Rapid perfusion abnormality estimation in acute stroke with temporal correlation analysis.

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Abstract

BACKGROUND AND PURPOSE: Determination of the presence or absence of ischemic penumbra through diffusion-perfusion mismatch requires rapid delineation of both abnormalities. Although singular value decomposition-based perfusion parameter estimation has offered valuable insights into the underlying cerebral hemodynamics, the associated postprocessing procedures have limited its widespread use. We explored the utility of a simple technique to define perfusion abnormality in acute stroke patients. METHODS: Twenty acute stroke patients were studied. The MR dynamic contrast approach was used to obtain cerebral blood flow, cerebral blood volume, and mean transit time (MTT). Temporal correlation was used to correlate 4 reference functions-an arterial input function (AIF), a normal tissue function, a lesion function, and a venous output function-with dynamic contrast MR images, and correlation coefficients (CCs) were calculated pixel by pixel. In addition, chronic-state T2-weighted images were coregistered onto the images acquired acutely for assessing the sensitivity and specificity of CC-defined lesion. RESULTS: Statistically significant differences in cerebral blood flow and MTT were found between CC-defined normal and abnormal tissues with all 4 reference functions used. When the final infarct volume was used as the gold standard, a similar sensitivity between MTT (78%) and AIF (76%) CC-defined lesion was obtained, whereas the specificity was higher for AIF (61%) than that obtained with MTT-defined lesion (52%). CONCLUSIONS: We explored CC maps as a simpler alternative of estimating perfusion abnormality, and results demonstrated the potential clinical utility of a correlation-based technique for estimating brain perfusion status.