Review: Magnetic resonance angiography detects lower-extremity arterial disease in claudication or critical limb ischemia

QUESTION

How accurate is magnetic resonance angiography (MRA) for diagnosing lower-extremity arterial disease in patients with claudication or critical limb ischemia?

DATA SOURCES

Searches included MEDLINE (1985 to May 2000), EMBASE/Excerpta Medica (1988 to May 2000), *Current Contents* (to May 2000), and the bibliographies of relevant papers. The authors made no attempt to identify unpublished studies.

STUDY SELECTION

Selected studies compared MRA with conventional arteriography (CA) or intra-arterial digital subtraction angiography (iaDSA) in patients with claudication or critical limb ischemia, evaluated the lower-extremity arteries for detection of > 50% stenosis or occlusion, and presented data to enable the formation of 2 × 2 contingency tables. Studies of MRA after percutaneous transluminal angioplasty or surgery and those in languages other than English, German, or French were excluded.

DATA EXTRACTION

Extracted data included MRA technique (2-dimensional [2-D] or 3-dimensional [3-D]), reference standard used, and study quality; arterial tract(s) examined (aortoiliac tract from the infrarenal aorta to the common femoral artery, femoropopliteal tract from the common femoral artery to the trifurcation, or infrapopliteal tract from the trifurcation to the pedal arteries) or number of subdivisions within an arterial tract; and results. Outcomes included sensitivity, specificity, likelihood ratios, and diagnostic odds ratio (DOR)* of tests to detect lower-extremity arterial disease defined as > 50% stenosis or occlusion of arteries.

MAIN RESULTS

34 studies met the selection criteria. Ranges of sensitivity, specificity, and likelihood ratios are in the Table. Studies had significant heterogeneity of the DOR ($P < 0.001$). Studies using 3-D gadolinium-enhanced MRA had better discriminative power than those using 2-D MRA. A higher number of subdivisions also improved diagnostic performance. The estimated Q-points (where sensitivity = specificity) were 94% for 3-D gadolinium-enhanced MRA and 90% for 2-D MRA.

CONCLUSION

In patients with claudication or critical limb ischemia, magnetic resonance angiography (MRA) is highly accurate for diagnosing lower-extremity arterial disease with a small gain in accuracy for 3-D over 2-D MRA.

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*DOR = sensitivity/(1–sensitivity) ÷ (1–specificity)/specificity.

Range of test characteristics for detection of lower-extremity arterial disease†

Tract	MRA	Sensitivity	Specificity	+LR	−LR
Aortoiliac	2-D	81 to 100	23 to 100	1.30 to ∞	0 to 0.25
	3-D	81 to 100	85 to 100	6.07 to ∞	0 to 0.20
Femoropopliteal	2-D	88 to 100	82 to 100	5.04 to ∞	0 to 0.12
	3-D	91 to 100	98 to 99	43.6 to 81.0	0 to 0.09
Infrapopliteal	2-D	81 to 100	91 to 97	9.39 to 33.3	0 to 0.20
	3-D	91 to 94	64 to 100	2.64 to ∞	0.06 to 0.09
Aggregate	2-D	69 to 100	73 to 97	3.21 to 36.7	0 to 0.36
	3-D	85 to 97	83 to 98	5.76 to 46.9	0.03 to 0.16

†2-D = 2-dimensional magnetic resonance angiography (MRA) technique; 3-D = 3-dimensional MRA technique. Diagnostic terms defined in Glossary; sensitivity, specificity, and LRs calculated from data in article.

COMMENTARY

Peripheral arterial disease (PAD) is a common manifestation of systemic atherosclerosis. 20% of the elderly population are affected by PAD as defined by an abnormal ankle–brachial index. About 30% to 40% of patients with PAD have claudication (leg symptoms on exercise) and < 5% ultimately develop critical leg ischemia (ischemic rest pain or ischemic ulcers) (1). The study by Koelemay and colleagues found that MRA was highly accurate and may even be better than angiography at visualizing distal tibial vessels, which is important for some patients having vascular reconstruction.

What is the role of MRA in patients with PAD? Clinicians can diagnose most patients with PAD with a simple noninvasive test by using the ankle-brachial index (ankle systolic pressure divided by arm systolic pressure, with abnormal index < 0.90). Because most patients do well with medical management, few need further visualization with duplex ultrasonography, MRA, or contrast angiography. These maneuvers should be reserved only for patients in whom medical therapies have failed to relieve symptoms and revascularization is clearly indicated.

In the study by Koelemay and colleagues, most of the patients evaluated were being treated for claudication. In these patients, surgery is typically not indicated. In contrast, a minority of patients studied in this report had critical leg ischemia for whom a revascularization procedure, principally surgery, is mandated. MRA is an accurate, noninvasive test to visualize the peripheral circulation, but its use should be restricted to the few patients who may benefit from surgical intervention.

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Reference

1. **Weitz JI, Byrne J, Clagett GP, et al.** Diagnosis and treatment of chronic arterial insufficiency of the lower extremities: a critical review. Circulation. 1996;94:3026-49. Erratum. 2000;102:1074.