Computed Tomographic Angiography or Magnetic Resonance Angiography for Detection of Intracranial Vascular Malformations in Patients With Intracerebral Hemorrhage

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Early identification of an intracranial vascular malformation (IVM; brain or pial/dural arteriovenous malformations/ fistulae, and aneurysms) after intracerebral hemorrhage (ICH) may improve outcome if treatment can prevent recurrence. Intra-arterial digital subtraction angiography (IADSA) is the reference standard for detection of IVMs as the cause of ICH. Computed tomographic angiography (CTA) and magnetic resonance angiography (MRA) are less invasive than IADSA and may be as accurate.

Objectives
We performed a systematic review of the diagnostic test accuracy of CTA and MRA compared with IADSA for the detection of IVMs as a cause of ICH.

Methods
We searched MEDLINE (1948 to August 2013), EMBASE (1980 to August 2013), MEDION (August 2013), the Database of Abstracts of Reviews of Effects (August 2013), the Health Technology Assessment Database (August 2013), ClinicalTrials.gov (August 2013), and World Health Organization (International Clinical Trials Register Portfolio; August 2013). We also performed a cited reference search for forward tracking of relevant articles on Google Scholar, screened bibliographies, and contacted authors to identify additional studies.

We selected studies reporting data that compared CTA or MRA, or both, with IADSA in the same patients for the detection of IVMs after ICH. Two authors independently extracted data on study characteristics, diagnostic test characteristics, and measures of diagnostic test accuracy. We combined data using a bivariate model. We generated forest plots of the sensitivity and specificity of CTA and MRA and created a summary receiver operating characteristic plot.

Main Results
Eleven studies (n=927 participants; 8 [n=526] compared CTA with IADSA and 3 [n=401] compared MRA with IADSA) met our inclusion criteria (Figure). Methodological quality varied considerably, with partial verification bias and retrospective designs being particularly prominent. The pooled estimate of sensitivity and specificity was 0.95 (95% confidence interval, 0.90–0.97) and 0.99 (95% confidence interval, 0.95–1.00), respectively, for CTA and 0.98 (95% confidence interval, 0.80–1.00) and 0.99 (95% confidence interval, 0.97–1.00), respectively, for MRA. An indirect comparison of CTA with MRA failed to reveal a statistically significant difference in sensitivity or specificity (P=0.6).

Conclusions
CTA and MRA are probably of a comparable diagnostic accuracy with IADSA for the detection of IVMs in patients with ICH. These estimates should be interpreted with caution.

Figure. Forest plot of the paired sensitivity and specificity values for the detection of an intracranial vascular malformation after intracerebral hemorrhage using computed tomographic angiography (CTA) or magnetic resonance angiography (MRA) compared with a reference standard of catheter intra-arterial digital subtraction angiography. CI indicates confidence interval.
because of few studies, variable methodological quality, and small sample sizes.

**Implications for Clinical Practice and Future Research**

Future research should evaluate CTA and MRA in a broad spectrum of patients after ICH. They should also address the implications of false-negative and false-positive results. A false-negative CTA or MRA may be more consequential because the result leaves the patient at risk of recurrent hemorrhage if IADSA is not performed. A higher sensitivity at the relative expense of specificity may, therefore, be optimal.

This article is based on a Cochrane Review published in The Cochrane Library 2012, Issue 9 (see www.thecochranelibrary.com for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and The Cochrane Library should be consulted for the most recent version of the review.1

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**Reference**


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положительных результатов. Особое внимание стоит уделять ложноотрицательным результатам КТА или МРА, поскольку если не провести ВАЦСА, при подобном результате у пациента сохраняется риск развития повторного кровотечения. В связи с этим высокая чувствительность при относительно высокой специфичности являются оптимальными.

Литература


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