Supplementary Material 3. Analysis of CT and MRI Images

Image analysis was performed by four board-certified abdominal radiologists in different institutions who did not participate in data collection or preparation: Reviewer 1 (Asan Medical Center), Reviewer 2 (Severance Hospital), Reviewer 3 (Bucheon Hospital), and Reviewer 4 (Korea University Guro Hospital), with 5, 6, 10, and 21 years of experience, respectively, in interpreting abdominal CT and MRI. They independently analyzed the DICOM images on their personal computers and submitted the results to the central site via a web-based case report form that we developed by using an online survey tool (https://docs.google.com/forms). For each case, the reviewers were required to input the case identification number and their email addresses for the purpose of quality assurance; the e-mail notification was sent to their e-mail addresses each time they submitted the evaluation results. If the reviewers wanted to correct errors in the submitted form, they were asked to re-submit the case report form with correct information; thus, in cases where duplicate case report forms were submitted by the same reader, the last form was included in analysis.

In the first round of image analysis, the reviewers evaluated the MRI images of each hepatic lesion according to the LI-RADS version 2014 (1). First, they measured the maximum tumor size on hepatobiliary images, determined the presence or absence of major features, tumor in vein, and features that favor non-hepatocellular carcinoma (HCC) malignancies, and then determined the initial LI-RADS category (without using ancillary features). The information about the presence or absence of threshold growth and antecedent US visibility, determined prior to image analysis, were provided in the case report form. Next, they were asked to determine the presence or absence of ancillary features and assign the final LI-RADS category (using all the imaging features they evaluated).

In the second round of image analysis conducted at least 8 weeks after the first round to minimize recall bias, they evaluated the CT images in the same manner as the MRI evaluation. With CT, the tumor size was measured using the dynamic phase and image plane on which the tumor showed the greatest diameter and was delineated best.

For both CT and MRI, if the reviewers were not able to find a hepatic lesion in the marked area, the lesion was recorded as ‘not visible’ and considered a benign lesion for all analyses. They were asked to characterize a feature as absent if they could not determine unequivocally whether the feature was present or absent due to the suboptimal or poor image quality. During imaging analysis, the reviewers were aware that the cases were pathologically-confirmed HCC, other malignancies, or benign lesions in patients with chronic liver disease, but unaware of other clinical information and final pathologic diagnosis.

In the evaluation and definition of imaging features, we followed the LI-RADS version 2014, except for washout appearance. LI-RADS suggests that washout appearance should be assessed only in the portal phase when gadoxetate is used as contrast media, because lesion hypointensity in the transitional or hepatobiliary phase could be ‘pseudo-washout’ due to relative hyperenhancement of surrounding liver parenchyma due to the hepatocyte uptake of gadoxetate. However, in some countries including Korea and Japan, lesion hypointensity in the transitional phase and even hepatobiliary phase can be regarded as washout appearance (2-6). Therefore, in the present study, we used both the portal and transitional phases in the evaluation of washout appearance. However, we also asked the reviewers to determine whether washout appearance was unequivocally noted in the portal phase so that we could compare the results within and without regarding lesion hypointensity in the transitional phase as washout appearance. For this analysis, two investigators not involved in image analysis recategorized all the cases according to the LI-RADS diagnostic algorithm, on the basis of the results of each reader’s evaluation of washout appearance in the portal phase and other major features.

REFERENCES