New Data Supporting Modified RECIST (mRECIST) for Hepatocellular Carcinoma

Riccardo Lencioni

The modified Response Evaluation Criteria in Solid Tumors (mRECIST) guideline has introduced specific amendments to standard RECIST to address the unique complexities involved in the evaluation of tumor response in hepatocellular carcinoma. A growing amount of data suggests that mRECIST, designed for response assessment in clinical trials, may translate into a tool for clinical practice. Clin Cancer Res; 19(6): 1–3. ©2013 AACR.

In this issue of *Clinical Cancer Research*, Kim and colleagues (1) show that the assessment of tumor response by modified Response Evaluation Criteria in Solid Tumors (mRECIST) criteria (2) predicts overall survival in patients with hepatocellular carcinoma (HCC) treated by transcatheter arterial chemoembolization (TACE). The study confirms the results of several recent investigations conducted in the United States, Europe, and Asia (3–5).

The development of imaging criteria for response assessment in patients with HCC has been a long process (Fig. 1). In 2000, the European Association for Study of Liver (EASL) first proposed an amendment to the World Health Organization (WHO) criteria, the ones most commonly used at that time (6). The WHO criteria were designed for the evaluation of cytotoxic agents and recommended the use of the product of the 2 longest perpendicular diameters to monitor changes in tumor size. These criteria were unable to capture the anticancer activity of tumor-directed therapies used in the treatment of HCC, such as percutaneous ethanol injection, radiofrequency ablation, and TACE. The EASL guideline recommended taking into account the treatment-induced tumor necrosis and measuring the product of the longest diameters of the viable portion of the tumor, as recognized by contrast-enhanced radiological imaging, instead of the product of the longest diameters of the whole tumor mass. Assessment of tumor response according to the EASL amendment has been used in HCC patients receiving tumor-directed treatments for more than a decade. The modified Response Evaluation Criteria in Solid Tumors (mRECIST) for response assessment in hepatocellular carcinoma has been a major advancement in the standardization of response assessment. The RECIST model clearly defines the categories of target lesions, nontarget lesions, and new lesions, and provides overall response classifications resulting from the different combinations of the responses observed in each of these categories. In addition, the RECIST criteria simplified the assessment of the target lesions by recommending the use of unidimensional measurements and the sum of the longest tumor diameters instead of the bidimensional approach of the WHO method including 2 measurements and the sum of the products. The original 1.0 RECIST guideline recommended measuring up to a maximum of 5 target lesions per organ and 10 target lesions in total, representative of all involved organs, whereas the revised 1.1 RECIST recommendations have reduced to 2 the maximum number of target lesions to measure per organ, and to 5 the maximum total number of target lesions.

A limitation of the 2000 EASL guideline is that it only provides recommendations for the evaluation of target lesions. With the advent of systemic treatments for HCC, the need for a comprehensive model for response assessment has been widely acknowledged (7, 8). In the meantime, the WHO criteria were largely replaced by the RECIST criteria in oncology trials. The introduction of RECIST has been a major advancement in the standardization of response assessment. The RECIST model clearly defines the categories of target lesions, nontarget lesions, and new lesions, and provides overall response classifications resulting from the different combinations of the responses observed in each of these categories. In addition, the RECIST criteria simplified the assessment of the target lesions by recommending the use of unidimensional measurements and the sum of the longest tumor diameters instead of the bidimensional approach of the WHO method including 2 measurements and the sum of the products. The original 1.0 RECIST guideline recommended measuring up to a maximum of 5 target lesions per organ and 10 target lesions in total, representative of all involved organs, whereas the revised 1.1 RECIST recommendations have reduced to 2 the maximum number of target lesions to measure per organ, and to 5 the maximum total number of target lesions.

The RECIST panel acknowledged that amendment to the guideline could be needed for specific tumors or anatomic sites presenting unique complexities. Specific refinements to standard RECIST criteria in the setting of HCC clinical research were introduced at the time of the Sorafenib Hepatocellular Carcinoma Assessment Randomized Protocol (SHARP) trial comparing sorafenib versus placebo (2). The SHARP study identified a distinct overall survival benefit for sorafenib as compared with placebo. The assessment of the secondary endpoints, time-to-progression (TTP) and disease control rate (DCR), was conducted by an independent blinded radiological panel following specific recommendations for image interpretation aimed at preventing incorrect diagnoses of progression. In fact, in the SHARP trial, TTP...
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CIST criteria adapted the concept of viable tumor progression. In addition, the mRECIST produced at the time of the SHARP trial to prevent several changes were based on the recommendations resulting criteria were named mRECIST for HCC (2). Formal amendments to standard RECIST (Fig. 1). The therapies and molecular targeted agents, and produced survival observed in HCC trials with both tumor-directed mRECIST seems to have broader applicability with respect to the EASL criteria. By keeping the accepted standard RECIST model as a reference, mRECIST enables assessment of overall response by taking into account target lesion response, nontarget lesion response, and presence or absence of new lesions. The important new information brought by the article by Kim and colleagues in this issue of Clinical Cancer Research (1) is that the ability of mRECIST criteria to predict survival in patients with HCC receiving TACE is not dependent on the maximum number of target lesions that are measured in the liver. Measurement of up to 5 target lesions, following the original 1.0 RECIST guideline, was as efficacious as measurement of up to 2 target lesions, according to the revised 1.1 RECIST recommendations. Thus, mRECIST seems to be suitable for use with either the 1.0 or the 1.1 standard RECIST models for target lesion assessment.

The mRECIST guidelines have been increasingly adopted in HCC clinical research. Several key recommendations, such as those concerning the classification of ascites, hepatic hilar lymph nodes, vascular invasion, and new lesions, all of which may have a major impact on the assessment of TTP and DCR, have been incorporated into the radiology charters of clinical trials, even when target lesion measurements were conducted according to standard metrics, and therefore, the criteria were formally named standard RECIST. The main open question is whether the use of the mRECIST viable tumor concept for target lesion measurements can bring ORR back as a surrogate for survival. Several clinical trials from investigators around the globe have suggested that this is indeed the case in patients receiving tumor-directed therapies (1, 3–5). In patients treated with TACE, mRECIST ORR of 32% to 57% were observed, with significant correlation between response and overall survival (3, 5). Data in patients treated with molecular targeted agents are still limited. Studies in patients receiving sorafenib have reported ORR ranging 9% to 23% according to mRECIST; in these series, patients who achieved an objective response had a longer overall survival than patients with stable disease or progression (9, 10). However, further research is needed to understand the prognostic value of ORR as per mRECIST in the setting of systemic treatments.

In conclusion, a growing body of scientific evidence suggests that mRECIST, designed for response assessment in clinical trials, may translate into a tool for clinical practice, a process that has already started with the recommendations issued in the recent clinical practice guidelines.
produced by the EASL and the European Organization for Research and Treatment of Cancer (11) and by the European Society of Medical Oncology and the European Society of Digestive Oncology (12).

Disclosure of Potential Conflicts of Interest
No potential conflicts of interest were disclosed.

References
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