Article

Radiation Methods for Studying the Liver in the Diagnosis of Sinusoidal Obstruction Syndrome in Cancer Patients During Drug Therapy

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Abstract: Due to the widespread use of drug therapy in the treatment of oncological diseases in the practice of a radiologist, various manifestations of its damaging effects on the liver parenchyma have become more common. One of these side effects is sinusoidal obstruction syndrome, in which a violation of microcirculation develops at the level of the sinuses of the hepatic lobes. Developing pathological changes in the liver parenchyma of a vascular, structural and functional nature can simulate the progression of the oncological process. Also, late diagnosis of drug toxicity can lead to the development of irreversible changes - liver cirrhosis, portal hypertension. Thus, diagnosing sinusoidal obstruction during various medical imaging methods is an urgent task for a radiologist.

Keywords: sinusoidal obstruction syndrome, computed tomography, magnetic resonance imaging, chemotherapy

1. Introduction

Sinusoidal obstruction syndrome (SOS), formerly called veno-occlusive disease, is a life-threatening complication that is associated with high-dose chemotherapy. SOS often develops rapidly and unpredictably. It is important to identify risk factors that will allow timely diagnosis of this complication and initiation of appropriate therapy [1].

It is believed that with SOS there is a toxic effect on the sinusoidal endothelium, endothelial cells, which leads to damage to the sinusoidal barrier [3], giving the liver a bluish tint. This primary damage to the endothelium leads to extravascular release of red blood cells, leukocytes and other blood cells into the space of Disse, which can lead to thrombo-fibrinolytic balance, further dissection of the endothelial lining with embolization and venular occlusion [4]. In the future, hepatorenal hypertension may develop with the development of multiorgan failure.

SOS can manifest itself in acute (1–3 weeks), subacute and chronic phases. Chemotherapy regimens associated with this condition include oxaliplatin, cisplatin, cyclophosphamide and vincristine [2].

Clinically, patients with SOS present with jaundice, hepatomegaly, weight gain, abdominal pain, and encephalopathy [4]. Chronic SOS can progress to liver cirrhosis.

When using instrumental research methods for SOS, hepatosplenomegaly, ascites, edematous thickening of the gallbladder wall, portosystemic shunts and periportal edema are detected. When ascites is detected, it is important to confirm the diagnosis of SOS and carry out a differential diagnosis with malignant ascites associated with the spread of the pathological process through the peritoneum or metastases [7,11]. In surgical patients, the presence of signs of portal hypertension is important because these signs are potentially associated with a worse prognosis for patient survival due to an increased risk of bleeding or liver failure after surgery [6].

2. Diagnostics

Contrast-enhanced CT shows heterogeneous enhancement in the arterial and portal phases of the scan, which is explained by perfusion abnormalities characterized by a "mosaic pattern" or diffuse linear areas of low density resulting from hepatic congestion, which in the delayed phase of scanning may merge with the liver parenchyma [14].

A diffuse reticular pattern in the hepatobiliary phase of contrast-enhanced MRI in patients after chemotherapy is a characteristic feature of TOS [8]. MR images demonstrate a heterogeneous reticular or linear pattern in normal parenchyma, characterized by hypointensity on T1-weighted images and hyperintensity on T2-weighted images. When using a hepatotropic contrast agent, reticular hypointensity of liver tissue on hepatobiliary phase images with a location in the peripheral areas of the liver is highly specific for TOS [12]. This radiological pattern is likely due to decreased penetration of contrast agent into liver tissue due to dysfunctional hepatocyte damage and decreased portal blood flow [13]. In focal SOS, the presence of unclear boundaries, especially on hepatobiliary phase images, as well as the absence of diffusion restriction are important differential diagnostic criteria between toxic manifestations in the liver parenchyma and metastases. Table 1 shows the features of sinusoidal obstruction syndrome [2].

Table 1. Features of sinusoidal obstruction syndrome

Sinusoidal obstruction syndrome occurs when the sinusoidal endothelium of the liver is damaged, usually after administration of oxaliplatin, cyclophosphamide and vincristine. This condition is associated with an increased risk of bleeding and liver failure.	
Radiological findings	**A drug**
Ultrasound: ascites, thickening of the gallbladder wall and hepatosplenomegaly. CT: Ascites, decreased diameter of the right branch of the portal vein (‹0.45 cm), paraesophageal varices, hepatosplenomegaly and recanalization of the umbilical vein. MRI: diffuse hypointense reticular pattern on post-contrast delayed phase hepatobiliary T1-weighted imaging, periportal edema	Oxaliplatin, 6-MP, dacarbazine, azathioprine, cyclophosphamide, fluorouracil and vincristine

3. Results

When conducting oxaliplatin-based chemotherapy, the maximum radiological manifestations of the severity of SOS are determined approximately 4 months after the start of treatment, radiological remission is observed approximately 3 months after cessation of treatment [9]. Cessation of chemotherapy is often accompanied by a decrease in these manifestations, suggesting that SOS, at least in mild to moderate forms, both diffuse and focal, is potentially reversible [10]. Severe forms of SOS can also progress after cessation of therapy, leading to the appearance of regenerative nodules, followed by the formation of cirrhotic changes [15].

4. Conclusions

In conclusion, many chemotherapy drugs can cause various liver lesions in cancer patients, which are becoming more common due to the longer life expectancy of patients. Radiologists must be aware of the imaging features of liver tissue damage during chemotherapy to guide physicians in making therapeutic decisions and, thus, prevent the development of serious complications in patients.

Application of artificial intelligence: The review is written without the use of artificial intelligence technologies.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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