GADOXETIC ACID-ENHANCED MR IMAGING FOR T-STAGING OF GALLBLADDER CARCINOMA: EMPHASIS ON LIVER INVASION

Jiyoung Hwang[1], Young Kon Kim[2], Mi Hee Lee[3], and Hyun-joo Kim[1]
[1]Department of Radiology, Soonchunhyang University Seoul Hospital, Seoul, Seoul, Korea, [2]Department of Radiology and Center for Imaging Science, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Seoul, Korea, [3]Radiology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Seoul, Korea

Target Audience: Gastrointestinal radiologists who use MR imaging for evaluation of gallbladder carcinoma.

Purpose: To evaluate the diagnostic performance of gadoxetic acid-enhanced MR imaging and to determine usefulness of hepatobiliary phase (HBP) in the preoperative T-staging of gallbladder carcinoma.

Methods: Our study received institutional review board approval, and the requirement for informed consent was waived. Sixty-six patients with surgically-confirmed gallbladder carcinoma underwent MR imaging. All MR images were acquired using a 3.0-T whole-body MR system with a 16-channel phased-array coil that was used as the receiver coil. Two radiologists independently reviewed two sets of gadoxetic acid-enhanced MR imaging without HBP and with HBP. Local tumour spread was evaluated according to the T-staging, and the results were compared with pathologic findings. The diagnostic performance of two image sets to differentiate each T-stage was compared.

Results: The sensitivities of MR imaging with HBP to differentiate T1 versus ≥ T2 lesions, ≤ T2 versus ≥ T3 lesions, and ≤ T3 versus T4 lesions were 96.3%, 85.7%, and 100% for observer 1, and 92.6%, 95.2%, and 100% for observer 2, respectively ($P < 0.0001$). By adding HBP, four and three pT3 lesions with liver invasion which were misinterpreted as T2 lesions by observer 1 and 2, respectively, were correctly discerned as T3 lesion. Thus, the sensitivities to differentiate ≤ T2 versus ≥ T3 lesions were increased from 66.7% to 85.7% for observer 1 and from 81.0% to 95.2% for observer 2, although there was no significant difference ($P > 0.05$). Regarding differentiation of T1 versus ≥ T2 lesions and ≤ T3 versus T4 lesions, the diagnostic performance between MR imaging without HBP and with HBP was equivalent for the two observers. The overall accuracies for T-staging were increased from 80.3% to 86.4% for observer 1, a statistically significant degree ($P = 0.046$), and from 83.8% to 87.9% for observer 2 ($P > 0.05$). The k value for the two observers indicated excellent agreement.

Discussion: Our study achieved acceptable diagnostic performance with gadoxetic acid-enhanced MR imaging with HBP in terms of differentiating T1 versus ≥ T2 lesions, ≤ T2 versus ≥ T3 lesions, and ≤ T3 versus T4 lesions ($P < 0.0001$). This is comparable to the results of a previous study using MDCT, which showed an overall accuracy of 83.9%. Addition of HBP resulted in increased sensitivity to differentiate ≤ T2 versus ≥ T3 lesions, which was attributed to improved detection of focal liver invasion in the gallbladder bed. We believe that the HBP imaging enhances detection of liver invasion because it provides highest lesion conspicuity against strongly enhancing background liver, not hampered by accompanying hyperemia in the gallbladder bed of the liver due to accompanying cholecystitis or aberrant systemic venous drainage, which can obscure or mimic liver invasion.

Conclusions: Gadoxetic acid-enhanced MR imaging are useful in T-staging of gallbladder carcinoma, particularly in detection of liver invasion.

Figure. A 61-year-old woman with surgically confirmed T3 gallbladder carcinoma.
(a) Axial breath-hold multi-shot T2-weighted image shows wall thickening of gallbladder and high signal intensity area in adjacent liver (arrow).
(b, c) Axial gadoxetic acid-enhanced MR images obtained at (b) the arterial phase and (c) the portal phase show subtle low signal intensity lesion (arrow) with surrounding hyperemia in adjacent liver. Both observers diagnosed this as a stage T2 lesion with no liver invasion on MR imaging without HBP.
(d) Axial gadoxetic acid-enhanced 20-minute HBP image clearly shows low signal intensity lesion indicating focal liver invasion of gallbladder cancer into adjacent liver (arrow). Both observers correctly diagnosed as stage T3 lesion with focal liver invasion on MR imaging with HBP.

(a) (b) (c) (d)