

### ■ Infarct core vs penumbra on hyperacute CT

Parsons et al. compared early ischemic change on noncontrast CT with concurrent perfusion CT. Focal swelling identified penumbral tissue, and parenchymal hypodensity, infarct core. However, many acutely hypoperfused regions appeared normal on noncontrast CT, whereas perfusion CT accurately classified these regions as core or penumbral.

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### ■ Still learning from noncontrast CT in acute stroke

Commentary by Keith W. Muir, MD, FRCP

The concept of the penumbra, a region of tissue with variable fate, whose blood flow lies between the thresholds of tissue necrosis and electrical function of neurons, is central to therapeutic intervention in acute ischemic stroke. Diffusion-weighted and perfusion MRI provided the first practical imaging index of the penumbra, and experience with these modalities supports the importance of the following concept: when thrombolytic therapy is targeted to those with diffusion-perfusion mismatch, the window of efficacy may extend to 9 hours, and treatment within 3 hours appears to be safer when compared to clinical trials that used unenhanced CT.<sup>1</sup> However, most centers worldwide remain reliant on CT for treatment decisions. As experience of sub-3 hour CT has grown, it has become clear that sensitivity to

early ischemic changes (EIC) is greater than first thought, present in 50% of trial patients within 3 hours of onset, and up to 90% of proximal middle cerebral artery occlusions within 6 hours. However, conventional descriptions of EIC do not distinguish parenchymal hypodensity from focal tissue swelling. Previous small studies comparing CT with either perfusion MRI<sup>2,3</sup> or perfusion CT<sup>4</sup> indicate that these appearances have distinct pathophysiology. Parsons et al. now confirm in a series of acute stroke patients that isolated focal swelling of the cortex on unenhanced CT corresponds to increased cerebral blood volume on simultaneous quantitative CT perfusion, and that cerebral blood flow is reduced to a lesser degree than in hypodensity. While hypodensity correlated strongly with subsequent infarction, the fate of tis-

sue with isolated focal swelling was variable, consistent with it representing a CT index of the penumbra. Further work to see if the limited sensitivity of this feature can be improved with systematic approaches, as has occurred with other acute CT features, is required.

#### References

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