How Much Should One Rely on Computed Tomography in Patients with TIA in the Era of Diffusion-Weighted Magnetic Resonance Imaging?

To the Editor:

We read with great interest the paper by Douglas et al in *Stroke*. The authors report that the 90-day risk of stroke in transient ischemic attack (TIA) patients with a new infarction on CT is higher than patients with normal CT. This is an important piece of information, coming out almost 20 years after the original report by Waxman and Toole that first introduced the concept that clinically transient events are not necessarily transient in the brain. TIAs often leave footprints, small islands of permanent injury, on the brain. Nonetheless, CT is not the best available technique to pursue such footprints of ischemia. Diffusion-weighted imaging (DWI) offers much greater power in classifying patients who have ischemia as the cause of their reversible neurological deficit. Though more expensive, the cost-effectiveness of MRI might rest in using it to prevent stroke in this subgroup with TIA-associated infarction.

Recent studies using DWI reveal that infarctions in patients with TIs are often very small. Rovira et al reported that the lesion size ranged from 2 to 40 mm (mean = 15 mm) in their 39 patients with TIA. A second study reported that infarction size was less than 15 mm in diameter in 85% of 27 TIA patients with a positive DWI, of which 83% were punctate (<5 mm). These small infarctions will be missed by CT and even by conventional magnetic resonance images (T1-, T2-, FLAIR-weighted). These conventional techniques are limited by lower lesion-to-background signal ratio compared with DWI. Diffusion-weighted imaging also provides a unique opportunity to differentiate acute infarction from chronic lesions. This temporal information that allows to determine the age of infarction turns into a clinical advantage especially in case of small infarctions such as those associated with TIAs and lacunar syndromes. There is no reliable way to mark a small infarction as new or old using conventional imaging methods. In addition, most TIA patients (about 50%) harbor chronic multiple small silent infarctions that, in turn, further blur the confidence to call an infarction new and clinically related to the TIA. Being in a clinically appropriate location does not simply qualify a small infarction as acute and related to the clinical syndrome.

Using DWI as the gold standard, one can actually estimate the amount of error that could be imposed by the use of conventional images in patients with TIA. In a series of studies conducted in patients with syndromes associated with small infarctions (TIAs and lacunar syndromes), our group has determined the diagnostic accuracy of conventional images in capturing acute infarctions. In these studies, the examiners first reviewed T2-WI with clinical information in hand and determined infarctions in the contralateral hemisphere according to the symptoms or in the arterial territory indicated by the symptoms (clinically appropriate lesion). The same procedure was repeated for FLAIR images in a blinded fashion with regard to DWI. Finally, diffusion-weighted images were rated in conjunction with T2-WI and FLAIR. Table 1 shows that conventional images miss or misidentify the acute infarctions apparent on DWI in about one half of the patients with TIA and about one quarter of those with lacunar infarctions.

In conclusion, the paper by Douglas et al is an important step in the right direction, because it demonstrates that patients with TIA who have a new infarct on CT scan have increased risk of subsequent stroke. The overall risk of making an error in using CT to assign patients who do or do not have infarcts related to their TIAs is about 50%. If infarction during a TIA raises the risk of subsequent stroke, then a CT-based study should markedly underestimate the utility of brain imaging to identify patients at high risk for second infarct. We concur with the authors that future studies in this direction should include DWI. An MRI-based study is sorely needed to determine the prognosis of patients with TIAs and associated infarction.

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Response

We agree completely that magnetic resonance diffusion-weighted imaging should provide a more accurate assessment of whether an acute infarction has occurred in the setting of a clinical transient ischemic attack (TIA), and thereby may be a better predictor of subsequent risk of stroke. Whether the increased cost of magnetic resonance imaging is justified for all patients with TIA will depend not only on its ability to differentiate high and low risk groups but also on whether a distinct treatment plan is justified for those so classified. Riskier acute interventions, such as a loading dose of clopidogrel or a platelet glycoprotein 2b3a inhibitor, may be justified in those at high risk for stroke after TIA. However, no large-scale trial of an acute intervention to prevent stroke after TIA has been performed.

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**TABLE 1.** Diagnostic Yield of T2-WI and FLAIR-WI in Patients With Clinical Syndromes Associated With Small Infarctions

<table>
<thead>
<tr>
<th>Acute Infarction</th>
<th>TIA</th>
<th>Lacunar Infarction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T2-WI</td>
<td>FLAIR-WI</td>
</tr>
<tr>
<td>Missed</td>
<td>32%</td>
<td>20%</td>
</tr>
<tr>
<td>Misidentified</td>
<td>27%</td>
<td>32%</td>
</tr>
<tr>
<td>Correctly identified</td>
<td>41%</td>
<td>48%</td>
</tr>
</tbody>
</table>
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