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The QIBA Profile for Dynamic Susceptibility Contrast MRI Quantitative Imaging Biomarkers for Assessing Gliomas

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Abstract

The dynamic susceptibility contrast (DSC) MRI measures of relative cerebral blood volume (rCBV) play a central role in monitoring therapeutic response and disease progression in patients with gliomas. Previous investigations have demonstrated promise of using rCBV in classifying tumor grade, elucidating tumor viability after therapy, and differentiating pseudoprogression and pseudoresponse. However, the quantification and reproducibility of rCBV measurements across patients, devices, and software remain a critical barrier to routine or clinical trial use of longitudinal DSC MRI in patients with gliomas. To address this limitation, the RSNA DSC MRI Biomarker Committee of the Quantitative Imaging Biomarkers Alliance developed a Profile that defines statistics-based claims for the precision of longitudinal measurements. Although rCBV is the clinical marker of interest, the Profile focused on the reproducibility of the measured quantitative imaging biomarker, which is the area under the contrast agent concentration-time curve (AUC) normalized by the mean value of normal-appearing contralateral white matter tissue (tissue-normalized AUC values). Based on previous reports of within-subject coefficient of variation (wCV) in the tissue-normalized AUC values for enhancing gliomas (wCV = 0.31), an increase of 182% or more with respect to the baseline tissue-normalized AUC value indicates that an increase has occurred with 95% confidence. In contrast, a decrease of 64% or more with respect to baseline suggests that a decrease has occurred with 95% confidence. Similarly, an increase of 399% or more in the tissue-normalized AUC values in normal brain gray matter tissue (wCV = 0.40) suggests that an increase has occurred with 95% confidence, whereas a decrease of 80% or more with respect to baseline suggests that a decrease has occurred with 95% confidence. This article provides the rationale for these claims and the compliance activities needed to achieve these claims. Potential updates to incorporate new data based on advances in technology and clinical care in the Profile are also discussed.