Hyperacute Liver Failure Resulting From COVID-19 Infection

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INTRODUCTION: Acute liver failure (ALF), characterized by acute liver injury, hepatic encephalopathy, and an increased international normalized ratio, is subcategorized based on the timeline as hyperacute (<7 days) and acute (7 to 21 days) where cerebral edema is typical, or subacute (>21 days and <26 weeks). In coronavirus disease 2019 (COVID-19), a form of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), ALF may result from the virus invasion, which directly infects cells via angiotensin-converting enzyme receptor-2 present in the liver cells, including cholangiocytes (60%) and hepatocytes (3%); and are absent in Kupffer cells, where direct viral impact, systemic inflammation, drug-induced damage, congestion abnormalities, and hypoxia-induced damage contribute to liver damage.

CASE PRESENTATION: A 54-year-old obese Hispanic female with a history of diabetes presented complaining of fevers, chills, headache, chest pain, abdominal pain, nausea, vomiting, diarrhea, body aches, and back pain for three days. Two days prior, the patient had tested positive for COVID-19. On admission, the patient did not have any respiratory compromise. Initial biochemical tests were unremarkable, except for elevated inflammatory markers (Figure 1) and imaging suggestive of atypical pneumonia. After the third day in the hospital, the patient began developing worsening respiratory status and was transferred to critical care, the following day the patient was intubated for acute respiratory failure. On day eight of admission, the patient began having elevated liver-related proteins and worsening inflammatory markers (Figures 1 and 2). Two days later the patient passed despite aggressive therapeutic measures. The patient survived for ten days after admission.

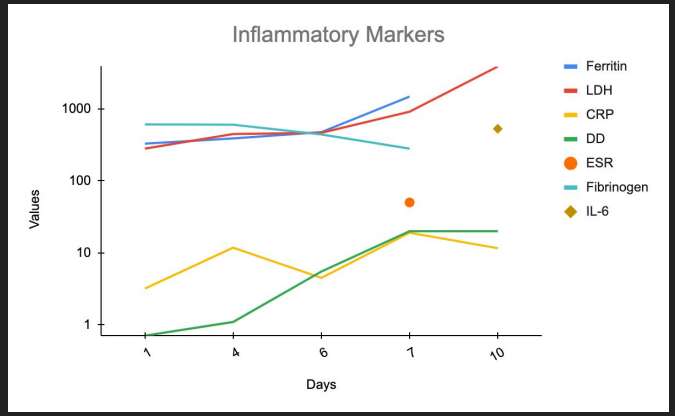

Figure 1. Inflammatory markers trending from day one of admission to day ten. Ferritin (blue line), Lactate Dehydrogenase (LDH; red line), C-reactive protein (CRP; yellow line), D-Dimers (DD; green line), Erythrocyte sedimentation rate (ESR; orange dot), Fibrinogen (turquoise line), Interleukin-6 (IL-6; gold diamond).

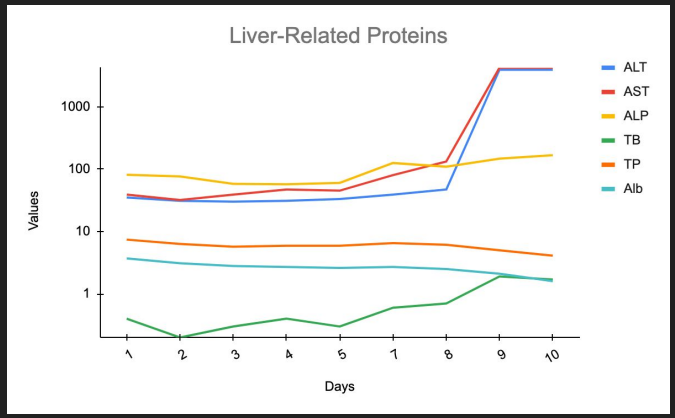

Figure 2. Liver-related proteins trending from day one of admission to day ten. Alanine aminotransferase (ALT; blue line), Aspartate aminotransferase (AST; red line), Alkaline phosphatase (ALP; yellow line), Total bilirubin (TB; green line), Total protein (TP; orange line), Albumin (Alb; turquoise line).

DISCUSSION: In reaction to COVID-19 infection, macrophages and dendritic cells trigger an initial immune response, including lymphocytosis and cytokine release, resulting in a cytokine storm, an acute hyperinflammatory response responsible for critical illness in many conditions, including viral infections, cancer, sepsis, and multi-organ failure. This exaggerated acute response resulting in high serum levels of cytokines is inversely related to the total lymphocyte count; low cytotoxic T cells may reduce viral clearance. The cytokine storm is responsible for producing multi-organ failure, defined as failure of at least 2 of the following organs; liver, lung, and kidneys, but recent studies suggest that after the lungs, the liver is the second organ mainly affected by COVID-19.

Empiric therapy is often started along with the diagnostic workup when hyperacute or ALF is suspected, consisting of N-acetylcysteine (NAC). NAC is typically used for patients with suspected acetaminophen-associated ALF as it significantly improves outcomes if started early and has very few side effects. However, NAC has also been used for non-acetaminophen-induced ALF. When COVID-19 infection is complicated with ALF, management is directed based on the specific clinical requirements of each patient; in such cases, NAC, anticoagulants, monoclonal antibodies, plasmapheresis, and symptomatic treatment may be used concomitantly to improve outcomes.

CONCLUSION: Cases of hyperacute liver failure itself are a rare disorder. Furthermore, throughout the pandemic and to date, this is the first documented case report that has been identified as hyperacute liver failure due to COVID-19 infection. When hyperacute or ALF is suspected in COVID-19 disease, early recognition and prompt action are required to improve patient survival.

REFERENCES: Upon request.