Apparent diffusion coefficient of hepatocellular carcinoma.

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Introduction: Interest in use of Diffusion Weighted Imaging (DWI) as a method for detecting and even characterizing tumors has exponentially grown. While hepatocellular carcinoma (HCC) is becoming a more common condition with the increasing prevalence of chronic liver disease, MR diffusion studies have frequently combined HCC with other liver tumors such as metastases (1). The purpose of this paper is to specifically characterize hepatocellular carcinoma with respect to diffusion properties and to determine if apparent diffusion coefficient (ADC) is further related to other imaging properties ascribed to HCC.

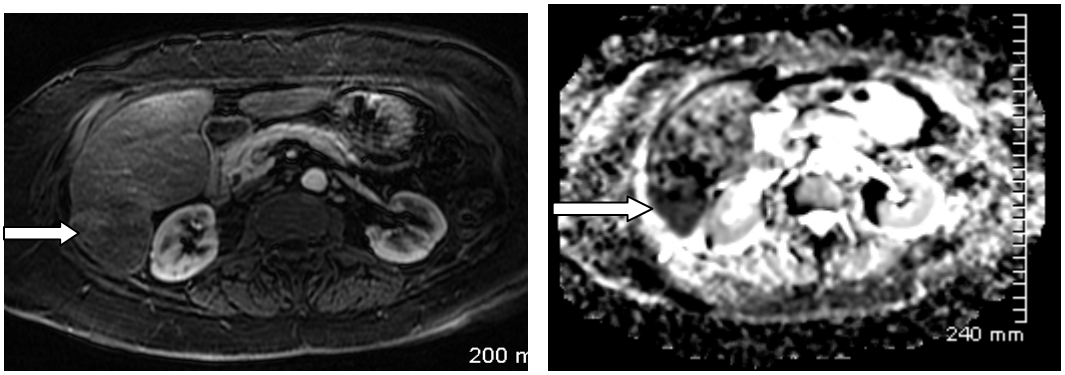
Methods: Patients with the ICD-9 code of HCC were retrospectively gathered for the time period (4/2006 to 12/2007) during which we incorporated DWI into our routine liver imaging protocols. A total of 23 patients with HCC were included (13 men and 8 women). MRI was performed at 1.5 T using the following sequences: T2FSE (fatsat), GRE with fat/water in and out of phase, 3D GRE imaging immediately prior and during arterial, and portal venous phases of liver enhancement, as well as an additional image at 7 minutes. DWI was performed after contrast enhancement using b-values of 0 and 500 sec/mm^2. Images were viewed in consensus by two observers at a workstation using manufacturer supplied software to calculate ADC maps and view enhancement patterns (Functool©, GEHC, Waukesha, WI). Images were viewed in consensus by two observers. In addition to ADC value, HCC was characterized by presence or absence of arterial enhancement, washout of contrast at 50 sec or 7 minute washout resulting in SI less than liver, presence of an enhancing or nonenhancing rim, and T2 SI (5 point scale).

Results: Pathological proof and tumor grade was available in 13 patients: 1 was poorly differentiated, 7 were moderately differentiated, 3 were well differentiated and two lesions were classified as hepatocellular carcinoma, NOS (not otherwise specified). In 10 patients, diagnosis was presumed based on a tumor present in a cirrhotic liver associated with substantially increased serum alpha-fetoprotein (AFP) level. Average tumor size for the 23 lesions was 5.1 cm (sd: 3.6 cm, range: 1.3 cm - 14.8 cm). The average and range of ADC for the 23 patients was 1.39mm^2/sec (sd: 0.48, range: 0.72 - 2.49). ADC average and range, grouped by tumor grade was: poorly differentiated (N=1): 1.79; moderately differentiated (N=7): 1.45 (0.724-2.49), well differentiated: 1.47 (0.921 – 2.21). Six lesions with ADC values above 1.5 (not restricted), included the poorly differentiated carcinoma, one well differentiated carcinoma, and 4 lesions without pathologic proof. Five lesions with ADC values of less than 1.0 (restricted) included 1 well differentiated HCC, 2 moderately differentiated HCCs, and 2 lesions without pathologic proof.

17/23 (74%) lesions displayed T2 SI greater than liver (one with T2 almost "cyst like"); ADC did not significant correlate with T2 SI. 19/23 (83%) of the lesions showed arterial enhancement. Of the 4 lesions that did not show evidence of arterial enhancement, one lesion was the poorly differentiated carcinoma, while the remaining 3 did not have pathologic proof. The lesions showing no arterial enhancement had ADC values ranging from 1.08 - 1.79. 12/23 (52%) of lesions showed washout at either 50 sec or 7 minutes, while 16/23 (75%) displayed a rim sign. Neither Washout nor Rim signed appeared to strongly correlate with ADC value.

Conclusions: The difficulty that conventional MRI has with HCC was captured in our study, in that at least 25% of our HCC lesions failed to display high T2 SI, rim/capsule sign or washout, and even the mainstay of diagnosis, arterial enhancement, was not seen in 17% of our HCC lesions. Unfortunately, these difficulties in diagnosis are unlikely to be solved by application of DWI. Although ADC did not correlate with these conventional imaging results, thus suggesting new and independent information, neither did ADC raise the possibility of aiding in diagnosis or suggesting tumor grade, an important prognostic factor (2). Our study showed that HCC displayed a remarkably wide range of ADC values, overlapping those of many other liver tumors (3). Furthermore, though pathological grade has valuable prognostic value (2) our study failed to confirm even a trend in correlation between ADC value and tumor grade.

Figure 1 – Pathologically proven moderately differentiated hepatocellular carcinoma with a calculated apparent diffusion coefficient of 0.724 mm/sec. Note the difficulty in detecting the lesion during the arterial enhancement phase.



References:

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