Original Investigation

Liver Imaging Reporting and Data System: Substantial Discordance Between CT and MR for Imaging Classification of Hepatic Nodules

Yu-Dong Zhang, MD, Fei-Peng Zhu, MD, Xun Xu, MM, Qing Wang, MM, Chen-Jiang Wu, MM, Xi-Sheng Liu, MD, Hai-Bin Shi, MD

Rationale and Objectives: The Liver Imaging Reporting and Data System (LI-RADS) is a newly developed nomogram for standardizing the performance and interpretation of liver imaging. However, it is unclear which imaging technique is optimal to exactly define LI-RADS scale. This study aims to determine the concordance of computed tomography (CT) and magnetic resonance imaging (MRI) for the classification of hepatic nodules (HNs) using a LI-RADS scoring system.

Materials and Methods: Major imaging features (arterial hyper-enhancement, washout, pseudo-capsule, diameter, and tumor embolus) on CT versus MRI for 118 HNs in 84 patients with diffuse liver disease were rated independently using LI-RADS by two groups of readers. Inter-reader agreement (IRA) and intraclass agreement was determined by Fleiss and Cohen's kappa (κ). Logistic regression for correlated data was used to compare diagnostic ability.

Results: IRA was perfect for determination of nodule size and tumor embolus ($\kappa = 0.94–0.98$). IRA was moderate to substantial for determination of arterial hyper-enhancement, washout, and pseudo-capsule ($\kappa = 0.54–0.72$). Intraclass agreement between CT and MRI was substantial for determination of washout (0.632 [95% CI: 0.494, 0.771]) and pseudo-capsule (0.670 [95% CI: 0.494, 0.847]), and fair for arterial hyper-enhancement (0.203 [95% CI: 0.051, 0.354]). CT against MR produced false-negative findings of arterial hyper-enhancement by 57.1%, washout by 21.2%, and pseudo-capsule by 42.9%; and underestimated LI-RADS score by 16.9% for LR 3, 37.3% for LR 4, and 8.5% for LR 5. CT produced significantly lower accuracy (54.3% vs 67.8%, $P < 0.001$) and sensitivity (31.6% vs 71.1%, $P < 0.001$) than MRI in the prediction of malignancy.

Conclusions: There are substantial discordance between CT and MR for stratification of HNs using LI-RADS. MRI could be better than CT in optimizing the performance of LI-RADS.

Key Words: hepatocellular carcinoma; Liver Imaging Reporting and Data System; computed tomography; magnetic resonance imaging; hepatic nodule.

© 2015 The Association of University Radiologists. Published by Elsevier Inc. All rights reserved.

INTRODUCTION

Hepatocellular carcinoma (HCC) is the most predominant primary malignant hepatic tumor and the third leading cause of cancer death worldwide (1–3). The developed imaging techniques, including computed tomography (CT) and magnetic resonance imaging (MRI), have improved the ability of these imaging modalities for lesion detection and malignancy discrimination (4–6). Several organizations, including the American Association for the Study of Liver Diseases, the European Association for the Study of the Liver, the Organ Procurement and Transplantation Network, the Asian Pacific Association for the Study of the Liver, and the National Comprehensive Cancer Network, have proposed the guidelines for appropriate utilization of imaging for HCC diagnosis and management (7–11). Although specific imaging features such as "arterial phase (AP) hyperenhancement," "washout," and "capsule" proposed by these guidelines are widely recognized as important, there is no established consensus yet regarding their exact definitions, and there is no established criteria yet for the standardization of the performance and interpretation of these imaging features.

Acad Radiol 2015; ■:■■–■■

From the Department of Radiology, The First Affiliated Hospital with Nanjing Medical University, No. 300, Guangzhou Road, Nanjing 210000, China. Received September 22, 2015; revised October 29, 2015; accepted November 10, 2015.
Address correspondence to: H.-B.S. e-mail: njmu_shb@163.com

© 2015 The Association of University Radiologists. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.acra.2015.11.002

The Liver Imaging Reporting and Data System (LI-RADS) is a newly developed nomogram to standardize the terminology for reporting, assessing, and recommending action in liver imaging (12,13). According to integrative evaluation of classic imaging features of hepatic lesion, for example, enhancement pattern in arterial and/or portal phase, tumor capsule, intravenous tumor embolus, and tumor growth rate, LI-RADS allows radiologists to standardize individual observations by assigning the imaging findings to one of five categories (LR 1–5). As reported currently, LI-RADS exhibited competitive individual features against conventional algorithms, for example, the Organ Procurement and Transplantation Network (14) and the American Association for the Study of Liver Diseases (15), for screening and surveillance of HCC. The five-point LI-RADS scale, including its fixed criteria, is determined by integrative evaluation of classic imaging features of the observations in cirrhotic liver (13,16–18). However, the definition of these major imaging features and the scoring results of LI-RADS could be technology associated (19); for example, arterial hyper-enhancement, one of the important features for the imaging diagnosis of HCC, could be interpreted with great difference between CT and MRI because of the limited tissue contrast for CT imaging. To date, it is yet unclear whether and how the technological difference between CT and MRI will take effect on the imaging observation and the final scoring results of LI-RADS.

Therefore, the purpose of our study was to determine the concordance of CT and MRI for the imaging classification of hepatic nodules (HNs) in cirrhotic liver using the LI-RADS scoring system.

MATERIALS AND METHODS

Patient Selection, Reference Standard, and CT/MR Technique

This single-institution retrospective study was institutional review board approved. The institutional review board waived the requirement for informed patient consent. Patient selection, CT and MR technique, and reference standard were prepared as previously described (20). The datasets were selected from 467 consecutive patients with chronic hepatitis or cirrhosis between April 2009 and May 2015. This work was completed by a fellowship-trained abdominal radiologist (X.X., 2 years of experience) who retrospectively reviewed our institutional database for liver CT and MRI reports in patients suspected of having hepatic mass. The inclusion criteria were (1) history of chronic viral hepatitis or cirrhosis; (2) availability of both standard liver CT and MRI examinations with a time interval between the CT and MRI examinations of less than 1 month; (3) no prior locoregional therapy with transcatheter arterial chemoembolization (TACE) or hepatic radiation therapy; (4) patients without surgery who underwent at least 1 year follow-up imaging; and (5) an objective diagnosis, proven by operation, percutaneous biopsy, or an integrative-evaluation criteria (IEC). The IEC was partly referred to practice guidelines of the European Association for the Study of the Liver for clinical diagnosis of HCCs (11): (1) a history of chronic viral hepatitis and/or cirrhosis; (2) high levels of serum a-fetoprotein (>11 ng/mL); and (3) consistent findings (concerning HCC) at CT/MR images or digital subtraction angiography combined with TACE treatment, and a dominant iodized oil uptake at one or more follow-up CT examinations performed at 4-week intervals after TACE. This selection yielded a final cohort of 84 subjects (M/F: 57/27; mean age of 55.9 years and age range of 33–79 years; Child-Pugh A of 52 and Child-Pugh B of 32). Of these 84 patients, there were 53 overlapped cases from our previous study (20) and 31 new cases updated from our picture archiving and communication system (PACS) databases.

CT and MR Protocols

CT examination was performed with a 16-slice or 128-slice CT scanner (SOMATOM Definition AS+, Siemens Medical Solutions, Forchheim, Germany). MR examinations were performed with a 1.5T MR scanner (Signa Excite; GE Medical Systems, Milwaukee, WI, USA). All patients were scanned with standard liver CT and MRI protocols. The time interval between the examination of CT and examination of MRI was less than 1 month. Standard liver CT examination at our institution included a nonenhanced spiral scanning with a tube voltage of 120 kVp (180 milliampere seconds, 0.8 of pitch, 0.5 s/rotation, display field of view (DFOV) 42 cm^2, 512 × 512 matrix, and 32 × 1.2-mm collimation). Patients were then injected with nonionic contrast material (Ultravist 370, Bayer Schering Pharma AG, Berlin, Germany) with antecubital venous access at a rate of 3.0 mL/s; a total of 90–120 mL (1.5 mL per kilogram of body weight) was injected by using a CT-compatible power injector (Spectris; Medrad, Pittsburgh, PA) during the late hepatic AP and portal venous phase (PVP). The scanning delay for late hepatic AP imaging was determined by using automated scan-triggering software CareBolus (Siemens Medical Systems, Iselin, NJ). AP scanning automatically began 10–15 seconds after the trigger attenuation threshold (100 Hounsfield units) was reached at the level of the supraceliac abdominal aorta. At a delay of 30 seconds after AP scanning, hepatic PVP scanning began. A delayed equilibrium phase was performed 2–7 minutes after AP scanning.

MR protocols included axial breath-hold T1-weighted gradient echo in-phase and opposed-phase images, axial fat-suppressed respiratory-triggered T2-weighted fast spin-echo images, as well as coronal breath-hold T2-weighted half-Fourier acquisition single-shot fast spin-echo images. Axial breath-hold single-shot echo planar imaging was performed with diffusion module and fat suppression pulses; diffusion in three directions was measured by using b values of 0 and 600 s/mm^2. After a routine MR examination, all patients received an axial dynamic contrast-enhanced MRI with three-dimensional fat suppressed T1-weighted interpolated spoiled gradient echo (liver acceleration volume acquisition) sequence. Five-phase (pre contrast-enhanced, early arterial [20 s], late arterial-early portal [40 s], portal venous [60–90 s], and

Download English Version:

https://daneshyari.com/en/article/4217727

Download Persian Version:

https://daneshyari.com/article/4217727

Daneshyari.com