

## Article

# Computed and Magnetic Resonance Imaging in the Diagnosis of Focal Nodular Hyperplasia in the Liver in Cancer Patients During Chemotherapy

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**Abstract:** The differential diagnosis of focal changes in the liver remains an urgent task for the radiologist. Focal nodular hyperplasia (FNH), being the second most common benign formation of hepatocellular origin, is formed in cancer patients as a result of vascular disorders during chemotherapy, in particular with the development of sinusoidal obstruction. As a result, the resulting FNH node can simulate metastasis in a cancer patient, especially in cases where the primary tumor has a hypervascular structure. However, radiation semiotics based on computed tomography and magnetic resonance imaging data allows, in most cases, to confidently differentiate the nature of the focal formation and avoid false-positive diagnostic results.

**Keywords:** FNH-like lesions, computed tomography, magnetic resonance imaging, chemotherapy

## 1. Introduction

Focal nodular hyperplasia is a benign liver lesion consisting of a proliferation of hyperplastic hepatocytes surrounding a central stellate scar. Any new formation in the liver in a patient with a history of cancer raises serious concerns regarding metastasis. After or during chemotherapy treatment, changes such as steatosis, steatohepatitis, and sinusoidal obstruction syndrome may occur in the liver, which may manifest as focal lesions [2]. In addition to manifestations of hepatopathy, against the background of high doses of chemotherapy, benign regenerative lesions in the form of pseudometastatic nodules are detected in the liver [3]. These lesions are considered a late manifestation of sinusoidal obstruction syndrome (SSO). In adults, focal nodular hyperplasia (FNH) develops in patients with colorectal cancer after oxaliplatin-based chemotherapy [4]. The exact pathogenesis leading to the occurrence of FNH after chemotherapy remains unknown. FNH is a benign hyperplastic lesion that occurs in the setting of a vascular malformation and often occurs with a local increase in pressure in the hepatic arteries [5]. An important side effect of treatment regimens using oxaliplatin is the occurrence of sinusoidal obstruction syndrome (SSO), which has a toxic effect on sinusoidal endothelial cells. SSO reduces oxygen saturation of the liver [6], in-



increases the expression of hypoxia-induced factors and stimulates angiogenesis by activating angiogenic factors [7]. It is hypothesized that SSO and associated liver hypoperfusion may lead to the formation of benign regenerative lesions such as FNH.

New or enlarged FNH-like lesions in the liver in patients under observation with a history of cancer prone to metastasis to the liver may lead to unnecessary invasive procedures if they are mistaken for metastases.

**2. Diagnostics**

On computed tomography (CT), focal nodular hyperplasia classically appears as a homogeneous, isodense, or slightly hypodense lesion relative to the liver parenchyma. On CT with bolus intravenous contrast, the mass appears as a homogeneous hypervascular lesion; In delayed phases of the scan, accumulation of a central scar can be observed. These pathognomonic signs of FNH should be taken into account in the differential diagnosis of hypervascular metastases in the liver. A differential diagnostic sign that distinguishes FNH from metastases is an irregular shape, unclear contours, hypervascular foci in the hepatobiliary phase of scanning on magnetic resonance imaging (MRI). Metastases often accumulate contrast agent in a ring-like pattern.

Additional MRI features characteristic of FNH are signal isointensity on T1- and T2-weighted images, early contrast enhancement of the lesion, and absence of diffusion restriction on DWI (diffusion-weighted imaging) [8].

Metastatic malignancies that are commonly treated with oxaliplatin regimens are most often hypovascular on MRI. Thus, when hypervascular foci appear in the liver in cancer patients during chemotherapy, one should not immediately write about a metastatic lesion; FNH-like benign lesions should be included in the differential list [9].

Table No. 1 shows the features of sinusoidal obstruction syndrome [8].

Table 1. Features of sinusoidal obstruction syndrome

|  |                                |
|--|--------------------------------|
| <b>Focal nodular hyperplasia is thought to result from microvascular changes in the liver and is associated with oxaliplatin use. Oncologists should be aware of this focal lesion because it can be mistaken for hypervascular metastasis. MRI with hepatospecific contrast agent provides important information for the differential diagnosis of focal nodular hyperplasia.</b> |                                |
| <b>Radiological findings</b>   | <b>A drug</b>                  |
| MRI: signal isointensity on T1- and T2-weighted images, early contrast enhancement and no diffusion restriction (DWI)  | Oxaliplatin-based chemotherapy |

**3. Conclusions**

Although the appearance of FNH-like lesions in the liver during chemotherapy is rare, it is important for physicians to be aware of the occurrence of these benign lesions because they can simulate metastases and prevent overdiagnosis in such cases and prevent unnecessary invasive procedures.

**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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