Dual-Energy CT Differentiates Contrast Staining From Hemorrhagic Conversion of Ischemic Stroke

The Neurohospitalist
2018, Vol. 8(1) 42-43
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DOI: 10.1177/1941874417704754
journals.sagepub.com/home/NHO

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Keywords

stroke and cerebrovascular disease, intracranial hemorrhages, neuroradiology

A 67-year-old woman presented to the emergency department with fluctuating symptoms of left middle cerebral artery (MCA) distribution ischemia. The initial noncontrast computed tomography (CT) was unremarkable (Figure 1A). CT angiography (not shown) demonstrated a left distal M1 and

proximal M2 thrombus, and intravenous tissue plasminogen activator (TPA) was initiated. Shortly after beginning TPA, her symptoms worsened and another noncontrast CT was obtained with dual-energy (DECT) technique (Figure 1B), which demonstrated interval development of a new small hyperdensity in the left parietal region. However, after processing of the DECT data, a “virtual noncontrast” image (Figure 1C) was generated that did not show hyperdensity in this area, indicating that it represented contrast staining rather than hemorrhage. Magnetic resonance (MR) images obtained later the same day (Figure 1D) demonstrated no evidence of hemorrhage, confirming the virtual noncontrast CT result.

Dual-energy is a relatively new technique in which 2 different energy X-ray spectra are used to generate CT images.¹ By comparing the relative attenuation of materials such as blood and iodine at different energies, these materials can be differentiated, despite being visually indistinguishable on standard CT images.^{2,3} A virtual noncontrast image can then be generated by subtracting the effects of iodinated contrast. An additional application of DECT in neuroimaging is bone removal in CT angiography images.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Figure 1. Initial unremarkable axial noncontrast computed tomography (CT) image (A). Subsequent axial dual-energy CT obtained after interval iodinated contrast load for CT angiography (B) demonstrated left parietal hyperdensity (arrow). Virtual noncontrast image from the dual-energy technique axial CT obtained at the same time does not show this hyperdensity (C), indicating that it represented iodinated contrast. An axial gradient echo-type echo planar imaging (GRE-EPI) magnetic resonance (MR) sequence obtained following the CT confirms lack of hemorrhage in this location (D).

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