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tions for appropriate medical management. While it is laudable to use noninvasive techniques (in this case, CTA instead of catheter angiography), the more important issue is the need to evaluate the site of the disease itself. Dissection is a problem of the arterial wall. While catheter angiography has been the traditional method of diagnosis and follow-up, this technique produces high resolution images of the arterial lumen; the wall itself and the overall increased diameter of the artery cannot be defined on such a study. It is these parameters that have the highest predictive value in the diagnosis of acute dissection by CTA, and it is these parameters that should be assessed in follow-up. Acute dissection may be quite subtle on angiography, and I have personally used MRI on a number of occasions to image the "halo" of mural blood surrounding a normal-size lumen to make the diagnosis. When this "halo" is hyperintense, as in the subacute stage, it is readily visible. What about the acute stage, when the intensities of blood and muscle in the arterial wall may be the same? This is when it is most important to assess the wall itself and the width of the artery. The same principles are true for the follow-up of the disease. Healing is not complete because the lumen has returned to a normal size, but because the hematoma has been absorbed from the wall. CTA is an excellent method for making these assessments.

Evaluating the vascular dissection in this way not only leads to a better understanding of the natural history of the disease process, particularly its recovery phase, but also to a more rational use of treatments such as anticoagulation and antiplatelet therapy. At this time, we have no good rationale for using anticoagulants for a given time period. The luminal diameter as defined with repeat catheter angiography is usually used to help make this decision, but does a narrowed lumen on such a study reflect persisting hematoma in the wall, mural scarring, or decreased flow secondary to a stenosis above or below the narrowed segment? CTA may give us a much better way to decide how long to use medical therapies.

I have recently encountered another reason to assess the state of healing of a dissection by evaluating the arterial wall, a problem not addressed by Leclerc and his colleagues. A dissecting aneurysm of the intracranial vertebral artery more frequently presents with subarachnoid hemorrhage (SAH) than ischemia. Because repeat hemorrhage is common and may be fatal, neurosurgeons usually recommend surgical trapping of the involved segment. Extension of the dissection process to involve the origin of the posterior-inferior cerebellar artery origin may not be apparent on the initial angiogram, and may require direct visualization at the time of surgery, when the enlarged, bluish dissected segment is visualized directly. The status of the mural abnormality provided by CTA would, however, aid in that preoperative evaluation. We have recently had a case of bilateral intracranial vertebral artery dissections, occurring spontaneously weeks apart. The more severe dissection had produced SAH, and surgical ligation was the preferred treatment. Was the other vertebral artery sufficiently healed to carry the increased blood flow following vertebral artery trapping? In retrospect, CTA would have been a marvelous way to help make this difficult decision. I am sure that other scenarios will be forthcoming, where the ability of CTA to evaluate vascular abnormalities will have a significant impact on medical and surgical management.

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Thrombolytic Treatment for Acute Stroke Should Be Individualized for Each Patient

After the publication in 1995 of The National Institute of Neurological Disorders and Stroke (NINDS) study (1), which demonstrated the efficacy of intravenous recombinant tissue plasminogen activator (rt-PA) in the treatment of acute stroke when administered within the first 3 hours after acute stroke onset, one could almost hear the collective sigh of relief from the neurology and neuroradiology communities. Finally, our colleagues in neurology had a proven method of treatment to improve outcomes in acute stroke patients; and, many neuroradiologists were thankful that they could at least temporarily defer plans for developing a team of individuals at each institution who were proficient at performing intraarterial thrombolysis in acute stroke patients, 24 hours a day, 7 days a week.

In this issue of the *American Journal of Neuroradiology*, Kucinski et al (page 839) remind us again of the inherent methodologic flaw of both the NINDS and the European Cooperative Acute Stroke Study (ECASS) (2) analyses; that is, the lack of imaging documentation of the site of vascular occlusion. Kucinski et al retrospectively correlated the 3-month clinical outcomes with the pretreatment CT scans and arteriograms of 74 acute stroke patients who had been selected for intraarterial thrombolytic treatment. The authors found there was a higher predictive value and sensitivity concerning early fatality for those patients with angiographically-documented occlusions at the intracranial internal carotid artery bifurcation (the carotid "T" occlusion) than in those patients with early infarct changes on CT involving greater than one third of the vascular territory of the middle cerebral artery (an exclusion criteria for en-

rollment in the ECASS study). Another important finding of Kucinski et al's report is that complete or incomplete recanalization was achieved in only 37% of patients with carotid "T" occlusions, compared to a 61% recanalization rate for the entire cohort of patients. Successful recanalization was proven to be a statistically significant prognosticator; for the entire cohort of patients, successful recanalization was followed by death in 13% of patients compared to 61% when recanalization failed. The authors conclude that thrombolytic treatment for patients with carotid "T" occlusions is not useful and may even be dangerous because of the higher rate of hemorrhagic transformation observed in this subset of patients.

Important questions regarding thrombolytic treatment for acute stroke patients remain unanswered. Which subset of patients will have better outcomes with intraarterial treatment compared to intravenous treatment and vice versa? Which patients will do better with no thrombolytic treatment? Answers to these questions will likely depend heavily upon the site of vascular occlusion. Many neurologists and neuroradiologists intuitively agree that intraarterial thrombolysis should have better outcomes than intravenous thrombolysis since more drug is delivered to the site of occlusion. That concept, however, still remains to be proven in a randomized, controlled study. For all physicians participating in the evaluation and management of the acute stroke patient, a crucial question remains. What is the best neuroimaging method to distinguish between already-infarcted tissue and potentially salvageable ischemic tissue at risk for infarction; the ischemic penumbra?

It is certainly understandable why angiography was not obtained prior to randomization in the ECASS and NINDS trials. The inherent delay of mobilizing the angiography team and the performance of the procedure would have pushed many participants out of the therapeutic time window. Therefore, by default, CT was the only neuroimaging procedure employed in both trials; primarily to exclude patients with hemorrhage in the NINDS trial and to exclude patients with hemorrhage and an infarct greater than one third of the middle cerebral artery territory in the ECASS trial. I believe a noncontrast CT is an inadequate screening examination when done prior to instituting thrombolytic therapy. It is fraught with problems of poor interobserver agreement regarding the extent of already-infarcted brain tissue. In addition, it often gives us little information regarding the site of vascular occlusion and no information regarding the size of the ischemic penumbra. The time has come for us to start employing currently available, noninvasive imaging techniques that were not readily available prior to 1995 during the conduction of the ECASS and NINDS trials. Numerous articles have appeared in the literature in recent years demonstrating the utility of MRA, diffusion/perfusion echo-planar MR imaging, MR spectroscopy, xenon CT, helical CT with bolus contrast technique, and CT angiography in the evaluation of the acute stroke patient. As we continue to upgrade CT and MR scanners, many of these techniques and modalities will become readily accessible at the community level within the accepted time necessary for the evaluation and management of acute stroke patients. It is our responsibility to determine which exam or combination of exams is optimal in the pretherapeutic evaluation of the acute stroke patient.

We know that the site of vascular occlusion and the volume of the ischemic penumbra are important indicators for the efficacy and safety of thrombolytic treatment. The final chapter on acute stroke therapy was not written with the publication of the ECASS and NINDS trials. We, as diagnostic and interventional neuroradiologists, will need to play an important role in the design and implementation of future acute stroke therapy trials.

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Spinal Cord Abnormalities in Metabolic, Nutritional, and Toxic Disorders

It is well known that certain metabolic and nutritional disorders preferentially affect particular areas and tracts of the spinal cord. In this issue of the journal, Pema et al (page 894) describe and illustrate the MR findings of a patient in whom discrete dorsal column involvement resulted from nitrous oxide abuse and secondary vitamin B12 inactivation. The predominate, but not exclusive, dorsal column abnormality in diseases such as subacute combined degeneration and vacuolar myelopathy raises the question of why such selectivity should exist if these diseases are biochemical in nature; in other words, why, as beautifully demonstrated in Figure 1B of Pema's report, is this the preferential site?

The high signal on T2 weighted images in this patient, confined to the dorsal columns, correlated well with findings of diminished light touch and vibratory sensation, ataxia (loss of joint position sense),