

MRI-based screening improves assignment of stroke patients to endovascular treatment

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Micrograph showing cortical pseudolaminar necrosis, a finding seen in strokes on medical imaging and at autopsy. H&E-LFB stain. Credit: Nephron/Wikipedia

A Massachusetts General Hospital (MGH)— developed system for determining which patients with severe strokes are most likely to benefit from catheter-based systems for blood clot removal led to a greater percentage of screened patients receiving treatment and to outcomes similar to recent studies that found significant treatment benefits. In

their paper published online in *JAMA Neurology*, the research team reports how the precision of their classification system, which combines diffusion MRI with key clinical characteristics, more than doubled the percentage of screened patients who were assigned to and probably benefited from treatment.

"Endovascular therapy has been proven to be effective and superior to other approaches for the treatment of severe strokes caused by the blockage of large brain arteries," says Gilberto González, MD, PhD, director of Neuroradiology in the MGH Department of Radiology and senior author of the *JAMA Neurology* paper. "The critical question has been how to optimize its use to benefit the most patients while minimizing any harm. It appears that the MGH approach to patient selection is superior to other approaches and may be the optimal approach."

Thabele Leslie-Mazwi, MD, of the Neuroendovascular and Neurologic Critical Care Program in the MGH Department of Neurology, the study's lead author, says, "The recent ground-breaking endovascular clinical trials used CT selection criteria for stroke patients as an effective way to identify who would benefit from endovascular stroke therapy. Our work shows that MRI identifies patients with greater precision, which means that fewer patients are inaccurately excluded from a treatment that might otherwise benefit them. As endovascular therapy expands at a regional, national and international level, we think this precision will be essential to providing the most personalized and cost-effective care."

The most critical factor in treating ischemic strokes—those caused by blockage of a brain artery and not by hemorrhage—is restoring blood flow as quickly as possible in order to reduce the amount of brain tissue that is destroyed. The use of the clot-dissolving drug tissue plasminogen activator (tPA) can reduce and in some cases eliminate the effects of a

stroke, but tPA treatment must be carried out within a few hours—4.5 at the most—of symptom onset and is not always effective for patients whose strokes are caused by large blood clots. While endovascular stroke treatment has been available for several years, some of the earliest devices developed to ensnare and remove clots had unreliable results.

The past year has seen an almost complete turnaround for [endovascular treatment](#), with major clinical trials in several countries reporting that use of the most sophisticated clot-removing devices—often in combination with tPA—led to significant recovery in from 33 to as high as 70 percent of patients with major strokes if treatment was initiated within 6 hours of symptom onset. The studies achieving the best outcomes used several advanced CT-based imaging techniques for patient selection. In contrast, the MGH team primarily used diffusion-weighted MRI (which measures the diffusion of molecules like water through tissues) because it produces the most precise estimate of the size of the ischemic core - the area of brain tissue that has been destroyed by the stroke.

The study analyzed treatment results for all patients receiving endovascular therapy at MGH from 2012 through 2014 for acute strokes caused by blockage of one of two major arteries within the brain, along with a subset of patients who did not receive endovascular treatment because it was determined to have little or no potential benefit for them. The research team—including endovascular specialists, stroke neurologists and neuroradiologists—had previously developed a system for classifying patients as likely, uncertain or unlikely to benefit from treatment based on their age, time from [symptom onset](#), size of the clot and the blocked artery, other health issues and the size of the ischemic core, as determined by MRI. The current study also included a group of patients who received endovascular treatment after CT scanning only, either because they were unable to receive MRI or for other reasons.

Among 103 patients who received endovascular therapy during the study period, 72 were screened with diffusion MRI, leading to 40 being classified as likely to benefit and 32 for whom benefit was uncertain. Three months after treatment, 52 percent of the likely-to-benefit group had a favorable outcome, defined as a return to complete functional independence, a result achieved by 32 percent of the uncertain-to-benefit group and 31 percent of those evaluated by CT only. Results were even better in the likely-to-benefit patients for whom treatment restored circulation to tissue around the ischemic core, with favorable outcomes in 74 percent. None of the patients classified as unlikely to benefit had favorable outcomes.

The positive results experienced by the likely-to-benefit group were similar to those reported in the recent clinical trials, but a key difference is that the precision provided by diffusion MRI led to a significantly greater number of screened patients receiving endovascular treatment. In two of the trials that used advanced CT imaging to determine the size of the ischemic core, only 7 to 13 percent of screened patients actually received endovascular therapy, while 33 percent of patients screened with the MGH system were assigned to endovascular treatment.

Study co-author Joshua Hirsch, MD, director of Endovascular Neuroradiology at MGH, says, "The next frontier to investigate is treatment 6 to 24 hours after stroke onset. Data we have accumulated over the past decade suggests that many patients may be successfully treated at this late stage, and MRI is the most powerful means to accurately identify these individuals. If that is true, there may be time to transfer patients who first present at regional hospitals to centers like the MGH that have the capability to conduct this type of screening program. While diffusion MRI is broadly available, only a few major institutions have recognized its critical role and made it available around the clock in emergent fashion for the evaluation of severe stroke patients."

Lee Schwamm, MD, director of Stroke Services and vice-chair of the MGH Department of Neurology, also a co-author of the *JAMA Neurology* paper, adds, "Although only 5 percent of [stroke patients](#) would be candidates for endovascular treatment, they are the ones at risk of the greatest disability. This treatment has been FDA approved for years, but until now we haven't known the best method for patient selection. Patterns of stroke care will need to change to accommodate and ensure access to endovascular [treatment](#), but for [patients](#) with severe strokes, it can be a real game changer with an effect that is twice as powerful as intravenous tPA."

Provided by Massachusetts General Hospital

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