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Q/ What is the best imaging method for patients with a presumed acute stroke?

EVIDENCE-BASED ANSWER

A/ It depends on whether the stroke is ischemic or hemorrhagic. For early detection of ischemic stroke, magnetic resonance imaging (MRI) using diffusion-weighted imaging (DWI) is highly sensitive and specific, whereas computed tomography (CT) is less sensitive but about as specific (strength of recommendation [SOR]: **B**, a meta-analysis of lower quality RCTs). MRI using DWI and CT are probably comparable for detecting acute hemorrhagic stroke (SOR: **B,** a cohort study).

When thrombolysis is being considered and hemorrhage must be ruled out rapidly, either test is acceptable if it can be performed and interpreted within 45 minutes of patient arrival, although MRI typically costs about twice as much as CT (SOR: **C,** expert opinion).

Evidence summary

A Cochrane review identified 7 studies that compared MRI with CT for detecting ischemic stroke in a total of 226 patients, average age 65 years, with stroke-like symptoms.[1] Investigators performed imaging within 12 hours of symptom onset in all patients, including those whose final diagnosis was transient ischemic attack (TIA). They identified 161 patients with ischemic stroke based on a combination of imaging and clinical examination. MRI with DWI was more sensitive than CT (0.99; 95% confidence interval [CI], 0.23-1.00 vs 0.39; 95% CI, 0.16-0.69); both techniques had comparable specificity (0.92; 95% CI, 0.83-0.97 and 1.00; 95% CI, 0.94-1.00, respectively).

Many issues could have affected the ischemic stroke analysis: All studies included some retrospective data collection; in all but one study, the MRI was performed a mean of one hour after the CT; and in 4 studies, the physicians reading the scans weren't blinded to the clinical outcome. The Cochrane authors also found evidence of "prescreening" that appeared to select for patients with middle-cerebral artery infarcts. They concluded that the reliability and generalizability of the results "were questionable."

MRI and CT have similar sensitivity and specificity for hemorrhagic stroke

A prospective cohort study of 27 patients (mean age 76 years) who had an acute hemorrhagic stroke that was imaged using both MRI with DWI and CT within 3 hours of symptom onset found that both imaging studies had comparable sensitivity (0.81; 95% CI, 0.61-0.93 vs 0.89; 95% CI, 0.70-0.97, respectively) and specificity (1.0; 95% CI, 0.98-1.0 for both).[2]

A retrospective case-control study evaluated the ability of DWI to detect hemorrhagic stroke in 86 patients who presented with symptoms consistent with acute stroke.[3] Investigators compared the sensitivity and specificity of DWI against the pooled results of 5 different MRI sequences. Both case and control imaging was performed within 6 hours of symptom onset. Half of the patients in the study had hemorrhagic strokes (43); the rest had ischemic strokes (41) or a TIA and postictal

deficit (2). The sensitivity and specificity of DWI for hemorrhagic stroke were both 1.0. However, there was no independent reference standard.

MRI costs more than CT

Although costs vary widely, one textbook put the national average charge for a head CT at about $1000.[4] MRI neuroimaging charges ranged from $1000 to $4700, with an average of about $2300. Medicare reimbursements were significantly less, although the cost of MRIs was still about double that of CTs.

Recommendations

The Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology says that DWI is more useful than noncontrast CT for diagnosing acute ischemic stroke in patients presenting within 12 hours of symptom onset.[5] The subcommittee made no recommendation for imaging hemorrhagic stroke.

American Heart Association and American Stroke Association guidelines for early management of adults with ischemic stroke recommend neuroimaging with either DWI or CT within 45 minutes of arrival in candidates for tissue plasminogen activator.[6] They also recommend neuroimaging with either CT or MRI to distinguish ischemic from hemorrhagic stroke.[7] The guidelines state that other imaging methods (including CT angiography, contrast-enhanced MRI, and magnetic resonance angiography) "may be considered" to evaluate for clinically suspected underlying structural lesions, including vascular malformations and tumors. JFP

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