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МОРФОЛОГИЧЕСКИЕ ИЗМЕНЕНИЯ В ПЕЧЕНИ ПРИ ИНФЕКЦИИ COVID-19

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MORPHOLOGICAL CHANGES IN THE LIVER DUE TO THE COVID-19 INFECTION

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Резюме. Исследование описывает морфологические изменения в печени, вызванные COVID-19, обнаруженные при аутопсийном и биопсийном исследованиях. Ключевые повреждения включали: стеатоз, портальное и дольковое воспаление, фиброз, некроз, патологию сосудов, гранулёмы.

Ключевые слова: COVID-19, патология печени, стеатоз, некроз, цитокиновый шторм.

Resume. The study examines the morphological changes in the liver caused by COVID-19, focusing on autopsy and biopsy findings. Key alterations include: Steatosis, Portal and lobular inflammation, Fibrosis, Hepatic necrosis, Vascular Pathologies, Granulomas.

Keywords: COVID-19, liver pathology, steatosis, necrosis, cytokine storm.

Relevance. The liver is a frequent target of SARS-CoV-2, with injury ranging from mild enzyme elevation to severe dysfunction. Understanding these changes is critical for managing COVID-19 complications.

Aim: to characterize the morphological liver changes in COVID-19 patients and elucidate their pathogenesis.

Objectives:

1. Describe gross and microscopic liver alterations.
2. Analyse mechanisms of injury (direct viral effects vs. systemic inflammation).
3. Correlate findings with clinical outcomes.

Material and methods. Samples- Analysis of results from liver biopsies and autopsy specimens of COVID-19 patients. Data sources- Peer-reviewed studies and case series (Lagana et al., 2020; Chu et al., 2021)

Results and their discussion. In COVID-19, grossly, the liver shows a congested appearance of varying degrees of yellow colour. It has features of: hepatomegaly- enlargement of the liver beyond its normal size, fibrosis- the excessive accumulation of extracellular matrix proteins, which leads to liver tissue thickening and scarring, vascular changes - such as endothelial injury, ischemia, vasodilation which occur to due to mechanism of systemic inflammation (fig. 1).

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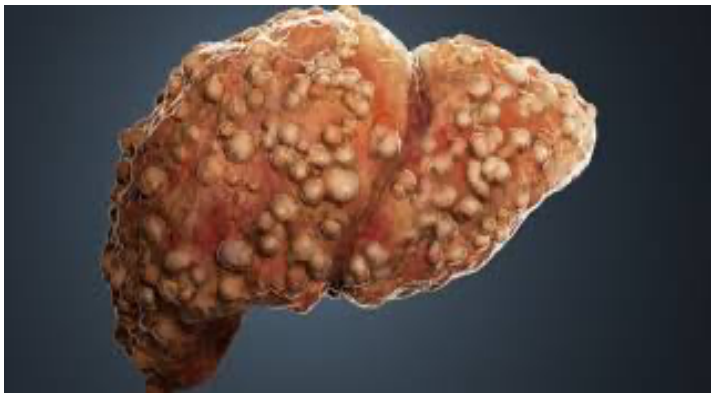

Fig. 1 – Fibrosis of liver

One of the main morphological changes observed was mild to moderate steatosis (also known as Fatty Liver) of both microvesicular and macrovesicular types (fig. 2). The process of steatosis refers to accumulation of fat droplets in the liver cells. Its correlation with COVID-19 is that this virus has a tend to cause increased cytokine production disrupting the process of lipid metabolism. Macrovesicular steatosis was predominant, "Active steatohepatitis with ballooning and Mallory-Denk bodies." [1] Steatosis was also found to be associated with medications and treatments "correlated with antiviral therapy combined with invasive mechanical ventilation intervention."[2] and also with immunosuppressants.

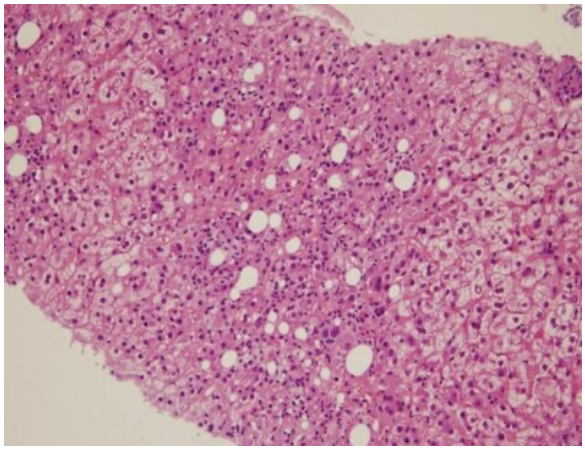

Fig. 2 – Steatosis seen under microscopic examination

Portal inflammation: this is an inflammatory process that occurs in the portal triads of the liver that tends to cause liver dysfunction (fig. 3). This is the most commonly found morphological change. COVID-19 triggers systemic inflammation and cytokine storm. It is associated with slight increase of plasma cells and lymphocytes, without eosinophils and neutrophils. The patients affected may have elevated levels of liver enzymes and altered liver function which is a contributing factor determining the degree of severity of the resulting liver disease. "The portal inflammation was mild, focal (present in <25% of portal tracts), and composed of lymphocytes" [3]. Portal tract inflammation was observed ranging from mild to moderate, with the main inflammatory cells being lymphocytes and macrophages.

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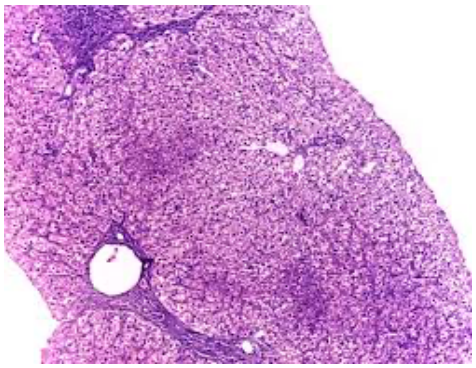

Fig. 3 – Portal inflammation with HE staining

Lobular inflammation (fig. 4) is a process characterized by the infiltration of immune cells such as lymphocytes and Kupffer cells, and hepatocyte injury occurring within lobules of the liver. Mild to severe forms were observed in patients. It tends to associated with localized inflammatory response of the body to SARS-CoV-2 virus and due to elevated cytokines [5]. Lobular changes have a correlation with steatosis of the macrovesicular type [4].

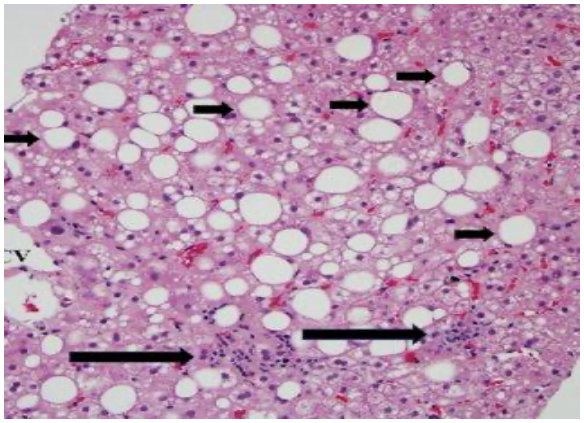

Fig. 4 – Microscopic examination depicting lobular inflammation with steatosis

Fibrosis of the liver affecting both the hepatocytes and the vascular wall (fig. 5). It causes thickening and scarring of the vessel walls which can indicate both chronic inflammation and liver injury. It can lead to obstruction, impairment of blood flow and is a contributing factor to cause portal hypertension which in turn leads to liver dysfunction [5].

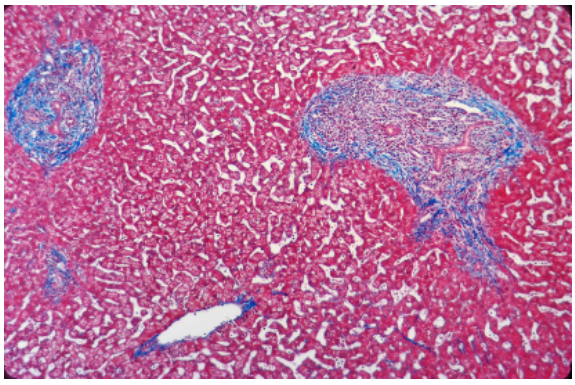

Fig. 5 – Liver fibrosis with MSB stain

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Centrilobular and bridging necrosis due to hypoxia, cytokine storm, or direct viral injury (ACE-2 mediated) was noticed. Phlebosclerosis, veno-occlusive disease, and hyalinosis as vascular pathology was present (fig. 6).

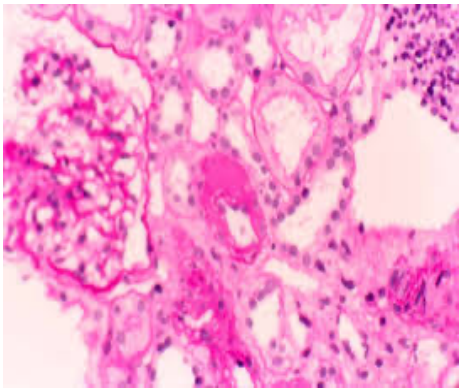

Fig. 6 – Liver arterioles hyalinosis with HE stain

There are 3 types of granuloma in liver due to COVID-19: fibrin-ring, necrotizing, and non-necrotizing (fig. 7, 8).

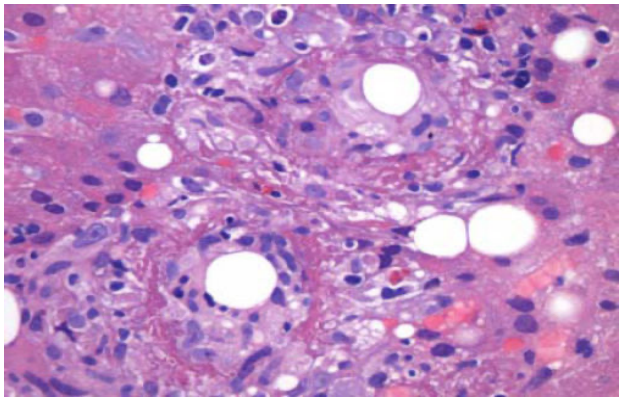

Fig. 7 – Fibrin ring-shaped granuloma

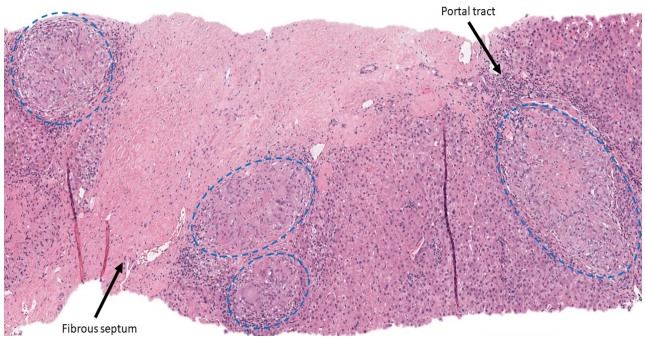

Fig. 8 – Multiple necrotizing granulomas

Conclusion:

The above-mentioned morphological changes reflect the ability of the virus to induce significant damage. As this is a relatively new area of research, the prevailing question still exists; does the virus have direct cytopathic effect of the hepatocytes, acting via the ACE-2

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receptors, facilitating viral replication and direct damage or whether the impact is mediated through virus associated complications?

Literature

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