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Editorial

HCC surveillance after curative treatment: A new frontier for abbreviated MRI: Editorial on "Non-contrast magnetic resonance imaging for detection of late recurrent hepatocellular carcinoma after curative treatment: a prospective multicenter comparison to contrast-enhanced computed tomography"

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For patients at a high risk of developing hepatocellular carcinoma (HCC), regular surveillance is vital for early diagnosis and improved overall survival. The standard recommendation for patients without a prior history of HCC is ultrasonography, with or without serum alpha-fetoprotein (AFP), at 6-month intervals.[1-3] However, the inherent limitations of ultrasound, including its highly variable sensitivity due to patient-related factors, operator experience, and tumor size, have spurred active research on alternative surveillance modalities.[4,5] Various abbreviated magnetic resonance imaging (aMRI) protocols have recently gained significant attention. Compared to dynamic contrast-enhanced computed tomography (CT) or dynamic contrast-enhanced MRI, these aMRI protocols offer compelling advantages, such as the absence of ionizing radiation, shorter scan times, and reduced cost.[6] Recent studies have shown that non-contrast MRI, a form of aMRI, provides superior diagnostic performance for HCC detection, results in fewer false-positive referrals, and can detect HCC at an earlier stage than ultrasonography.[7,8]

However, to date, almost all studies have been limited to high-risk patients without prior treatment for HCC. Its application for surveillance in another critical high-risk group—patients who have undergone HCC treatment—has remained largely unexplored. A previous retrospective study compared the diagnostic accuracy of gadoxetic acid-enhanced MRI and non-contrast MRI for postoperative surveillance after hepatic resection of HCC. It has been reported that non-contrast MRI shows comparable performance

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to gadoxetic acid-enhanced MRI starting 1 year after resection.[9]

In this issue of *Clinical and Molecular Hepatology*, Lee et al. report a prospective study comparing the diagnostic performance of dynamic CT and non-contrast MRI in patients who had undergone curative treatment and remained recurrence-free for over 2 years.[10] Each patient underwent three cycles of dynamic CT and non-contrast MRI at 2–6-month intervals. Although the study was designed as a non-inferiority trial of non-contrast aMRI compared to dynamic CT, interestingly, it was found that on a per-patient basis, the accuracy, sensitivity, negative predictive value (NPV), and diagnostic yield were all significantly higher for non-contrast aMRI. The accuracy of non-contrast aMRI was significantly higher than that of dynamic CT (96.6% vs. 91.6%), as was its sensitivity (77.3% vs. 36.4%). The detected intrahepatic HCCs were very small, with a median size of 1.3 cm, and serum AFP and serum protein induced by vitamin K absence or antagonist-II levels were mostly within the normal range (86%, 19/22 and 95%, 21/22, respectively). Interestingly, the NPV of non-contrast aMRI was significantly higher than that of dynamic CT (97.3% vs. 92.7%). In the context of posttreatment surveillance, high sensitivity and NPV are significant because they are crucial indicators for trusting surveillance studies. The most common cause of false-negative diagnoses on dynamic CT (57%, 8/14) was small lesions mistaken for arterioportal shunts. This indicates that non-contrast aMRI, which reveals signal intensity alterations through various mechanisms across multiple sequences, can detect HCC more sensitively.

Non-contrast aMRI offers several advantages beyond its impressive diagnostic performance. In the post-treatment setting, the most commonly used imaging modality, CT, requires iodinated contrast and involves unavoidable radiation exposure. As noted by the authors, repeated imaging with iodinated contrast media may increase the risk of chronic renal disease.[11] Another concern with CT is radiation exposure. Radiation exposure from CT is increasing, and recent reports have estimated that approximately 5% of all future cancers may be caused by CT radiation, with abdominal CT as the largest contributor to this cancer risk.[12] Furthermore, liver dynamic CT includes a 4-phase scan, resulting in a higher dose than standard abdominal CT, typically exposing the patient to 20–30 mSv of radiation in a single examination. It is known that approximately 100 mSv of radiation exposure is associated with a 1% increase in lifetime cancer risk, which increases linearly with cumulative exposure.[13] For patients already treated for HCC, one might argue that accurate evaluation of HCC outweighs the radiation-induced cancer risk. However, for relatively low-risk patients who have received curative treatment and remain recurrence-free for a significant period, the cancer risk from radiation can be as important as that for the general population.[14] Dynamic MRI is also increasingly used for post-treatment surveillance; however, the gadolinium-based contrast agents used in MRI have the side effects of deposition in the dentate nucleus and globus pallidus with repeated use.[15,16] Currently, although no evidence exists that gadolinium deposition in the brain causes significant neurological diseases, if non-contrast aMRI demonstrates sufficient diagnostic performance, reducing its use should be considered.[16]

This study has shown the potential of post-treatment surveillance of HCC to become a new frontier for aMRI. Although non-contrast aMRI is believed to be less effective for aggressive recurrence patterns, such as small disseminated intrahepatic recurrence, infiltrative recurrence, vascular invasion, and extrahepatic recurrence, this study's cohort may represent the ideal target population.[9] Patients who are more than 2 years post-curative treatment likely have a lower probability of such aggressive recurrence, with recurrence being predominantly from *de novo* carcinogenesis. Further research is warranted to precisely define the optimal indications for non-contrast aMRI, perhaps by determining the best post-treatment timing or using risk scores based on clinicopathological and imaging features to select low-risk patients. Furthermore, a recent study assessing recurrence in patients with HCC treated with ablation using hepatobiliary aMRI reported similar diagnostic performance for both local and non-local recurrence.[17] This suggests that aMRI could also be used for local recurrence

Abbreviations:

AFP, alpha-fetoprotein; aMRI, abbreviated magnetic resonance imaging; CT, computed tomography; HCC, hepatocellular carcinoma; NPV, negative predictive value

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surveillance after locoregional therapy. However, further research is needed to determine which types of locoregional treatments and what post-treatment timing would be appropriate for aMRI application.

Ultimately, the most critical question remains: Does the superior diagnostic performance of aMRI, along with its safety benefits, translate into improved long-term survival in patients with treated HCC? Moreover, addressing the practical barriers of higher cost and limited accessibility compared with CT is crucial for its widespread adoption.

Authors' contribution

Hyungjin Rhee: Writing – original draft (Equal); Writing – review and editing (Equal). Jin-Young Choi: Conceptualization (Lead); Supervision (Lead); Writing – original draft (Equal); Writing – review and editing (Equal).

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Conflicts of Interest

The authors have no conflicts to disclose.

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