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Purpose
The utility of single bolus CT angiography (CTA) with whole brain perfused blood volume (PBV) imaging in the clinical evaluation of acute stroke patients has been demonstrated previously (1,2). Specifically, we have shown that admission PBV lesion volume approximates final infarct volume in patients receiving early, successful thrombolysis, whereas there is progression of lesion volume in unsuccessfully treated patients (1). The goal of the current study is to determine the added value of quantitative, first pass CT perfusion (CTP) imaging - over that of CTA with PBV alone - in predicting final infarct size in patients presenting with signs and symptoms of acute stroke.

Materials & Methods
Twenty-four consecutive acute (<6 hour) stroke patients received CTA with PBV at initial presentation, followed immediately by quantitative first pass cine CTP imaging of cerebral blood volume (CBV) and cerebral blood flow (CBF). CBF/CBV lesion area ratios ("mismatch") were computed for each patient from the admission single slab CTP dataset. Segmented regions-of-interest were drawn by hand, based on image appearance. Unsuccessfully treated/untreated patients were classified prospectively according to their degree of mismatch: low (CBF/CBV<4, n = 9), moderate (4<CBF/CBV<12, n = 8), or high (CBF/CBV>12, n = 3). Patients with complete, successful vascular recanalization following thrombolysis were analyzed separately (n = 4). Percent infarct growth was computed by comparing initial PBV lesion areas (at the level of the single slab CTP acquisition) to lesion areas on conventional follow-up imaging (mean time to follow-up was 4 days). Initial and follow-up lesion volumes also were compared. Infarct "core" was
defined as the initial CBV lesion area, and "penumbra" by the visual extent of the surrounding CBF lesion.

**Results**

Mean CBF/CBV ratios for the successful thrombolysis, low mismatch ratio, moderate mismatch ratio, and high mismatch ratio groups were, respectively: 3.0, 3.1, 7.9, and 22.1; mean infarct growth in these groups was: 89%, 52%, 230%, and 1697% by areas (single slab data), and 104%, 202%, 241%, and 8710% by volumes. The slope of the linear regression lines comparing initial PBV and follow-up lesion sizes were, respectively: 0.98 (p=0.18, r²=0.68), 1.18 (p=0.04, r²=0.47), 2.68 (p=0.04, r²=0.54), and 7.97 (p=0.16, r²=0.94) for the area data, and 1.52 (p=0.04, r²=0.92), 1.63 (p=0.14, r²=0.28), 2.15 (p=0.03, r²=0.59), and 107.89 (p=0.04, r²=1.00) for the volume data. In the infarct core, mean CBV and CBF were 0.9±0.3 ml/100 g and 10.1±12.7 ml/100 g/min; in the ischemic penumbra, mean CBV and CBF were 1.9±0.7 ml/100 g and 13.4±5.6 ml/100 g/min.

**Conclusion**

Quantitative first pass CT perfusion, like MR diffusion/perfusion imaging, provides a useful surrogate marker of tissue outcome in acute stroke patients. Subjects without significant CBF/CBV mismatch - or those with early, successful thrombolysis - are unlikely to have progression of their admission PBV lesion size (slope of regression line close to 1). Untreated or unsuccessfully treated patients with large mismatch, however, are likely to show substantial progression of infarct size on follow-up (slope of regression line >> 1). In this small group of patients, successful thrombolysis appeared to have a beneficial effect on salvageable ischemic penumbra.

**References**


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