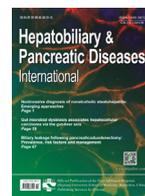




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Viewpoint

Prediction of microvascular invasion in hepatocellular carcinoma with preoperative imaging radiomic analysis: Is it ready for prime time?

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Microvascular invasion (MVI), also known as microvascular tumor embolism, refers to the cancer cell nest in vessels lined with endothelial cells. MVI may be found in the small branches of the portal vein and hepatic vein. Occasionally, MVI may also exist in the hepatic artery, bile duct and lymphatic vessels. The incidence of MVI in hepatocellular carcinoma (HCC) patients ranges from 15% to 57.1%, and MVI can predict the risks of tumor recurrence and long-term survival after surgery [1,2]. However, MVI is different from macrovascular invasion, and MVI cannot be preoperatively diagnosed by imaging. Due to the heterogeneity of HCC and the limited amount of tissue obtained by biopsy, clinicians cannot accurately assess the MVI status of HCC [3] and therefore, the identification of MVI is still based on histopathological examination of resected surgical specimens. Owing to its late postoperative diagnosis, MVI has limited usefulness in current clinical practice. An accurate preoperative evaluation method for MVI can provide an effective basis for individualized treatment plans for each patient. Currently, the preoperative assessment of MVI in HCC with non-invasive methods has become a hot topic.

Macrovascular invasion and MVI in HCC are usually associated with highly active biological tumor behavior and disease progression [4]. Perhaps because MVI is considered a mild manifestation of tumor invasiveness, its clinical significance has been underestimated. Many studies have shown that MVI is directly related to the outcomes of HCC patients after surgery, and many researchers have tried to predict MVI preoperatively. Some studies have predicted MVI by clinical and pathological characteristics (tumor size, number, differentiation, etc.) and serum markers for tumors [1]. However, these methods are still in the research stage and have not yet been applied in clinical practice due to their low specificity, complex technology and high cost. Although it is difficult to detect MVI through radiology techniques, some studies have begun to explore the imaging characteristics (tumor dimension, multinodularity, non-smooth tumor margins, peritumoral enhancement, etc.) of MVI [5]. Nevertheless, these conventional imaging data were not precisely analyzed. As a result, these imaging data cannot accurately reflect the biological tumor characteristics. The data also led to inconsistent conclusions between different studies.

Moreover, the evaluation of these imaging features depends on individual experience, which can lead to the exclusion of supporting evidence in clinical practice.

In recent years, breakthroughs in medical imaging technology have led to enormous increases in the amount of medical imaging data stored in digital formats. As a result, radiomics, a new technology based on medical data and artificial intelligence, has emerged. Radiomics focuses on improving image analysis using an automated high-throughput extraction technique to process large amounts of quantitative features from medical images and belongs to the last category of innovations in medical imaging analysis [6]. Radiomics provides a tool to comprehensively quantify and visualize intra-tumor heterogeneity at the radiological level, and aims to provide an accurate prediction model and assist in guiding clinical practice. Recently, several radiomics studies have been conducted for different cancers [7]. Radiomics has been successfully applied to the diagnosis and prognosis prediction of HCC [8]. A few studies have tried to predict MVI preoperatively with the radiomics technique [6,9]. However, the following key issues should still be addressed: (i) at present, researchers have only used single-modality imaging data to construct radiomics models. The use of multi-modality imaging data and its interactive information for the preoperative prediction of MVI has not been explored. (ii) Radiomic studies often use automatic and semi-automatic methods for segmentation, but since this process is not standardized between different studies, the reproducibility may be affected. (iii) Most of the results come from retrospective studies with a small patient cohort. These studies lack rigorous independent multi-institution validation. (iv) Most studies that focused on preoperative MVI assessment did not report the pathological sampling protocol in detail. A worldwide standard for the pathological sampling of MVI should be established. The use of radiomics for the preoperative prediction of MVI in liver cancer patients is still in its early stages, and large population studies are needed to validate the concept.

Radiomics is a highly powerful tool that can provide important information regarding diagnosis, individualized therapy, surveillance and prognosis in the future. High-precision preoperative prediction of MVI in HCC through radiomics can hopefully be achieved. However, it may be too early to involve radiomics in clinical practice due to the limitations listed previously. Radiomics may play a powerful role in the future management of HCC patients after validation with multicenter prospective clinical trials.

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Competing interest

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