# The "DeyeCOM Sign": Predictive Value in Acute Stroke Code Evaluations

Clarity R. Coffman, MPH,* Rema Raman, PhD,† Karin Ernstrom, MS,† Nabeel A. Herial, MD, MPH,* Konrad H. Schlick, MD,‡ Karen Rapp, RN,* Royya F. Modir, MD,* Dawn M. Meyer, NP, PhD,* Thomas M. Hemmen, MD, PhD,* and Brett C. Meyer, MD*

*Background:* Rapid diagnosis in stroke is critical. Computed tomography is often performed initially, even before a neurologic examination. Gaze deviation has been correlated with stroke diagnosis in some cohorts. Conjugate gaze deviation on stroke code imaging, the "DeyeCOM sign," may have emergency stroke care implications. *Methods:* We evaluated stroke code imaging from the University of California, San Diego database (2007-2013) for "DeyeCOM sign" diagnostic and predictive utility. Patients were grouped as DeyeCOM+ if conjugate gaze deviation was noted. The differences were assessed using the Fisher exact test for categorical and the Wilcoxon rank-sum test for continuous variables. *Results:* We evaluated 342 patients; 106 (31%) were DeyeCOM+. Mean age was 63. The most common diagnoses in the DeyeCOM+ group were ischemic stroke (50.94%), transient ischemic attack (8.49%), other (8.49%), somatization (6.6%), and hemorrhage (5.66%). The National Institutes of Health Stroke Scale was greater in stroke patients than that in nonstroke (8.2 versus 3.8; $P < .0001$), and in DeyeCOM+ compared with DeyeCOM− (6.8 versus 5.6; $P = .03$). DeyeCOM+ patients were more likely to have a +gaze score (26.4% versus 9.8%; $P < .0001$), and +gaze patients were more likely to have final stroke diagnosis (26.0% versus 3.6%; $P < .0001$). There was no overall difference between groups in final stroke diagnosis; however, patients with deviation of 15° or more were more likely to have final diagnosis stroke (63.9% versus 47.9%; $P = .03$). *Conclusions:* DeyeCOM+ patients scored higher and were more likely to have +gaze on the stroke scale, and deviation of 15° or more was correlated with final diagnosis stroke. In current environments, there is pressure to complete stroke evaluations rapidly. Reliable imaging information obtained early (such as gaze deviation on scan correlating with scale score and final stroke diagnosis) could augment decision making even with negative imaging. **Key Words:** Stroke—management—DICOM—gaze—deviation.


From the *Department of Neurosciences, and; †Department of Family and Preventive Medicine, University of California, San Diego, California; and ‡Department of Neurology, Cedars-Sinai Medical Center, Los Angeles, California.

Received September 3, 2014; revision received November 15, 2014; accepted January 31, 2015.

Supported by National Institutes of Health, 5P50NS044148.

Address correspondence to Clarity R. Coffman, MPH, UCSD Stroke Center, MON 3rd fl. Suite 3, 200 W. Arbor Drive, MC 8466, San Diego, CA 92103. E-mail: ccoffman@ucsd.edu.

1052-3057/$ - see front matter



http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2015.01.040

Acute stroke is an emergency, and early diagnosis is critical for prompt implementation of potentially lifesaving interventions. Computed tomography (CT) is often the initial imaging modality used in the evaluation of stroke in the acute care setting. A noncontrast CT scan of the head is widely used to quickly identify intracranial hemorrhage and signs of cerebral ischemia or other radiographic contraindications to thrombolytic therapy (eg, obvious parenchymal hypodensity or intracerebral hemorrhage [ICH]). More specific and subtle

CT findings may also contribute to triaging patients to acute stroke interventions, even when the scan is otherwise normal. The hyperdense middle cerebral artery sign may help persuade a practitioner to triage a patient to acute intervention, even in setting of otherwise normal imaging.[1] The sensitivity and specificity of this sign is rater dependent, and can easily be confused with other nonstroke specific findings such as vascular calcifications.[2] Even so, its utility is clear, and identifying other objective information on head CT correlated with the presence of an acute stroke may similarly assist practitioners in better identifying acute stroke and expediting lifesaving interventions.

Acute stroke imaging is often interpreted at the point of care by radiologists or stroke practitioners using Picture Archival and Communication systems. Images are stored in Digital Imaging and Communications in Medicine (DICOM) standard format and viewed using various DICOM viewers.[3]

In acute stroke, clinical gaze deviation to the side of the involved hemisphere and opposite to the side of paralysis, Prévost's sign, has been well noted in clinical practice and in the literature.[4] The finding of eye deviation on clinical examination has been found to correlate with diagnosis of stroke in particular cohorts.[5] Over recent years, rapid imaging evaluation has been performed more and more in an effort to optimize door-to-needle times in stroke. Often, this is done before a complete patient history has even been obtained, making imaging the first objective data obtained on the stroke code patient.

Conjugate gaze deviation seen on neuroimaging is also a common finding in acute stroke as practitioners are trained to look at the CT scan for numerous acute stroke findings. Data on diagnostic and predictive utility of this eye deviation found on initial head CTs or magnetic resonance imaging (MRIs) are available for particular cohorts and diagnostic groups. This conjugate eye deviation finding as applied in the acute stroke code imaging evaluation, the "DeyeCOM sign," may have significant implications in the emergency care of stroke patients, especially if the remainder of the CT scan does not show significant findings consistent with cerebral ischemia. Analogous to the hyperdense middle cerebral artery sign, this sign may augment a clinician's history and physical examination to help guide acute management of potential stroke patients even earlier in the evaluation period. In this analysis, we evaluated the stroke code CT imaging of acute stroke code patients to determine the diagnostic and predictive utility of the "DeyeCOM sign" in our acute stroke code patient cohort.

## Methods

This analysis included review of all adult acute stroke code patients from a prospectively collected, investigational review board–approved, registry of consecutive patients entered into the University of California, San Diego Specialized Programs of Translational Research in Acute Stroke database, and seen at one of our core University of California, San Diego facilities, from January 2007 to December 2013.

Patients were excluded from the analysis if initial head CT scan was not available or if significant motion artifact precluded the ability to determine angle of eye deviation (using the lenses as a reference point). Patients whose lenses were not present on at least 1 CT scan image were likewise excluded. Eye deviation was then determined for both globes from the noncontrast head CT obtained at the time of initial clinical presentation. Films were reviewed and angles scored by a single reader, who was blinded to patient data including final diagnosis. The DICOM images were viewed using IMPAX software (Agfa-Gevaert group, Mortsel, Belgium), and the angle of eye deviation was determined by drawing 3 intersecting lines. The first line was drawn anterioposteriorly through the midline nasal structures; the second line was perpendicular to the midline; and the third line was drawn through the horizontal axis of each lens. The angle of deviation was then calculated for each orbit (Fig 1). Conjugate angles more than 5° in both the right eye and the left eye as noted on initial noncontrast head CT were defined as presence of the "DeyeCOM sign." All other variations such as no eye deviation, lone eye deviation, or disconjugate eye deviation, for the purpose of this primary analysis, were considered as having an absence of the "DeyeCOM sign." This finding was recorded for each patient's scan and analyzed with the remainder of clinical information previously collected in the Specialized Programs of Translational Research in Acute Stroke database. Data included demographics, medical history, risk factors, onset-to-CT time, emergency department arrival-to-CT time, glucose, prestroke modified Rankin Scale (mRS) score, baseline National Institutes of Health Stroke Scale (NIHSS), final primary diagnosis (where stroke was defined as ischemic stroke or ICH), and 90-day mRS outcome.

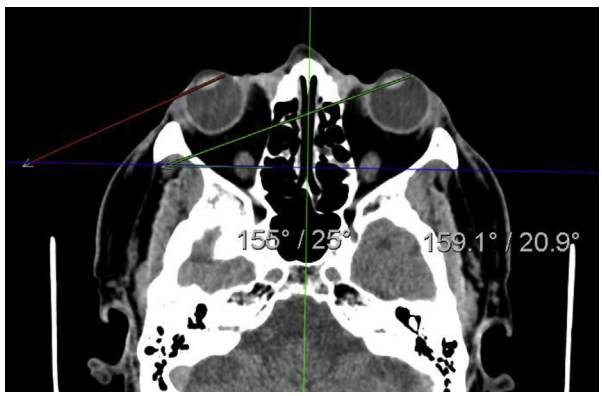


**Figure 1.** *"DeyeCOM sign" on noncontrast computed tomography scan of the head in a stroke code patient presenting to the emergency department. The right eye was deviated 25° and the left 20.9z.*