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# Emergent Neurovascular Imaging: A Necessity for the Work-Up of Minor Stroke and TIA

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Most ischemic strokes are judged “minor” and nondisabling.<sup>1</sup> Symptoms being too mild or minor is the most common reason for withholding thrombolysis.<sup>2</sup> However, this seemingly mild presentation is misleading because the prognosis is not benign, with up to one-third of patients having died or being disabled at follow-up.<sup>2</sup>

## Natural History and Imaging Findings

We can identify a subset of patients with minor stroke who are at the highest risk of poor outcome by using noninvasive CT angiography. Patients with minor stroke with documented intracranial arterial occlusion are at particularly high risk of early neurologic deterioration and disability.<sup>3–5</sup> This is true whether the occlusion is proximal or distal<sup>6</sup> or whether the initial deficits have completely resolved.<sup>7</sup> Even in the absence of neurologic deterioration, these patients are at higher risk of disability than those with minor stroke without intracranial occlusion. This presumably is from a mechanism such as silent infarct growth.<sup>8</sup> These patients represent at least 10% of those with minor stroke,<sup>4</sup> and this number is likely higher with better imaging techniques, such as multiphase CTA (mCTA)<sup>9</sup> and perfusion, helping to identify more distal occlusions.

## Why Image Minor Stroke?

Why bother identifying patients with minor stroke with intracranial occlusion? We believe that understanding disease pathophysiology is the first step in the treatment of these patients. Stroke is a plumbing disorder, so better identification of the problem and its exact location would result in better diagnosis and treatment. Few stroke physicians, particularly in the era of endovascular treatment<sup>10,11</sup> of stroke, would disagree that early vascular imaging with CTA is crucial for the early management of patients with moderate-to-severe stroke. We believe that the same is true for patients with minor cerebrovascular events (TIA and minor stroke).

## What Imaging Technique to Use

In most institutions, imaging of minor stroke is best completed by using CT, CTA and mCTA, or CT perfusion. In some parts of the world, MR imaging is easily performed, but vascular imaging is still required. DWI is useful in confirming that the patient actually has ischemia, but for many patients, the absence of a DWI lesion will not change the management plan.<sup>12</sup> The management plan is driven by finding an intracranial occlusion or an intracranial or extracranial stenotic lesion, thus making urgent vascular imaging a key part of the initial work-up.

## Triage and Management Decisions

At our institution, for several years, all patients with suspected stroke symptoms undergo a plain head CT, CTA, and mCTA. Clinical trials are being performed in patients with intracranial occlusion.<sup>13</sup> Ideally, patients would be randomized in such a trial. In the absence of an available trial, a decision can be made on an individual patient basis as to whether to perform thrombolysis or to use dual antiplatelet therapy, for example.<sup>14</sup> Further stroke etiology is an important driver of outcome because it strongly influences the early risk of recurrence with as much as 50% of early recurrences being due to large-artery disease.<sup>15</sup> In addition, recognizing of the magnitude of the problem, better understanding its natural history, and understanding the underlying pathophysiology will trigger new solutions for improving outcomes. Thus, it makes sense to image both the intracranial and extracranial circulation simultaneously in the emergency department. This allows urgent treatment decisions to be made quickly and a treatment plan to be implemented.

We have safely used findings from urgent CTA to triage patients who need to be seen that evening versus those than can be seen in the clinic the next day. Patients with high-risk vascular lesions are seen that night and admitted to the hospital, and those whose symptoms have resolved and have normal CTA findings are usually sent home. From an overall expense perspective, we believe that urgent CTA does not add additional cost because these patients require neurovascular imaging anyway (even if performed in a nonemergent fashion). Additionally, by standardizing the protocol for acute stroke work-up across major and minor stroke, we have been able to improve efficiency at all levels, including image acquisition, postprocessing, and interpretation.

In the near future, all patients with minor stroke and TIA should have emergent neurovascular imaging. This is a necessary step toward improving outcomes in these patients.

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