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Review Article

Evaluation of Liver Tumours Using Computed Tomography

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Abstract

Introduction: Imaging techniques such as computed tomography (CT) can provide unique information about any region of the body. It is an essential aid in detecting tumors and evaluating their size and growth over a period of time. Liver tumors/Hepatocellular carcinoma are difficult lesions to detect, and because of the presence of some isodense areas, false negative results can be expected, yet computed tomography is largely used for the evaluation of such tumors. With the advancement in technology, it now becomes easier to evaluate these tumors since this modality is important to assess those patients who are likely or not to get benefit from anticancer treatment. The Liver Imaging Reporting and Data System (LI-RADS) is one system that was released in 2011 to standardize the interpretation, development, and increased risk of hepatocellular tumors. A recent version of this system was released in 2018, which is LI-RADS v2018.

Aim of the Study: The aim of the present review is to understand the role of computed tomography in diagnosing and assessing the liver tumors.

Methodology: The review is a comprehensive research of PUBMED since the year 1992 to 2020.

Conclusion: Computed tomography-guided LI-RADS v2018 system provides data for the standardized interpretation of findings in patients at risk for hepatocellular. With the advent of advanced research in recent times, research into quantitative imaging and functional imaging has created a new way and opportunity in liver imaging and assessment of tumors. Certain parameters can be suggestive of expected liver tumors and could serve as early predictors of response.

Keywords: *Hepatocellular Carcinoma; Computed Tomography*

Introduction

LI-RADS was developed to provide a method for assessing and evaluating the presence of various liver tumors or hepatocellular carcinoma (HCC), or other malignancies and those who are at risk of developing these, based on imaging modality that is Computed tomography (CT) or magnetic resonance imaging (MRI). There are various categories assigned in this system to assess tumors; for example, the relative assessment of hepatocellular carcinoma or tumor in the vein of categorizing in a different category as LR-TIV, as shown in the table. The recent version of LI-RADS is now evolved to LI-RADSv2018, which includes guidance regarding contrast-enhanced computed tomography, MRI, ultrasound, and screening ultrasound to understand locoregional therapy of hepatocellular carcinoma [1].

The earlier version that is LI-RADS was in the context of patients with liver diseases such as chronic hepatitis B infection without cirrhosis or cirrhosis or a previous history of hepatocellular carcinoma. A drawback of LI-RADS is that it should not be used in cirrhosis patients with vascular causes because of its decreased specificity of arterial hyperenhancement for malignancy [2].

LI-RADS v2018 diagnostic categories [3]

Category	Definition
LR-1	Definitely benign
LR-2	Probably benign
LR-3	Intermediate probability of malignancy
LR-4	Probably HCC
LR-5	Definitely HCC
LR-M	Probably or definitely malignancy but not HCC specific
LR-TIV	Definite tumor in the vein
LR-NC	It cannot be categorized due to image degradation or omission
LI-RADS: Liver Imaging Reporting and Data System, HCC: Hepatocellular Carcinoma; LR-TIV: Tumour in Vein	

LI-RADS v2018

The Liver Imaging Reporting and Data System (LI-RADS) provides a step-by-step approach for the categorization of observations seen on computed tomography of patients with liver diseases such as chronic hepatitis B viral infection, cirrhosis, or history of liver tumor (hepatocellular carcinoma). Observations are categorized according to lesion present; LR-1 is categorized as definitely benign while LR-2 is probably benign (LR-2). These findings are based on typical CT features linked with specific benign entities. Findings in imaging modalities, it is suggestive malignancies other than hepatocellular carcinoma are categorized as LR-M. These imaging features of computed tomography include rim arterial phase hyperenhancement, targetoid restricted diffusion, and peripheral washout appearance. If initially imaging features and observations are not categorized as LR-1, LR-2, LR-M, LR-NC or LI-RADS, or LR-TIV (Tumor in Vein), then LI-RADS Diagnostic is used to categorize them on the basis of the presence or absence of features such as enhancing capsule, non-peripheral washout, threshold growth. This table [3].

Arterial Phase hyper enhancement (APHE) [3]		No APHE		Nonrim APHE		
Observation size (mm)		< 20	> 20	< 10	10 - 19	> 20
Additional Features: • Enhancing capsule • Non-peripheral washout • Threshold growth	None	LR-3	LR-3	LR-3	LR-3	LR-4
	One	LR-3	LR-4	LR-4	LR-4/LR-5	LR-5
	> Two	LR-4	LR-4	LR-4	LR-5	LR-5

Vascular phases for CT and MRI

To evaluate the regional vascular anatomy and patency in the liver, multiphase contrast-enhanced imaging is essential for the diagnosis of hepatocellular carcinoma (LI-RADS 5). An imaging CT taken without contrast provides information on pre-existing hyperattenuating and T1 hyperintense material, which is seen as sequelae of locoregional therapies. This bright material can hide or mimic enhancement in post-contrast phases. A pre-contrast phase is not mandatory for computed tomography imaging unless the patient has undergone locoregional therapy. This indicates the likely presence of pre-existing hepatic high attenuation material in a patient and is associated

with increased radiation dose from an additional computed tomography imaging phase. The phase of contrast known as the first needed post-contrast phase is the late hepatic arterial phase when there is no antegrade enhancement of the hepatic veins, but there is an enhancement of the portal vein. In some hepatocellular carcinoma and tumor, it is not conspicuous until the late hepatic arterial phase is reached. In such cases, earlier arterial phase imaging can result in reduced sensitivity for hepatocellular carcinoma [6]. For evaluation of the LI-RADS major feature of arterial phase hyperenhancement, the arterial phase is required [4].

The indication of the portal venous phase is when antegrade enhancement of the portal and hepatic veins occur, and there is peak parenchymal enhancement of the liver. Imaging of the portal venous phase best demonstrates "washout appearance," the major feature LI-RADS, which occurs due to the peak enhancement of the background liver. After the venous phase, the delayed phase occurs, which lasts 3 - 5 min after the injection of an extracellular contrast agent or gadobenate. There is an enhancement of vessels and parenchyma, but it exhibits decreased brightness when compared to the portal venous phase. For more reliable demonstration, a combination of the delayed phase and portal venous phase can in LI-RADS shows major features of "capsule appearance" and "washout appearance" than in the portal venous phase alone [5].

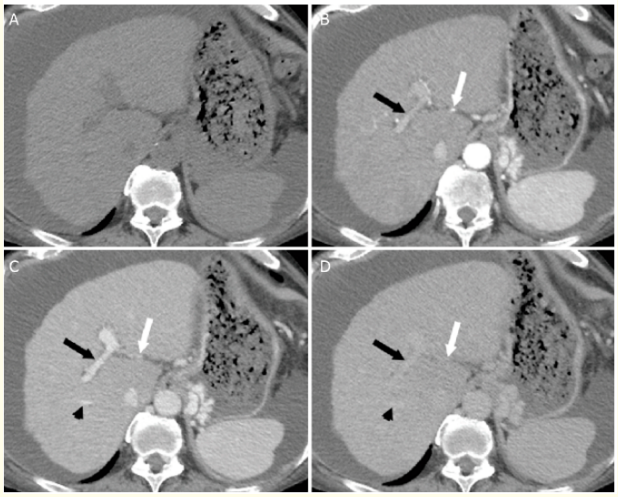

Figure 1: *Shows dynamic imaging for evaluation for hepatocellular carcinoma. Axial CT images demonstrating the pre-contrast (A), hepatic arterial (B), portal venous (C), and delayed (D) post-contrast imaging phases [3].*

The size increase in observation by more than 50% within six months in LI-RADS v2018 is known as Threshold growth. Threshold growth is only applicable on observations that are definitely masses because perfusion alterations can vary in size. The comparison needs to be done prior to the examination and must be a CT or MRI imaging that was done 6 months. This particular definition of threshold growth differed from previous versions of LI-RADS and was changed to achieve the threshold growth used by the OPTN. The development of a new observation within 6 months of a previous examination is not considered threshold growth because, according to the definition requires that the observation was present on the prior exam [6].

Tumor in vein

The vascular invasion of portal veins or hepatic veins is categorized as LR-TIV. When enhancing soft tissue is present, an unequivocal vascular invasion is present. There is no need for the presence of parenchymal mass for this category. Hence in such cases, the most probable etiology between hepatocellular carcinoma and non- hepatocellular carcinoma should be suggested [3,8].

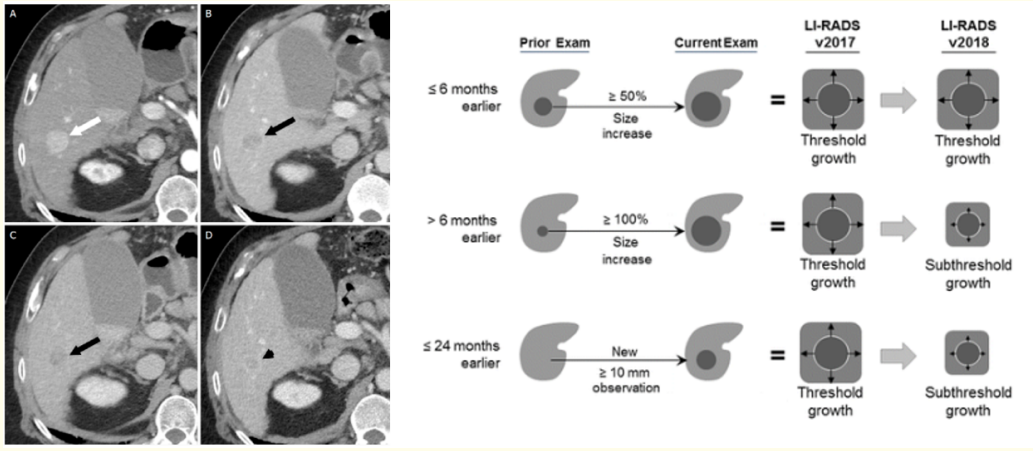

Figure 2: *Shows threshold growth. Axial CT images of a 21 mm mass in the right hepatic lobe. The mass demonstrates arterial phase hyperenhancement during the arterial phase (white arrow, A), and "washout" with "capsule" (black arrow) on the portal venous (B) and delayed phases (C) and changes introduced in Liver Imaging Reporting and Data System (LI-RADS) version 2018. (a) Changes in categorization. Observations 10–19 mm with arterial phase hyperenhancement (APHE) and non-peripheral "washout" are categorized as LR-5 (definite hepatocellular carcinoma) (b) Change in threshold growth definition. Only 50% size increase in 6 months [3,7].*

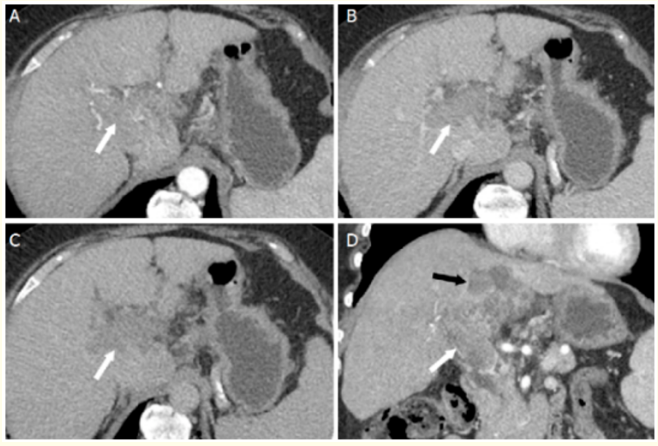

Figure 3: *Shows LR-TIV. Axial CT images from the hepatic arterial (A), portal venous (B), and delayed (C) phases after intravenous contrast administration, hepatic arterial phase (D) [3].*

Conclusion

Computed tomography-guided LI-RADS v2018 system provides data for the standardized interpretation of findings in patients at risk for hepatocellular. With the advent of advanced research in recent times, research into quantitative imaging and functional imaging has

created a new way and opportunity in liver imaging and assessment of tumors. Certain parameters can be suggestive of expected liver tumors and could serve as early predictors of response.

Bibliography

1. Elsayes KM., *et al*. "LI-RADS: a conceptual and historical review from its beginning to its recent integration into AASLD clinical practice guidance". *Journal of Hepatocellular Carcinoma* 6 (2019): 49.
2. Chernyak V., *et al*. "LI-RADS® algorithm: CT and MRI". *Abdominal Radiology* 43.1 (2018): 111-126.
3. Santillan C. "CT and MRI of the liver for hepatocellular carcinoma". *Hepatoma Research* 6 (2020): 63.
4. Ichikawa T., *et al*. "Hypervascular hepatocellular carcinoma: can double arterial phase imaging with multidetector CT improve tumor depiction in the cirrhotic liver?". *American Journal of Roentgenology* 179.3 (2002): 751-758.
5. Choi JY., *et al*. "CT and MR imaging diagnosis and staging of hepatocellular carcinoma: part I. Development, growth, and spread: key pathologic and imaging aspects". *Radiology* 272.3 (2014): 635.
6. Kielar AZ., *et al*. "An update for LI-RADS: version 2018. Why so soon after version 2017?" *Journal of Magnetic Resonance Imaging: JMRI* 50.6 (2019): 1990-1991.
7. Chernyak V., *et al*. "Liver Imaging Reporting and Data System (LI-RADS) version 2018: imaging of hepatocellular carcinoma in at-risk patients". *Radiology* 289.3 (2018): 816.
8. Freeny PC., *et al*. "Hepatocellular carcinoma: reduced frequency of typical findings with dynamic contrast-enhanced CT in a non-Asian population". *Radiology* 182.1 (1992): 143-148.

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