Accuracy of Diffusion-Weighted Imaging in the Diagnosis of Stroke in Patients With Suspected Cerebral Infarct

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Background and Purpose—The accuracy of diffusion-weighted imaging (DWI) for the diagnosis of acute cerebral ischemia among patients with suspected ischemic stroke arriving to an emergency room has not been studied in depth.

Methods—DWI was performed in 712 patients with acute or subacute focal symptoms that suggested an acute ischemic stroke (AIS), 609 of them with AIS.

Results—DWI demonstrated a sensitivity of 90% and specificity of 97%, a positive likelihood ratio of 31 and a negative likelihood ratio of 0.1 for detecting AIS. The overall accuracy was 95%. Of those patients who demonstrated abnormal DWI studies, 99.5% were AIS patients, and of those patients with normal DWI studies 63% were stroke mimics.

Conclusions—DWI is accurate in detecting AIS in unselected patients with suspected AIS; a negative study should alert for nonischemic conditions. (Stroke. 2013;44:1169-1171.)

Key Words: diagnosis ■ diffusion-weighted imaging ■ stroke

Diffusion-weighted imaging (DWI) is a sensitive technique for the diagnosis of acute ischemic stroke (AIS), but yields false-negative results when applied early after symptom onset or if these are small.1–5 Most studies demonstrating the usefulness of DWI in the diagnosis of AIS have been carried out in a series of consecutive ischemic stroke patients, or in which normal subjects served as control group, or the sample sizes were small and retrospective.1,6,7 Furthermore, stroke mimics (SM) occasionally yield positive DWI studies.1 The accuracy of DWI in the detection of AIS in unselected patients arriving to an emergency room (ER) with focal symptoms suggestive of AIS, where there could be SM, has not been studied in detail. In this short communication, we aimed at calculating the likelihood that DWI will detect AIS in a large, unselected series of patients arriving to an ER with acute symptoms suggestive of brain ischemia.

Methods

In this prospective study, all patients with suspected AIS admitted to the emergency department of Clínica Alemana de Santiago between December 2004 and March 2011 were evaluated by the neurologist on call within the first 15 to 30 minutes after arrival. After this clinical evaluation, stroke severity was assessed applying the National Institute of Health Stroke Scale, blood samples were obtained and an ECG was performed. Patients were then studied with a neuroimaging protocol, which has been previously described,6 consisting of a brain computed tomography and, in those patients without contraindications, a spiral computed tomographic angiography of the intracranial arteries and then DWI. The neuroradiologist on call was informed about the admission of a stroke patient and the location of the suspected lesion.

DWI examinations were performed using a 1.5-Tesla Signa whole-body scanner (GE Medical Systems, Milwaukee, WI), equipped with echo-speed gradients; the acquisition parameters were repetition time (TR), 1000 ms; spin time echo (TE) 73.9 ms; matrix 128×128; field of view 36×23 cm; 32 oblique sections with a thickness 5 mm; without intervals. The diffusion images were obtained with a diffusion weight (b) of 1000 s/mm² and sensitivity gradients of diffusion in planes x, y, and z.

Stroke was diagnosed in patients with a history, clinical examination, and evolution typical of vascular brain damage, with signs of brain ischemia on computed tomography/DWI in our stroke neuroimaging protocol, or on follow-up imaging, or if an occluded vessel was observed in the symptomatic territory. Patients with repeated negative imaging, but with an evident neurovascular syndrome, and no other alternative diagnosis after extensive workup were finally diagnosed as stroke.

The diagnosis of SM was based on the presence of focal acute or subacute neurological symptoms with a definite diagnosis different from stroke explaining the patient’s initial symptoms, and when the diagnosis of stroke had been ruled out. The Ethics Committee of Universidad del Desarrollo, Clínica Alemana de Santiago approved the protocol.

Statistical Analysis

Sensitivity, specificity, and their respective 95% confidence intervals (CIs) likelihood ratios, as well as diagnostic accuracy
Discussion

Our experience demonstrates that DWI is accurate in detecting AIS in unselected patients arriving to an ER with focal symptoms suggestive of this condition. Despite the fact that along a 6-year period almost 1 out of every 7 patients (13.4%) who presented to our ER had an alternative diagnosis to stroke, DWI demonstrated a diagnostic accuracy of 95% and a positive likelihood ratio over 10, which points to a large and often conclusive increase in the likelihood of an ischemic stroke and negative likelihood ratios of 0.1, indicating a low probability of acute stroke when this test was normal. Indeed, patients who had normal DWI studies were SM in 63% of cases.

Based on these results, a negative DWI study should alert the clinician to search for nonischemic conditions if the symptoms suggest AIS, but should not delay intravenous thrombolysis as 9.6% of our stroke patients had negative DWI examinations. The effect of thrombolysis is time-dependent, and SM patients have a favorable prognosis if treated.

Our study has some limitations; mainly that it is a single-center experience, and we cannot exclude that, in some cases, DWI was used to categorize the patients as having an AIS.

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Disclosures

None.

References


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