Abbreviated MRI for HCC surveillance: is it ready for clinical use?

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Key Points

- Abbreviated MRI (AMRI) protocols consist of acquiring only a minimal number of MRI sequences for HCC surveillance with acceptable diagnostic performance compared to complete MRI.
- AMRI protocol options include non-contrast AMRI, dynamic AMRI or hepatobiliary phase AMRI post gadoxetate injection.
- The best AMRI protocol for HCC surveillance needs to be defined in a large multicentre prospective study.

Hepatocellular carcinoma (HCC) is the second leading cause of cancer-related death worldwide. Clinical practice guidelines recommend HCC screening and surveillance in patients at risk (patients with cirrhosis and chronic HBV) for early detection and treatment, despite the limited number of high-quality studies demonstrating the effectiveness of HCC screening in decreasing mortality [1]. Specifically, the EASL (European Association for the Study of the Liver) guidelines recommend ultrasound (US) every 6 months [2], while the AASLD (American Association for the Study of Liver Diseases) recommend US with or without serum alpha fetoprotein (AFP) every 6 months in patients at risk [3].

However, US has shown limited ability for detection of small HCC, around 47%, especially in patients with large body habitus and/or advanced cirrhosis [4]. A recent Korean prospective study reported even lower sensitivity of US (27.9%) for HCC detection in the context of screening [5]. To improve the performance of imaging screening/surveillance, many centres perform CT or MRI exams, which are not necessarily optimal for HCC surveillance due to radiation

exposure (for CT) and higher cost and long exam duration for MRI (between 20 and 40 min).

This has recently fuelled interest in abbreviated MRI (AMRI) protocols which consist of acquiring only a few select MRI sequences to aim for a reduction in time while maintaining acceptable diagnostic performance for HCC detection. Several protocols/combinations of MRI sequences have been proposed, including a non-contrast (NC)-AMRI protocol combining T2-weighted imaging (T2wi) and diffusion-weighted imaging (DWI) [6, 7], dynamic (Dyn)-MRI with an extracellular gadolinium-based contrast agent [8] or gadoxetate-enhanced T1wi obtained during the hepatobiliary phase (HBP) with T2wi with/without DWI [6, 9]. The idea is to recall patients for CT or complete contrast-enhanced MRI in positive NC-AMRI and HBP-AMRI studies.

The current study by Whang et al [10] compared the diagnostic performance of NC-AMRI and HBP-AMRI for HCC detection in a population of patients with and without HCC. The authors included 140 patients with early HCC (according to Milan criteria) with gadoxetate-enhanced MRI and 123 patients without HCC used as controls. Two independent readers reviewed the 2 datasets (NC-AMRI and HBP-AMRI) extracted from the complete MRI. There was equivalent per-patient sensitivity (85.7% and 86.4% for NC-AMRI, and 90% and 89.3% for HBP-AMRI, for readers 1 and 2, respectively) and specificity (92.7% for both datasets and readers). The authors concluded that NC-AMRI and HBP-AMRI are equivalent for detection of early HCC.

This study unveiled important information about HCC detection with AMRI. The authors focused on the comparison between two different AMRI protocols, demonstrating the diagnostic value of AMRI for HCC screening, and its likely higher diagnostic performance compared to US, with the need to define the best AMRI protocol. In previous studies, NC-

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AMRI showed excellent sensitivity (79.1–85.5%) and specificity (94.9–97.9%) [6, 7]. Reconstructed HBP-AMRI with gadoxetate Whang reported HCC detection sensitivity of 79.6–85.7% and specificity of 91.2–97.3%, in diagnostic cohorts rather than screening cohorts, with no difference in sensitivity for HCC detection between diagnostic MRI and AMRI [6, 9]. The performance of Dyn-AMRI for HCC detection has been reported recently in a nonscreening population (with average per-patient sensitivity of 92.1% and specificity of 88.7%) [8]. When considering comparison with US, Park et al. recently published results on a prospective comparison of NC-AMRI to US in patients at high risk for HCC [7]. The authors demonstrated sensitivities of 27.9% for US and 79.1% for NC-AMRI, with a significant difference between US and NC-AMRI. Tillman et al. compared HBP-AMRI to US and concluded that HBP-AMRI provides higher sensitivity (85.2%) compared to reported US values [11].

Of note, the present study has two shortcomings that should be mentioned. First, the population assessed was not a screening population (more than 50% of patients had HCC), while HCC prevalence ranges typically between 0.25 and 7.6% in screening populations. Of note, this limitation is present in most published AMRI studies. This may overestimate the performance of AMRI. Second, the study included mainly HBV patients, which is not necessarily representative of the Western population at risk of HCC. This may limit generalization of study results.

It is currently difficult to define the best AMRI protocol for HCC screening and surveillance. In addition to diagnostic performance, one needs to consider feasibility, adoption, and cost/cost-effectiveness. From a practical point of view, NC-AMRI presents clear advantages over contrast-enhanced AMRI, by avoiding the need for contrast injection, which simplifies and shortens even more the protocol, and removes the potential risks of gadolinium-based contrast agents (GBCAs), namely nephrogenic systemic fibrosis and gadolinium tissue deposition. Contrast-enhanced AMRI including HBP-AMRI and Dyn-AMRI requires intra-venous GBCA injection, and seems to provide higher sensitivity even if statistical difference is not demonstrated, such as in the present study. With HBP-AMRI, the injection can be performed before the exam outside the AMRI room with acquisition at 20 min after contrast injection, which simplifies the injection process. HBP-AMRI is a highly sensitive sequence for HCC detection, however with the risk of false positives. Dyn-AMRI, on the other hand, has the advantage of providing detection and characterization during the same exam which is not possible with NC-AMRI and HBP-AMRI where a recall CT or complete MRI is required in positive cases. Additionally, the cost of extracellular GBCA is lower than that of gadoxetate. A recent cost-effectiveness study comparing HCC surveillance with US, CT, complete MRI, and AMRI concluded that HCC screening performed with AMRI was

cost-effective in a conservative scenario (52% surveillance compliance) [12].

While the most accurate and feasible AMRI protocol and the target population for AMRI still need to be clarified, AMRI is emerging as a promising tool to be used as an alternate to US for HCC surveillance. However, widespread use of AMRI will still be limited by MRI access/availability and potential contra-indications, compared to US.

Future large multicentre prospective studies in HCC screening population rather than diagnostic population comparing US with different AMRI protocols are needed to determine the AMRI diagnostic performance. The added value of circulating tumour biomarkers such as circulating tumour DNA should be assessed. Advanced cost-effectiveness analysis with models including each region population characteristics (HCC prevalence, type of chronic liver disease, body habitus) and radiologic exam costs will also be needed in order to implement AMRI in clinical practice.

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Compliance with ethical standards

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