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Arch Basic Clin Res 2024; 6(1): 69-72 · DOI: 10.5152/ABCR.2024.23121

Review

Coronavirus Disease 2019-Related Liver Injury: Imaging Aspects

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Cite this article as: Şenbil DC, Aydın S. Coronavirus Disease 2019 related liver injury: Imaging aspects. *Arch Basic Clin Res.* 2024;6(1):69-72.

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ABSTRACT

In the new coronavirus disease 2019 (COVID-19), there may be various degrees of abnormalities in liver functions. The reason for this situation may be an underlying liver disease or drugs used, or it may be due to direct liver injury from the virus. Several theories have been proposed in studies on this subject. This review summarizes the available and up-to-date information about imaging features of liver injury in COVID-19 disease.

Keywords: COVID-19, liver, injury, radiology

INTRODUCTION

The new coronavirus disease 2019 (COVID-19) is a zoonotic illness brought on by the coronavirus that causes severe acute respiratory syndrome.[1] The World Health Organization declared COVID-19 a pandemic on March 11, 2020, following its global expansion.[2] One of the significant organs affected by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral infection is the lung. However, the liver, heart, kidney, and gastrointestinal system are among the other organs that are harmed by COVID-19 disease.[3-6] However, some COVID-19 patients may experience acute respiratory distress syndrome and quickly progressing multiple organ failure. Coronavirus disease 2019 patients typically survive with mild symptoms.[1,7]

Previous research has revealed that COVID-19 disease affects some people and makes them experience symptoms like nausea, vomiting, diarrhea, and abdominal pain.[8,9] In addition, in some patients, the disease was observed to cause liver injury.[9] Studies conducted in China have found that COVID-19 disease causes liver damage in approximately 39%.[10] At the time of admission, abnormal liver function tests were found in certain COVID-19 patients.[11,12] These data collectively demonstrate that COVID-19 can harm the liver. The available data on radiographic imaging of liver injury in COVID-19 disease is summarized and given an overview in this review.

Thoracic computed tomography (CT), which has become a standard imaging procedure in COVID-19 patients, is crucial for both classifying and diagnosing the illness.[13,14] The radiological findings detected in thorax CT may vary according to the course of the disease. Radiological findings were shown to be related to the outcome of the disease.[15-17] When COVID-19 patients get CT scans, liver injury may result in radiological alterations that can be associated with the disease's severity.

The liver plays a significant role in pathogen protection. Most are impacted by systemic infections since it receives blood from both the portal and systemic circulation. The majority of the time, hepatocytes and cholangiocytes are directly cytopathically affected by viruses. Severe acute respiratory syndrome coronavirus 2 has been demonstrated by Yang et al.[18] to have a direct cytopathic effect on the liver. A COVID-19 patient's liver biopsy sample was examined, and it revealed necrosis, mitosis, cellular infiltration, and fatty degeneration. However, there is more than one disease responsible for severe liver injury. Additionally, sepsis and drug-induced liver damage can both exhibit it.[12]

Angiotensin converting enzyme-2 (ACE2) receptor is a protein that the SARS-CoV-2 virus employs to target host cell.[19] The hepatobiliary system has the ACE2 receptor, particularly in cholangiocytes and hepatocytes. According

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Received: January 27, 2023
Revision requested: April 24, 2023
Last revision received: May 2, 2023
Accepted: July 17, 2023
Publication Date: January 31, 2024

to studies, these receptors are particularly abundant in cholangiocytes.[20,21] Severe acute respiratory syndrome coronavirus 2 virus can exert a cytopathic effect by binding directly to ACE2-positive cholangiocytes, but not hepatocytes. Cholangiocytes play an important role in many mechanisms such as regeneration and immune response. For this reason, damage to cholangiocytes may cause deterioration in liver physiology. This circumstance is also supported by the fact that some COVID-19 patients have elevated levels of indicators such as gamma glutamyl transferase (GGT). In the examinations, it was observed that the GGT values of the patients increased after the COVID-19 infection[5] (Figure 1).

The direct cytopathic effect of the virus against the liver in COVID-19 may be the cause of the liver damage.[22] Lenti et al.[22] They discovered in their research that COVID-19 patients had elevated levels of the liver enzymes alanine transaminase, aspartate transaminase, and GGT. In liver biopsy samples from COVID-19 patients, Xu et al.[12] showed that microvesicular steatosis and modest lobular and portal activity were caused by COVID-19 infection or medications.

Radzina et al.[23] investigated the abdominal areas included in the sections in the thorax CT scans taken to evaluate the lung damage due to COVID-19 in their study. A region of interest (ROI) of about 1 cm^2 was used to measure density in liver segments 7 and 8. The findings showed that the average liver density in COVID-19 patients was 55 HU and that this density declined as a result of steatosis (Figure 2).

Radzina et al.[23] Using B mode ultrasonography (US), he performed an examination to assess steatosis and fibrosis in the liver. The echogenicity of the liver was compared to that of the adjacent kidney and spleen. It was discovered that in COVID-19 patients, liver steatosis caused an increase in echogenicity. Additionally, using shear wave elastography, the liver elasticity of COVID-19 patients was calculated in kilopascals (kPa). The mean liver stiffness value in the control group was 4.55 kPa. In the measurements made in the patient group, the liver stiffness value was found to be 5.06. In comparison to the control group, elasticity values were found to be considerably higher. The SARS-CoV-2 virus-induced fibrosis was assumed to be the primary cause of this disorder. In addition, it was observed that the fibrosis developed in the patients was mostly in the fibrosis-0 (F0) group according to metavir (Figure 3).

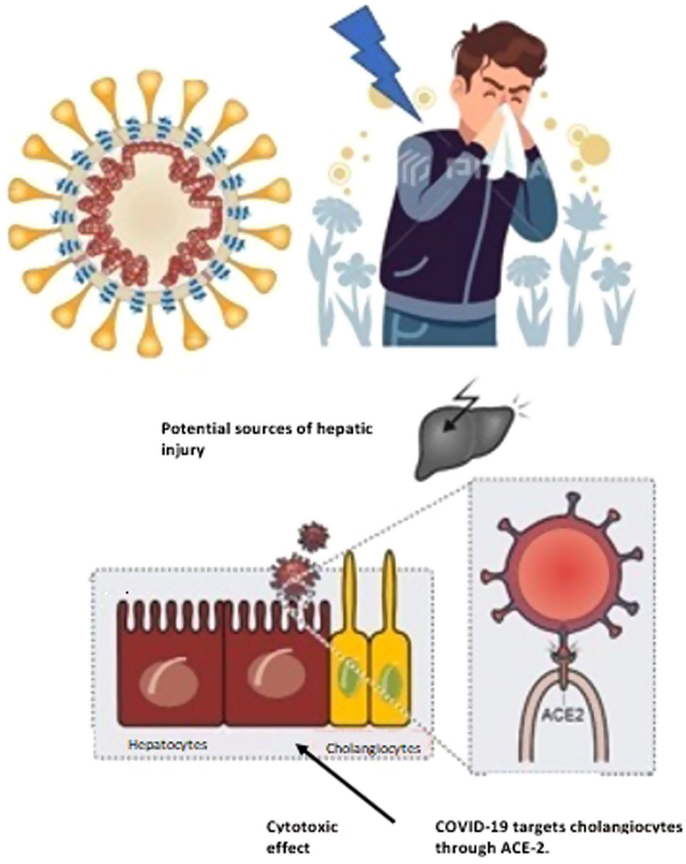

Figure 1. Clinical features and pathophysiology of coronavirus disease 2019 (COVID-19)-induced liver injury. ACE2, angiotensin converting enzyme-2.

MAIN POINTS

- Coronavirus disease 2019 (COVID-19) can affect many organs in the body.
- One of them is the liver.
- In this article, the radiological imaging features of liver damage in COVID-19 disease are described using the literature.

Ultrasonography is utilized to assess stomach pain and abnormal liver function tests in COVID-19 patients. Furthermore, not every stomach pain in COVID-19 individuals indicates an abdominal disease. Abdominal pain due to pneumonia is seen in 15% of patients. Abdelmohsen et al.[24] was found that the most common abdominal pathology in COVID-19 patients hospitalized in the intensive care unit was hepatomegaly (56%), and gallbladder wall thickening was the second. Bhayana et al.[25] found similar results in their study. Also, Bhayana et al.[25] detected portal venous gas in 1 patient in their study. Ultrasonography can be utilized to assess the vascular system due to the rise in coagulation and thrombotic problems in COVID-19 patients. Decreased vascularity detected in venous and arterial structures may be a sign of infarction.[26]

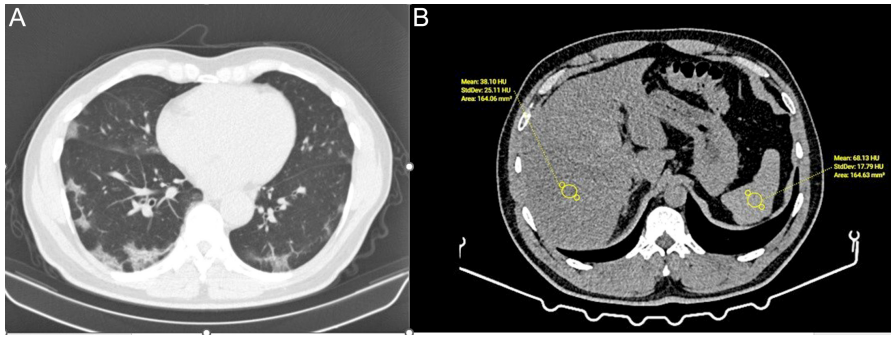

Figure 2. Fifty-two-year-old male patient with coronavirus disease 2019 diagnosis. Peripheral ground glass lesions are seen on both lungs (A, circles). The liver density decreased due to steatosis (B).

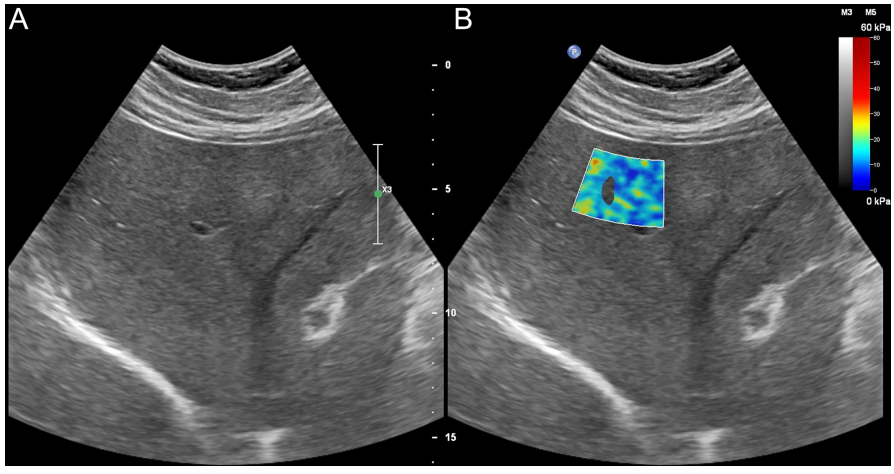

Figure 3. Thirty-five-year-old male patient. In the patient who was followed up due to coronavirus disease 2019, an appearance compatible with steatosis was observed in the ultrasound (A) and elastography (B) performed due to the high liver function tests.

Figure 4. A 48-year-old female patient. Main bile duct is enlarged on coronal Half fourier single-shot turbo spin-echo (HASTE) image (A, arrow). In the Magnetic resonance cholangiopancreatography (MRCP) image stones are seen in the lumen of the common bile duct (B, arrow). Computed tomography image shows typical peripheral ground-glass opacities (C, circles).

Magnetic resonance imaging (MRI) is employed far less frequently than US and CT in the assessment of liver damage in COVID 19 patients due to its high cost, extended scanning time, and nonspecific results. The most significant limiting factor for COVID-19 patients, particularly for those with respiratory failure, is the lengthy nature of the MRI.[25] Shiralkar et al.[27] discovered that the examination of biliary illness is greatly aided by MRI technology. The results, however, are general since cholestasis is linked to elevated ACE2 expression in cholangiocytes.[25,27] (Figure 4).

In conclusion, imaging, especially thoracic CT, is crucial for the diagnosis and care of COVID-19 patients. Hepatocyte and cholangiocyte damage caused directly by the COVID-19 virus is typically linked to liver harm caused by the virus. The liver damage brought on by COVID-19 is diagnosed using imaging modalities such as US, CT, and MRI. Imaging results of liver damage are typically vague and resemble steatosis. Furthermore, it was discovered that fibrosis increased liver elasticity in elastography. As additional research on COVID-19-related liver injury is undertaken, more varied findings will be attained.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.D.; Design – A.S.; Supervision – A.S.; Resources – S.D.; Materials – S.D.; Data Collection and/or Processing – A.S.; Analysis and/or Interpretation – A.S.; Literature Search – A.S.; Writing Manuscript – S.D.; Critical Review – A.S.; Other – S.D.

Declaration of Interests: The authors declare that they have no competing interests.

Funding: The authors declare that this study received no financial support.

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