

Correlation of dynamic multidetector CT findings with pathological grades of hepatocellular carcinoma

We read with interest the original article on the use of dynamic multidetector computed tomography (MDCT) in hepatocellular carcinoma by Tarhan et al. in the December 2011 issue of *Diagnostic and Interventional Radiology* (1). When reading this interesting article, some basic questions arose, which we would like the authors to answer.

The article, a retrospective evaluation of multiphasic MDCT examinations of the upper abdomen, gave no information about the indications for multiphasic MDCT. In all of the patients included in this retrospective evaluation, the abdominal computed tomography (CT) was performed in four phases: non-contrast-enhanced, arterial, portal venous, and late phase. The authors did not provide kVp or mA values; therefore, the reader cannot estimate the dose exposure. However, given the four scan phases, we would expect a high radiation exposure, especially when considering the age distribution of the patient population (the youngest was one year old). Is this a standard institutional protocol? Since only the range (1–90 years) is stated for the age distribution, one has no clear idea about the patient population. In addition, why were the multiphasic abdominal/liver studies performed with CT and not with magnetic resonance imaging (MRI)? MRI, the radiation-free modality with the highest soft tissue contrast, enables state-of-the-art dynamic imaging of hepatocellular carcinoma, and provides comprehensive information about the hepatic vasculature and biliary system (2), as well as diffusion information (3), and the use of hepatocyte-specific contrast agents (4). Finally, the authors report that all of their patients were given intravenous contrast medium at 3.5 mL/s with a power injector, which is definitely inappropriate for a one-year-old child.

We believe that radiologists need to make use of MRI instead of CT in liver imaging.

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Published online 10 February 2012
DOI 10.4261/1305-3825.DIR.5492-11.3

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Authors' reply

We read the comments of Drs. Alibek and Uder on our recently published article (1), and we would like to clarify the issues they raised.

In our study, our aim was to determine whether the various vascularization patterns of hepatocellular carcinoma (HCC) nodules observed during dynamic MDCT correlate with histopathological differentiation grades. First, this was a retrospective study and we only included the patients who had both dynamic MDCT and pathologically proven HCC from our archives. We reviewed our radiology archives from 2000 to 2007 and, within eight years, we found only 46 patients meeting these criteria. Ours is a transplant center and patients are referred to our hospital for evaluation of eligibility for transplantation. Most of the patients in the study were referred to our hospital for transplantation and our concern was not limited to the determination of HCC; we also evaluated the patency of vascular structures and other possible abnormalities before the decision regarding transplantation. Our transplant surgeons prefer CT examination for evaluation of patients prior to transplantation because, with new multidetector technology, dynamic MDCT is performed in a very short time and is well tolerated by the patients (2). After obtaining the raw data once, evaluating the parenchyma and vascular structures is possible later. Different reconstruction techniques are used for obtaining arterial and portal CT angiography images and 3- to 5-mm thick axial images. CT can be performed in patients having difficulty suspending respiration and still provides valuable data (2–4). Although MRI has the highest contrast resolution among different imaging modalities, this high contrast is not always sufficient to make it the modality of choice to detect HCC (4). The spatial resolution of magnetic resonance angiography is also inferior to that of CT angiography and catheter angiography (5).

In our department, we perform both dynamic MRI and dynamic multidetector CT examinations for evaluation of the liver, and selection of the examination is made for each individual based on the clinician's concerns and the patient's condition.

Only four patients younger than 18 years were enrolled and their ages were 1, 9, 13, and 16 years. The injection rate provided in the paper is the one we used in our standard protocol for dynamic MDCT; however, for children, we do

not use this injection rate. For children, injection rates are, approximately, between 1.0 and 2.0 mL/s and change according to the patient's age and weight.

In our standard multidetector CT protocol, the kV and effective mA used are 120 and 110 respectively (effective mA=mA/pitch). This also changes according to the patient's weight; thus, minor changes are made even while the patient is on the examination table. When examining children, we prefer to use the CARE Dose four-dimensional (4D) protocol (Siemens Medical Solutions, Forchheim, Germany) (6). CARE Dose 4D is an automatic exposure control that includes automatic tube current adaptation to the patient's size and anatomic shape together with an online-controlled tube current modulation for each tube rotation. This provides well balanced image quality at low radiation dose levels.

New techniques such as virtual unenhanced dual-source CT can also be used to image these patients. Studies have been reported showing that virtual unenhanced images can replace conventional unenhanced images, thereby significantly reducing the radiation dose received by the patient (7).

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Published online 10 February 2012
DOI 10.4261/1305-3825.DIR.5523-11.1

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