with human respiratory disease in China. *Nature*, 2020 Feb 579, 265-269.

3. Chen N, Zhou M. & Dong X. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. The *Lancet*, 2020 Feb 395, 507-513.

4. Huang H., Chen S, Li H. & Zhou X-L. The association between markers of liver injury and clinical outcomes in patients with COVID-19 in Wuhan. *Alimentary pharmacology and therapeutics*. 2020 Sep 52(6):1051-1059

5. Shi, X., Han, X. & Jiang, N., 2020. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis*. 2020 Apr;20(4):425-434.

6. WHO. WHO COVID-19 *dashboard; situation report* 203. 2020 Aug

7. Guan, W., Ni, Z., Hu, Y. & Liang, W. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Eng J Med*, 2020 Feb;382:1708-1720.

8. Zhang Y, Zheng L, Liu L et al. Liver impairment in COVID-19 patients: a retrospective analysis of 115 cases from a single center in Wuhan city, China. *Liver Int*. 2020 Sep;40(9):2095-2103

9. Chai X. et al. Specific ACE2 expression in cholangiocytes may cause liver damage after 2019-nCoV infection. *Bio Rxiv*. 2020 Feb

10. Chen L Y, Chu H K, Bai T, Tu S J et al. Liver damage at admission is an independent prognostic factor for COVID-19. *Journal of digestive disease*. 2020 Sep 21(9):512-518.

11. Wang D, Hu B, Hu C et al. Clinical Characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020 Mar 17;323(11):1061-1069

12. Lei F, Liu Y-M. & Zhou F et al. Longitudinal association between markers of liver injury and mortality in COVID-19 in China. *Hepatology*. 2020 Aug;72(2):389-398

13. Qi W, Zhao H. & Liu L-G. Pattern of liver injury in adult patients with COVID-19: a retrospective analysis of 105 patients. *Military Medical research*. 2020 Jun 7; 7:28

14. Chen T, Wu D, Chen, H, Yan W et al. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. *BMJ*. 2020 Mar 26:368:m1091

15. Piano S, Dalbeni A, Vettore E et al. Abnormal liver function tests predict transfer to intensive care unit and death in COVID-19. *Liver international*. 2020 Oct;40(10):2394-2406.

16. Hao S-R, Zhang S-Y, Lian J-S, Jin X et al. Liver Enzyme Elevation in Coronavirus Disease 2019: A multicenter, retrospective, cross sectional study. *Americal journal of gastroenterology*. 2020 Jul;115(7):1075-1083.

17. Chaibi S, Boussier J, Hajj W E, Abittbol Y et al. Liver function test abnormalities are associated with a poorer prognosis in Covid-19 patients: Results of a French cohort. *Clinics of research in hepatology and gastroenterology*. 2021 Sep;45(5):101556.

18. Phipps M M, Barraza L H, Lasota E D et al. Acute Liver Injury in COVID-19: prevalence and association with clinical outcomes in a large U.S. cohort. *Hepatology*. 2020 Sep;72(3):807-81.

19. Lv Y, Zhao, X, Wang Y, Zu J et al. Abnormal liver Function tests were associated with adverse clinical outcome: an observational cohort study of 2,912 patients with COVID-19. *Frontiers of Medicine*. 2021 Jun 9:8:639855.

20. Sikkema B J, Nicholaas J S & Wijngaarden, PV. No association between COVID-19 related liver injury and the course of disease: a retrospective study. *Scandinavian journal of gastroenterology*. 2021 Jan;56(1):68-71.