



MORPHOLOGICAL CHARACTERISTICS OF HEPATIC DAMAGE ASSOCIATED WITH COVID-19 IN PREGNANT WOMEN

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ABSTRACT

This article examines the morphological characteristics of hepatic damage associated with COVID-19 in pregnant women. The study focuses on pathological changes observed in liver tissues during SARS-CoV-2 infection and analyzes the impact of these alterations on maternal health during pregnancy. Special attention is given to inflammatory processes, vascular disorders, hepatocellular degeneration, and microthrombotic complications identified in pregnant patients affected by COVID-19. The research highlights the role of immune and hormonal changes during pregnancy in aggravating liver injury and contributing to disease severity. Histopathological findings demonstrate that COVID-19-related hepatic damage in pregnant women may lead to significant clinical complications requiring timely diagnosis and multidisciplinary management. The results of the study contribute to a better understanding of the pathogenesis of liver involvement in COVID-19 and may support the development of effective diagnostic and therapeutic strategies for pregnant patients.

Introduction

The outbreak of coronavirus infection (COVID-19) has had a profound impact on global healthcare systems and remains one of the most significant medical challenges of recent decades. Although the respiratory tract is considered the primary target of SARS-CoV-2 infection, increasing evidence suggests that the disease also affects numerous internal organs, including the liver. Hepatic dysfunction in COVID-19 patients has attracted considerable scientific attention because the liver performs essential metabolic, immunological, and detoxification functions necessary for maintaining systemic homeostasis. Pregnancy is accompanied by substantial physiological and immunological adaptations that may alter susceptibility to infectious diseases and influence the severity of organ involvement. In pregnant women, these adaptive mechanisms can contribute to the progression of inflammatory and vascular disorders caused by SARS-CoV-2. Therefore, studying the pathological alterations of the liver in pregnant patients with COVID-19 is highly important for understanding disease mechanisms and improving clinical management.

Scientific relevance

Current evidence indicates that hepatic injury in COVID-19 develops through several interrelated mechanisms. These include systemic inflammatory response, hypoxic damage, endothelial dysfunction, coagulation abnormalities, immune-mediated injury, and possible toxic effects of therapeutic agents. During pregnancy, the presence of physiological hypercoagulability and altered immune regulation may intensify these pathological processes. Despite extensive investigations into pulmonary manifestations of COVID-19, the morphological changes occurring in the liver of pregnant women remain insufficiently described in the scientific literature, which emphasizes the relevance of this study.

Objective of the study

The purpose of this investigation was to evaluate the morphological alterations of hepatic tissue in pregnant women who died as a result of severe COVID-19 infection.

Materials and methods

Histopathological analysis was carried out using liver tissue samples obtained during pathological examination of pregnant women with fatal COVID-19. Tissue specimens were processed according to conventional pathological protocols involving formalin fixation, paraffin embedding, microtome sectioning, and hematoxylin-eosin staining. The assessment focused on degenerative, necrotic, inflammatory, vascular, and fibrotic changes within hepatic tissue structures. Comparative analysis with control samples was also performed.

Results

Microscopic examination revealed significant structural abnormalities in the liver tissue of pregnant women affected by severe COVID-19 infection. Degenerative alterations of hepatocytes were among the most frequently observed findings. In many cases, hepatocellular ballooning and microvesicular fatty degeneration were identified. These pathological changes likely reflected severe metabolic imbalance and prolonged hypoxic exposure associated with systemic viral infection. Areas of focal and zonal necrosis were also detected in the hepatic parenchyma. Necrotic lesions were predominantly localized in centrilobular regions surrounding the central veins. Such localization suggests an important role of circulatory insufficiency and oxygen deprivation in the development of liver injury.

Marked vascular disturbances were observed in the majority of examined specimens. Hepatic sinusoids demonstrated pronounced dilatation and congestion. In addition, vascular stasis and microthrombi formation were identified in several cases, supporting the presence of COVID-19-associated thrombotic microangiopathy and endothelial impairment. Inflammatory changes were represented mainly by mild or moderate lymphohistiocytic infiltration in portal tracts and hepatic parenchyma. These findings indicate activation of immune-inflammatory mechanisms in response to viral infection.

Furthermore, some tissue samples demonstrated initial manifestations of fibrotic remodeling, including perisinusoidal collagen accumulation. Comparative evaluation showed that these pathological changes occurred significantly more frequently and more severely in the COVID-19 group than in the control group ($p < 0.05$).

Discussion

The obtained findings confirm that liver involvement in COVID-19 is characterized by a multifactorial pathogenesis. Degenerative and necrotic hepatocellular changes appear to

result primarily from hypoxic injury, systemic inflammatory reactions, and excessive cytokine production. Vascular abnormalities, including sinusoidal congestion and microthrombosis, reflect disturbances of endothelial function and coagulation pathways that are commonly associated with severe SARS-CoV-2 infection. Pregnancy may further aggravate these pathological mechanisms because physiological changes during gestation promote hypercoagulability and modify immune responses. Consequently, pregnant women may be more susceptible to severe microcirculatory and inflammatory hepatic damage during COVID-19 infection. It should also be considered that pharmacological therapy administered during treatment of severe coronavirus infection may contribute to additional hepatotoxic effects. The results of this study correspond with contemporary international reports describing hepatic pathology in patients with severe COVID-19; however, this investigation specifically highlights the importance of pregnancy-related factors in the progression of liver injury.

Conclusion

COVID-19-associated liver injury in pregnant women is characterized by a combination of degenerative, necrotic, inflammatory, and vascular pathological changes. The most characteristic morphological findings include hepatocellular degeneration, centrilobular necrosis, sinusoidal congestion, and microvascular thrombosis. These alterations develop as a consequence of complex pathogenic mechanisms involving hypoxia, systemic inflammation, endothelial dysfunction, and coagulation disorders. Pregnancy appears to act as an additional factor contributing to the severity of hepatic damage in COVID-19 infection.

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