

# Review: Contrast-enhanced MRA is more sensitive and specific than CT angiography or ultrasonography for detection of lower-limb PAD

Collins R, Burch J, Cranny G, et al. Duplex ultrasonography, magnetic resonance angiography, and computed tomography angiography for diagnosis and assessment of symptomatic, lower limb peripheral arterial disease: systematic review. *BMJ*. 2007;334:1257.

**Clinical impact ratings:** Cardiology ★★★★★☆☆ Hematol/Thrombo ★★★★★☆☆

## QUESTION

What is the diagnostic accuracy of magnetic resonance angiography (MRA), computed tomography angiography (CTA), and duplex ultrasonography (DUS) for assessment of lower-limb peripheral arterial disease (PAD)?

## METHODS

**Data sources:** MEDLINE, EMBASE/Excerpta Medica, BIOSIS Previews, Science Citation Index, NTIS Database, LILACS, SIGLE, Dissertation Abstracts Online, Inside Conferences, Pascal (to April 2005); Cochrane Database of Systematic Reviews (issue 3, 2005); journals on imaging and vascular disease; and bibliographies of relevant studies.

**Study selection and assessment:** Cohort or case-control studies in any language that assessed the diagnostic accuracy of MRA, CTA, or DUS in  $\geq 20$  patients  $\geq 18$  years of age with symptoms of lower-limb PAD, using a reference standard of intraarterial contrast angiography or findings at surgery or follow-up. 14 studies evaluated contrast-enhanced MRA, 7 studies evaluated CTA, and 28 studies evaluated DUS. Only studies that presented results by arterial segment were reported. Quality assessment of individual studies was based on the QUADAS checklist. The interpreter of the index test results was blinded to reference test results in 84% of MRA studies and 71% of CTA and DUS studies; the interpreter of the reference test results was blinded to the results in 84% of MRA studies, 71% of CTA studies, and 82% of DUS studies.

**Outcomes:** Sensitivity and specificity.

## MAIN RESULTS

For detection of stenosis  $\geq 50\%$  or occlusion in the lower limb, contrast-enhanced MRA had higher median sensitivity (MRA vs CTA vs DUS = 95% vs 91% vs 88%) and specificity (97% vs 91% vs 96%) than CTA or DUS. For detection of occlusion, MRA had lower median sensitivity than CTA (94% vs 97%) and higher median sensitivity than DUS (94% vs 90%); all 3 tests had similar median specificities (99% vs 100% vs 99%). Ranges of sensitivity and specificity for the diagnostic tests are in the Table. Results were

not pooled because of significant heterogeneity among individual studies.

## CONCLUSION

Contrast-enhanced magnetic resonance angiography is more sensitive and specific than computed tomography angiography or duplex ultrasonography for detection of arterial stenosis in the lower limb.

*Source of funding:* Health Technology Assessment Programme.

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### Sensitivity and specificity of contrast-enhanced magnetic resonance angiography (MRA), computed tomography angiography (CTA), and duplex ultrasonography (DUS) for assessment of lower-limb peripheral arterial disease\*

| Assessment                        | Test | Number (n) of studies | Sensitivity (95% CI) range         | Specificity (CI) range              |
|-----------------------------------|------|-----------------------|------------------------------------|-------------------------------------|
| Stenosis $\geq 50\%$ or occlusion | MRA  | 7 (279)               | 92% (88 to 95) to 100% (97 to 100) | 64% (56 to 71) to 99% (98 to 100)   |
|                                   | CTA  | 6 (245)               | 89% (78 to 95) to 99% (97 to 100)  | 83% (80 to 87) to 97% (96 to 98)    |
|                                   | DUS  | 7 (369)               | 80% (71 to 87) to 98% (93 to 100)  | 89% (84 to 92) to 99% (98 to 99)    |
| Occlusion                         | MRA  | 6 (244)               | 85% (76 to 91) to 100% (91 to 100) | 97% (95 to 98) to 100% (99 to 100)  |
|                                   | CTA  | 5 (195)               | 89% (84 to 92) to 100% (75 to 100) | 99% (98 to 100) to 100% (98 to 100) |
|                                   | DUS  | 7 (379)               | 74% (49 to 91) to 94% (84 to 99)   | 96% (93 to 98) to 100% (97 to 100)  |

\*CI and diagnostic terms defined in Glossary.

## COMMENTARY

The systematic review by Collins and colleagues evaluated the use of DUS, MRA, and CTA for diagnosis of symptomatic lower-limb PAD. The implications for clinical practice must be interpreted within the scope of the published studies in the review.

Patient history, physical examination, and measurement of the ankle-brachial index are nearly always sufficient for diagnosis and management of patients with intermittent claudication or asymptomatic PAD. In contrast, patients with limb-threatening ischemia require detailed assessment of their arterial system to guide open surgery or endovascular therapies. Physicians and surgeons caring for such patients must choose an imaging modality that is safe, accurate, and available.

Collins and colleagues compared the diagnostic accuracy of 3 non-invasive techniques with the reference standard, contrast angiography. MRA had a higher median sensitivity and specificity than DUS or CTA for detecting stenosis  $\geq 50\%$  or occlusion in the lower limb. Contrast-enhanced MRA may be more accurate than 2-dimensional

time-of-flight MRA. Availability and interobserver variability of specific MRA techniques should be considered at each institution.

Detailed imaging must be undertaken when intervention is being considered for PAD. DUS is the simplest and safest modality and is readily available in most institutions. If more detail is required to plan an intervention, MRA is more accurate than CTA and does not expose patients to ionizing radiation. MRA is also superior in the face of arterial calcification. However, both MRA and CTA are quite accurate, and either may be chosen to delineate the arterial system. Conventional contrast angiography will probably play an unimportant role in the assessment of PAD in the future. Further studies evaluating the effect of assessment method on patient outcomes are needed.

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