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asymptomatic volunteers undergoing sacroiliac arthrography, assuming the volunteers had intact sacroiliac joint surfaces.

Even with the exact mechanism of pain remaining unproved, the article reinforces the role of provocative tests in the diagnosis of atypical low back pain, and provides an avenue for further investigation toward rational diagnosis and treatment of this vexing clinical problem.

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Acute ischemic stroke therapy continues to present unique therapeutic challenges. The treatment of acute intracranial thromboembolism and internal carotid artery (ICA) stenosis have been undergoing parallel advances and have been combined as a series in only a handful of individual reported cases. Mori et al, in this issue of the *AJNR* (page 1462), focus on two current stroke treatment techniques performed in a single patient: the combined therapy of balloon dilatation of middle carotid artery (MCA) occlusion and balloon angioplasty and stent therapy of ICA stenosis.

The recently reported Prolyse in Acute Thromboembolism Trial (PROACT) II study has confirmed the effectiveness and safety of medical recanalization of M1 and M2 occlusions achieved by using intra-arterial recombinant prourokinase within 6 hours of onset (1). A 15% absolute benefit and 60% relative benefit was achieved, with the end point being a modified Rankin outcome score of 0–2 (minimal nondisabling deficit). That study seems to confirm other anecdotal opinions that intra-arterial thrombolytic therapy offers some benefit for stroke patients beyond the 3-hour window accepted for intravenous tissue plasminogen activation (tPA) therapy.

Mechanical revascularization achieved by angioplasty of acute thrombotic occlusive lesions is standard in the coronary system, but its use in the MCA has been delayed by the concern that squeezing thrombus into lenticulostriate perforators (if not already there) is probably bad. Moreover, fragmentation of thrombus into distal vessels, perhaps decreasing collateral flow, may be worse than a stable proximal thrombus that already has done its major damage. In addition, it is not surprising that enthusiasm for angioplasty originated in Japan, where underlying atherosclerotic stenoses are known to be most prevalent. Nakano and colleagues' series of 10 patients with MCA occlusions, thought to be poor candidates for thrombolysis and at risk for hemorrhagic complications or reocclusion, supports the belief that balloon-assisted recanalization is a viable option (2). Fifty percent excellent to good, 50% fair, and no poor outcomes or deaths validates this concept.

Ueda et al reported that, with MCA occlusion resistant to thrombolysis, outcomes for angioplasty-treated patients were better than for patients treated by thrombolysis alone (3). Although this is a selected group of patients, some treated immediately and others treated some days later, this investigation gives additional insight into safety and patient selection.

Mori et al's patient had an initial National Institutes of Health Stroke Scale score of 18, possibly suggesting, according to PROACT II control-group data, a 25% chance of good outcome if nothing were done. On the other hand, the patient did not suffer the fatal outcome of 25% of MCA occlusions either. Therefore, we may assume a benefit was accrued by the balloon-assisted angioplasty, although the anecdotal nature of the report must not be overlooked. Time from ictus and arteriographic collateral flow characteristics are not described, so these additional concerns cannot be factored into the discussion of outcome. ICA angioplasty and stenting subsequently led to an excellent appearance of the ICA, but the exact degree of ''high-grade stenosis'' initially present is still not clear from the report.

The excellent outcome in an individual case must be viewed with the reservation that the same treatment paradigm might not be applicable to patients with similar angioarchitectural appearances. Heterogeneous patient-specific factors primarily will influence the applicability of any therapy. Intracerebral hemorrhage is certainly the most feared sequelae of revascularization, typically expected in 5% to 10% of thrombolysis patients. It is possible that MCA angioplasty at 3 hours post ictus may be safer than thrombolysis conducted from 3 to 5 hours, because time to recanalization, and hence ischemia time, is reduced. On the other hand, high-pressure recanalization of an ischemic (and maximally dilated) vascular bed 6 hours post ictus may be more harmful than an unsuccessful thrombolysis.

If an intracranial angioplasty result is not as excellent as those obtained by Mori et al, and thrombolysis of distal clot is required, it is not clear that additional thrombolytic therapy will be as beneficial. Perhaps if the patient is within a reasonable window for intravenous tPA therapy, we may find that IV tPA, given as rapidly as possible to delay the time to thrombolysis and followed by angiography and angioplasty or intra-arterial thrombolysis for residual occlusions, may also be safe and perhaps more efficacious.

But what about the treatments in series: intracranial and extracranial angioplasty then stenting? Further increasing flow and pressure in ischemic, maximally dilated vascular beds by opening the ICA after MCA recanalization may be doubly dangerous. It may be less dangerous in a hemisphere with good MCA collateral flow and subcritical ICA stenosis treated within 3 to 4 hours in which intracranial hemodynamics may be less altered. Nevertheless, it may be risky in the patient with critical stenosis preexisting the MCA embolic event, with maximal vasodilatation, increased oxygen extraction (misery perfusion), *and* poor corticocortical collateral flow, treated at 6 hours. Early angiographic studies in acute stroke, including PROACT II, have suggested a 10% to 20% likelihood of proximal ICA occlusions, most with distal emboli, emphasizing the significance of the issue.

Historically, the risk of reopening the occluded, severely stenotic ICA after stroke via early carotid endarterectomy has created major caveats (4). Spearman and his colleagues at the University of Pittsburgh, however, reported success with angioplasty performed after intracranial thrombolysis in four cases (5), and have performed others subsequently without intracerebral hemorrhage (Jungreis C., personal communication). Endo et al reported five cases of thrombolysis followed by ICA angioplasty, but the vascular details of thrombolysis are described less well. Nevertheless, three of four patients with such early therapy did well, without hemorrhage. There may be no time like the present to open a carotid in a patient who will have a relatively small infarct and neurologic deficit after MCA recanalization. But what about the clot presumably present at the ICA origin, some of which embolized to the MCA? Is it at risk for further distal embolization? If a lytic agent has been used, perhaps some systemic effect may have contributed to lysis of that clot. If intracranial angioplasty is chosen, that lytic benefit will not be offered.

Angioplasty may increase the ICA lumen sufficiently to augment flow intracranially, yet not enough to create risks of full hyperperfusion that stenting may cause. Current stent practice typically calls for pretreatment with antiplatelet agents, full anticoagulation, and postprocedural antiplatelet therapy, at the minimum. This combination is designed to minimize thromboembolic complications postprocedurally, but may prove to present too great a hemorrhagic risk for the recently thrombolysed patient, who typically has infarction of variable volume, even under the best of circumstances.

Patient selection and meticulous intraprocedural medical management will be the key to matching Mori and colleagues' results under more varied circumstances. Can patient selection be improved with other imaging techniques? Does diffusion and perfusion MR imaging, xenon-CT CBF, single-photon-emission CT, or CT perfusion angiography help select patients for therapy? There are, almost assuredly, patients destined for major infarction and hemorrhage risk even if treated at 2 to 3 hours post ictus, and others who can be treated safely within 12 hours of symptom onset. Can imaging define those patients? Does the time devoted to imaging aimed at finding those who will not benefit from treatment diminish the advantage for those who can gain from therapy? A 30-minute delay in therapy with IV tPA may diminish the probability of clinical improvement by approximately 10% (6). Do similar time-benefit relationships hold for intra-arterial therapies?

Is it possible that any imaging paradigm may be shifted once another parallel development, that of immediate, clot-removal devices, is realized? All data heretofore centered on thrombolysis performed with delays over hours, may become of historical interest only, and prove to be an iteration along the way. Actually removing a thrombus as fast as possible may be the penultimate predictor of the result and outcome after recanalization, and any delay to image along the way may only reduce treatment efficacy. The challenge to respond to ''brain attacks'' in the ''Decade of the Brain'' is being reformulated. Will MCA angioplasty or clot removal or both further improve outcomes? Time will tell!

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