

Sudden Onset Cold Painful Leg
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Albrecht T, Foert E, Holtkamp R, et al. 16-MDCT angiography of aortoiliac and lower extremity arteries: comparison with digital subtraction angiography. <i>AJR Am J Roentgenol.</i> 2007;189(3):702-711.	Observational-Dx	50 patients; 2 blinded observers	Prospective, blinded study to compare CTA performed on a 16-MDCT scanner and DSA in patients with PAD.	Of 958 steno-occlusive lesions on DSA, CTA observers 1 and 2 detected 933 and 929 lesions, respectively. Sensitivity and specificity for the detection of hemodynamically relevant (>50%) lesions was 93.3% and 96.5% for observer 1 and 90.1% and 95.6% for observer 2. CTA is an effective noninvasive alternative to DSA for the evaluation of PAD.	1
2. Berg F, Bangard C, Bovenschulte H, et al. Hybrid contrast-enhanced MR angiography of pelvic and lower extremity vasculature at 3.0 T: initial experience. <i>Eur J Radiol.</i> 2009;70(1):170-176.	Observational-Dx	21 consecutive patients; 2 independent reviewers	Prospective, blinded study to evaluate if 3D CE-MRA of the pelvis and lower extremities at 3.0T, using a hybrid technique and randomly segmented central k-space ordering is feasible to achieve high spatial resolution images without venous contamination of the aortoiliac, femoropopliteal and calf station.	490 and 488 of 495 arterial segments were visualized with diagnostic image quality by observer 1 and observer 2, respectively. Image quality was excellent in 470 and 457 arterial segments, respectively. Relevant arterial stenoses (50%–99%) were detected in 43 and 47 segments by observer 1 and observer 2, 66 and 65 arterial segments, respectively, were interpreted as occluded. The hybrid MRA protocol at 3.0T offers high diagnostic quality for the whole peripheral arterial tree without venous contamination at high spatial resolution.	2
3. 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. <i>Bmj.</i> 2007;334(7606):1257.	Review/Other-Dx	107 studies	Systematic review to determine the diagnostic accuracy of duplex US, MRA, and CTA, alone or in combination, for the assessment of lower limb PAD; to evaluate the impact of these assessment methods on management of patients and outcomes; and to evaluate the evidence regarding attitudes of patients to these technologies and summarize available data on adverse events.	For the detection of stenosis ≥50% in a lower limb vessel, CE-MRA had the highest diagnostic accuracy with a median sensitivity of 95% (range 92%–99.5%) and median specificity of 97% (64%–99%). The results were 91% (89%–99%) and 91% (83%–97%) for CTA and 88% (80%–98%) and 96% (89%–99%) for duplex US. CE-MRA might be a viable alternative to contrast angiography where available.	4

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4. Heijenbrok-Kal MH, Kock MC, Hunink MG. Lower extremity arterial disease: multidetector CT angiography meta-analysis. <i>Radiology</i> . 2007;245(2):433-439.	Review/Other-Dx	436 patients from 12 studies of 9,541 arterial segments	To obtain the best available estimates of the diagnostic performance of MDCTA compared with that of DSA in the assessment of symptomatic lower extremity arterial disease and to identify the most important sources of variation in diagnostic performance between studies.	Of the 70 studies initially identified, 12 were included in which MDCTA was used to evaluate 9541 arterial segments in 436 patients. The pooled sensitivity and specificity for detecting a stenosis of at least 50% per segment were 92% (95% CI: 89%, 95%) and 93% (95% CI: 91%, 95%), respectively. 3 studies provided data about the diagnostic performance of MDCTA in subdivisions of the arterial tract. The diagnostic performance of MDCTA in the infrapopliteal tract was lower than but not significantly different from that in the aortoiliac ($P>.11$) and femoropopliteal ($P>.40$) tracts. Regression analysis showed that diagnostic performance was not significantly influenced by differences in study characteristics.	4
5. Kreitner KF, Kunz RP, Herber S, Martenstein S, Dorweiler B, Dueber C. MR angiography of the pedal arteries with gadobenate dimeglumine, a contrast agent with increased relaxivity, and comparison with selective intraarterial DSA. <i>J Magn Reson Imaging</i> . 2008;27(1):78-85.	Observational-Dx	22 patients; 2 observers	Prospective study to compare Gd-BOPTA-enhanced MRA of the pedal vasculature with selective DSA in patients with PAOD.	No differences between CE-MRA and DSA in detecting patent vessel segments with a high degree of agreement (kappa = 0.89), and interobserver agreement for MRA was substantial (kappa = 0.89). Good agreement between DSA and CE-MRA for assessment of relevant vessel stenosis (kappa = 0.61); interobserver agreement for MRA was good (kappa = 0.65). CE-MRA detected significantly more patent metatarsal arteries than did DSA ($P<0.001$). Gd-BOPTA-enhanced MRA is comparable to DSA for assessment of the pedal vasculature, and is able to delineate significantly more patent vessels without segmental occlusions and more metatarsal arteries than selective DSA.	2

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6. Met R, Bipat S, Legemate DA, Reekers JA, Koelemay MJ. Diagnostic performance of computed tomography angiography in peripheral arterial disease: a systematic review and meta-analysis. <i>Jama</i> . 2009;301(4):415-424.	Review/Other-Dx	20 studies 957 patients 2 reviewers	Systematic review and meta-analysis to determine the accuracy of CTA compared with intra-arterial DSA in differentiating extent of disease in patients with PAD.	Sensitivity of CTA for detecting more than 50% stenosis or occlusion was 95% (95% CI, 92%–97%) and specificity was 96% (95% CI, 93%–97%). CTA correctly identified occlusions in 94% of segments, the presence of more than 50% stenosis in 87% of segments, and absence of significant stenosis in 96% of segments. Overstaging occurred in 8% of segments and understaging in 15%. CTA is an accurate modality to assess presence and extent of PAD in patients with intermittent claudication; however, methodological weaknesses of examined studies prevent definitive conclusions from these data.	4
7. Gupta R, Hennebry TA. Percutaneous isolated pharmaco-mechanical thrombolysis-thrombectomy system for the management of acute arterial limb ischemia: 30-day results from a single-center experience. <i>Catheter Cardiovasc Interv</i> . 2012;80(4):636-643.	Observational-Tx	24 patients	To study the efficacy of isolated pharmaco-mechanical thrombolysis-thrombectomy by Trellis device (Covidien, Mansfield, MA) in managing acute limb ischemic.	24 patients constituted 32 arteries; 18 (56.25%) were suprainguinal including 3 grafts (9.4%) and 14 (43.75%) were infrainguinal native arteries. Substantial or complete response was seen in >90% vessels with 87.5% patients revealing TIMI 3 flow while none demonstrated TIMI 2 or 3 pretreatment. Only 3 patients required adjunctive post-isolated pharmaco-mechanical thrombolysis. In-hospital and 30-day all-cause mortality was 4.16%. 1 patient died in-hospital and no patient underwent amputation.	3
8. Kuhn JP, Hoene A, Miertsch M, et al. Intraarterial recombinant tissue plasminogen activator thrombolysis of acute and semiacute lower limb arterial occlusion: quality assurance, complication management, and 12-month follow-up reinterventions. <i>AJR Am J Roentgenol</i> . 2011;196(5):1189-1193.	Observational-Tx	129 patients	To assess the efficacy of intra-arterial thrombolysis in acute and semiacute occlusions of the lower limb.	Recanalization was accomplished by recombinant tissue plasminogen activator thrombolysis in 73.6% of all cases. There was no difference in primary therapeutic success between native arteries and bypass grafts ($P=0.601$). Thrombolysis was more effective in acute peripheral occlusions, and hospital stays were shorter than those for patients with semiacute occlusion ($P=0.001$). The morbidity rate was 31% (minor complications, 20.2%; major complications, 10.9%), and the mortality rate was 2.3%. Within 12 months, radiologic and surgical interventions were necessary for 27 patients. The limb salvage rate after primarily successful recanalization was 89.5%.	2

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9. Schrijver A, Vos J, Hoksbergen AW, et al. Ultrasound-accelerated thrombolysis for lower extremity ischemia: multicenter experience and literature review. <i>J Cardiovasc Surg (Torino)</i> . 2011;52(4):467-476.	Observational-Tx	57 patients	To evaluate the short-term outcome of US-accelerated thrombolysis in patients with lower extremity ischemia caused by thromboembolic occlusions.	Initial technical success was 97%, radiologic success was 82%, and overall clinical success was 77%. Median thrombolysis time was 21 hours (IQR, 15–24). In 38/51 procedures with successful lysis (75%) complete lysis was achieved within 24 hours. Major hemorrhage occurred in 2 procedures (3%), and distal embolization in 2 procedures (3%). During the initial hospitalization, the major amputation rate was 8% (N=5) and the mortality rate was 2% (N=1). The 30-day patency rate was 81%, without additional mortality. During a median 6-month (range, 2–14) follow-up, 9 reinterventions were performed. 2 patients underwent major amputation and 3 patients died; because of malignancy (N=2) and stroke (N=1).	3
10. Hentsch A, Aschauer MA, Balzer JO, et al. Gadobutrol-enhanced moving-table magnetic resonance angiography in patients with peripheral vascular disease: a prospective, multi-centre blinded comparison with digital subtraction angiography. <i>Eur Radiol</i> . 2003;13(9):2103-2114.	Observational-Dx	203 patients	Prospective, multi-center study to assess the accuracy of moving table MRA compared to DSA in PVD.	For pelvis and thigh, there was statistically significant diagnostic agreement between CE-MRA and intra-arterial DSA on-site (94%) and off-site (86%–88%). Overall, for detection of clinically significant stenoses, 93% sensitivity and 90% specificity were achieved in on-site evaluation, with 71%–76% and 87%–93% off-site; for detection of occlusion, sensitivity and specificity on-site were 91% and 97%, with 75%–82% and 94%–98% off-site. Evaluation was more sensitive on-site than off-site for detection of stenoses and occlusion, whereas specificity was similar. The CE-MRA with 1.0-mol gadobutrol gave results comparable to those of intra-arterial DSA for the larger arteries of pelvis and thigh. Results for calf arteries were compromised by spatial resolution and technical limitations.	1
11. Scherthaner R, Fleischmann D, Stadler A, Scherthaner M, Lammer J, Loewe C. Value of MDCT angiography in developing treatment strategies for critical limb ischemia. <i>AJR Am J Roentgenol</i> . 2009;192(5):1416-1424.	Review/Other-Dx	28 patients	Retrospective study to assess the value of MDCTA in the development of strategies for the treatment of patients with CLI.	MDCTA findings lead to accurate recommendations for the management of CLI. CTA is therefore an important technique for the management of stage IV PAOD in patients without absolute contraindications to CTA.	4

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12. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/Quality-Safety/Resources/Contrast-Manual .	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4
13. Langer S, Kramer N, Mommertz G, et al. Unmasking pedal arteries in patients with critical ischemia using time-resolved contrast-enhanced 3D MRA. <i>J Vasc Surg</i> . 2009;49(5):1196-1202.	Observational-Dx	29 consecutive patients; 34 feet	Prospective study to test the diagnostic relevance of fast Gd-BOPTA enhanced, time-resolved, 3D MRA of distal calf and pedal vasculature in CLI in comparison with conventional selective DSA and high-resolution duplex US scan.	MRA images of diagnostic quality were achieved in all patients. Significantly more patent pedal arteries were identified by applying t3D MRA than DSA ($P<.001$) and US scan ($P<.02$). For estimating the degree of stenosis, no technique proved to be superior ($P>.28$). Overall image quality was rated best for 3D-MRA. Additionally, potential bypass target vessels could be clearly discriminated from pedal veins due to the temporal resolution.	1
14. Huegli RW, Aschwanden M, Bongartz G, et al. Intraarterial MR angiography and DSA in patients with peripheral arterial occlusive disease: prospective comparison. <i>Radiology</i> . 2006;239(3):901-908.	Observational-Dx	20 patients	To prospectively evaluate the feasibility of intra-arterial MRA in the depiction of significant stenoses and occlusions.	Intra-arterial DSA revealed 78 moderate stenoses, 57 significant stenoses, and 28 occlusions. Sensitivity, specificity, and accuracy of intra-arterial MRA in the characterization of significant stenoses or occlusions were 92% (95% CI: 72%, 99%), 94% (95% CI: 82%, 98%), and 93%, respectively, in femoropopliteal arteries and 93% (95% CI: 83%, 98%), 71% (95% CI: 51%, 86%), and 86%, respectively, in infrapopliteal arteries. The main artifact observed with intra-arterial MRA was venous contamination (12%).	2

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15. Swan JS, Carroll TJ, Kennell TW, et al. Time-resolved three-dimensional contrast-enhanced MR angiography of the peripheral vessels. <i>Radiology</i> . 2002;225(1):43-52.	Observational-Dx	69 patients	To compare diagnostic accuracy of 3-D CE-MRA with conventional angiography for imaging the lower extremity vasculature.	At pooled readings, CE-MRA had a sensitivity of 78% and a specificity of 98% for detection of occlusion. For detection of significant stenosis (at least one $\geq 50\%$ stenosis), sensitivity and specificity were 77% and 91%, respectively. Interreader agreement was high for detection of both occlusion (kappa = 0.76) and significant stenosis (kappa = 0.68). Sensitivity increased as MR angiographic technical parameters were optimized. When improvements resulting from coil type and injection protocol were considered, the sensitivity and specificity of TRICKS MRA were 89% and 97%, respectively, for occlusion detection and 87% and 90%, respectively, for significant stenosis detection	1
16. Menke J, Larsen J. Meta-analysis: Accuracy of contrast-enhanced magnetic resonance angiography for assessing steno-occlusions in peripheral arterial disease. <i>Ann Intern Med</i> . 2010;153(5):325-334.	Review/Other-Dx	32 studies 1,022 patients	To summarize evidence of prospective studies about how well MRA identifies or excludes arterial steno-occlusions (50% to 100% lumen reduction) in adults with PAD symptoms.	Overall, the pooled sensitivity of MRA was 94.7% (95% CI, 92.1% to 96.4%) and the specificity was 95.6% (CI, 94.0% to 96.8%) for diagnosing segmental steno-occlusions. The pooled positive and negative likelihood ratios were 21.56 (CI, 15.70 to 29.69) and 0.056 (CI, 0.037 to 0.083), respectively. MRA correctly classified 95.3%, overstaged 3.1%, and understaged 1.6% of arterial segments. Similar to most studies of CTA in PAD, the primary studies reported the diagnostic accuracy of MRA on a per-segment basis, not a per-patient basis. This meta-analysis of 32 prospective studies further increases the evidence that CE-MRA has high accuracy for identifying or excluding clinically relevant arterial steno-occlusions in adults with PAD symptoms.	4
17. Burbelko M, Augsten M, Kalinowski MO, Heverhagen JT. Comparison of contrast-enhanced multi-station MR angiography and digital subtraction angiography of the lower extremity arterial disease. <i>J Magn Reson Imaging</i> . 2013;37(6):1427-1435.	Observational-Dx	152 patients	To compare diagnostic accuracy of multi-station, high-spatial resolution CE-MRA of the lower extremities with DSA as the reference standard in patients with symptomatic PAOD.	Sensitivity and specificity ranged from 73% to 93% and 64% to 89% and were highest in the thigh area. Both readers showed comparable results. Evaluation of good and better quality MRAs resulted in a considerable improvement in diagnostic accuracy.	3

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18. Hahn WY, Hecht EM, Friedman B, Babb JS, Jacobowitz GR, Lee VS. Distal lower extremity imaging: prospective comparison of 2-dimensional time of flight, 3-dimensional time-resolved contrast-enhanced magnetic resonance angiography, and 3-dimensional bolus chase contrast-enhanced magnetic resonance angiography. <i>J Comput Assist Tomogr.</i> 2007;31(1):29-36.	Observational-Dx	40 patients; 2 independent readers	Prospective, blinded study to compare the 2-D time of flight, the 3-D time-resolved CE-MRA, and the 3-D 3-station bolus chase CE-MRA in assessing distal station atherosclerosis stenosis. Reference standard was a combined interpretation of all 3 sequences by both readers in consensus.	For the 240 calf segments scored for length, concordance with reference assessment was poorer for the time of flight than for either the bolus chase or time-resolved angiography ($P=0.0021$ and $P=0.0082$, respectively), and the latter two were statistically indistinguishable. For stenosis grading of the 461 calf and pedal segments, the time-resolved and bolus chase methods were superior to the time of flight ($P\leq 0.0001$ and $P=0.0041$, respectively), and the contrast-enhanced methods were statistically indistinguishable. Both contrast-enhanced time-resolved and bolus chase MRA are superior to the time of flight in diagnosing distal station PVD.	2
19. Nael K, Krishnam M, Nael A, Ton A, Ruehm SG, Finn JP. Peripheral contrast-enhanced MR angiography at 3.0T, improved spatial resolution and low dose contrast: initial clinical experience. <i>Eur Radiol.</i> 2008;18(12):2893-2900.	Observational-Dx	20 patients; 2 independent reviewers	To examine a high spatial resolution peripheral CE-MRA protocol, applying a dedicated multi-channel array coil and accelerated parallel acquisition at 3.0T in evaluation of patients with PVD.	67 arterial segments with significant stenoses ($>0\%$) were detected by observers with excellent interobserver agreement ($\kappa = 0.82$; 95% CI: 0.76, 0.88). Significant correlation between CE-MRA and conventional angiography ($R_s = 0.91$ and 0.94 for reader 1 and 2, respectively) for the assessment of the degree of stenosis.	1
20. Ruhl KM, Katoh M, Langer S, et al. Time-resolved 3D MR angiography of the foot at 3 T in patients with peripheral arterial disease. <i>AJR Am J Roentgenol.</i> 2008;190(6):W360-364.	Observational-Dx	21 patients	To prove the feasibility and clinical relevance of fast contrast-enhanced time-resolved 3D MRA with submillimeter spatial resolution at a high magnetic field strength.	In all patients, images of diagnostic quality were obtained. Despite the known limitations regarding signal intensity measurements in images acquired with the use of parallel imaging technique, signal-to-noise ratio and contrast-to-noise ratio proved to be excellent, with mean +/- standard deviation values of 294 ± 158 and 248 ± 144 , respectively. Although most of the patients had diabetic foot syndrome with arteriovenous shunting, the arteries and the potential vessel for bypassing could be clearly separated from the veins in each case due to the temporal information given by our study. The ability to reliably discriminate arteries from veins is of high clinical relevance in planning pedal bypass surgery.	4

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21. Lim RP, Jacob JS, Hecht EM, et al. Time-resolved lower extremity MRA with temporal interpolation and stochastic spiral trajectories: preliminary clinical experience. <i>J Magn Reson Imaging</i> . 2010;31(3):663-672.	Observational-Dx	26 patients; 646 infragenuous segments in 51 extremities	To retrospectively assess added value of a new time-resolved technique with temporal interpolation and stochastic spiral trajectory through k-space and parallel imaging to conventional bolus chase MRA for infragenuous peripheral artery evaluation.	Image quality and diagnostic confidence were superior for bolus chase+ time-resolved-MRA compared with bolus chase-MRA alone ($P<0.001$). Adding time-resolved-MRA improved sensitivity (85.7% vs 80.7%; $P<0.05$) and diagnostic accuracy (88.1% vs 85.4%; $P<0.05$) for hemodynamically significant stenosis. Venous contamination (0% vs 13.1% segments) and motion (0.9% vs 8.0%) were decreased for bolus chase+ time-resolved-MRA vs bolus chase-MRA alone, $P<0.01$. For bolus chase+ time-resolved-MRA, time-resolved-MRA was rated more useful than bolus chase-MRA in 30/51 legs (58.8%). Time-resolved-MRA identified retrograde flow in 5 segments. Where available, there was high concordance between conventional angiography and bolus chase+ time-resolved-MRA (91.6%) for stenosis. Adding time-resolved-MRA with temporal interpolation and stochastic spiral trajectories to bolus chase MRA improves image quality, diagnostic confidence and accuracy. It provides hemodynamic information and minimizes venous contamination and patient motion.	3
22. Menke J. Improving the image quality of contrast-enhanced MR angiography by automated image registration: a prospective study in peripheral arterial disease of the lower extremities. <i>Eur J Radiol</i> . 2010;75(3):e1-8.	Observational-Dx	404 leg MRAs	To prospectively validate the prior findings in patients with peripheral arterial disease of the lower extremities. The prior retrospective study has shown that image registration can improve the MRA image quality especially in the lower legs.	All studied image quality parameters showed similar trends. Generally, registration improved the leg MRA quality significantly ($P<0.05$). The 12% of lower legs with a body shift of 1 mm or more showed the highest gain in image quality when using linear registration instead of no registration, with an average vessel detection probability gain of 20%–49%. Warp registration improved the image quality slightly further. Automated image registration can improve the MRA image quality especially in the lower legs, which is comparable to the effect of pixel shift in DSA.	2

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23. Hadizadeh DR, Gieseke J, Lohmaier SH, et al. Peripheral MR angiography with blood pool contrast agent: prospective intraindividual comparative study of high-spatial-resolution steady-state MR angiography versus standard-resolution first-pass MR angiography and DSA. <i>Radiology</i> . 2008;249(2):701-711.	Observational-Dx	27 patients 334 arterial segments	To prospectively compare the accuracy of high-spatial-resolution steady-state MRA with standard-resolution first-pass MRA in the lower extremities, with DSA as the reference standard.	A total of 334 arterial segments were available for intraindividual comparison of first-pass MRA, steady-state MRA, and DSA in 27 patients. In 20 (74%) of 27 patients, the stenosis grade of at least one of the evaluated vessels differed at steady-state MRA from that at first-pass MRA. In total, stenosis grade was judged as higher at first-pass MRA than at DSA (overestimation) in 28 of 334 segments and as lower (underestimation) in 15 of 334 segments. The stenosis grade as judged at steady-state MRA matched with that at DSA in 334 of 334 vessel segments.	2
24. Ersoy H, Rybicki FJ. Biochemical safety profiles of gadolinium-based extracellular contrast agents and nephrogenic systemic fibrosis. <i>J Magn Reson Imaging</i> . 2007;26(5):1190-1197.	Review/Other-Dx	N/A	To consolidate and update the available information on known side effects, adverse reactions, and toxicity of the Gd-chelates with particular emphasis on NSF.	Most clinical cases of NSF are not well described. Gadodiamide is the predominant but not the exclusive etiology of NSF.	4
25. Habibi R, Krishnam MS, Lohan DG, et al. High-spatial-resolution lower extremity MR angiography at 3.0 T: contrast agent dose comparison study. <i>Radiology</i> . 2008;248(2):680-692.	Observational-Dx	45 consecutive patients	To determine whether contrast material dose reduction at 3.0 T allows preserved image quality for high-spatial-resolution MRA of the lower extremities.	More than 99% of arterial segments were found to be of diagnostic image quality by both readers in all dose groups. Generalized estimating equation analysis showed a significant difference among the three groups with regard to vessel definition ($P=.019$). No significant difference was found between the high- and intermediate-dose groups; however, the low-dose group had significantly better vessel definition compared with the high-dose ($P=.034$) and intermediate-dose ($P=.015$) groups. There was no significant difference among the groups in visualization of collateral vessels. Venous contamination was seen less frequently in the low-dose group, but the difference did not achieve significance. The study showed that, compared with widely used dose strategies at 1.5 T, the contrast agent dose for 3.0-T lower extremity MRA can be reduced multifold without compromising image quality.	2

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26. Hoey ET, Ganeshan A, Puni R, Henderson J, Crowe PM. Fresh blood imaging of the peripheral vasculature: an emerging unenhanced MR technique. <i>AJR Am J Roentgenol.</i> 2010;195(6):1444-1448.	Review/Other-Dx	N/A	To describe the technical aspects of performing lower extremity MRA and illustrate some sample cases.	Fresh blood imaging is an emerging unenhanced MRA technique that has recently become commercially available. Early clinical trials appear promising and it is anticipated that fresh blood imaging will become invaluable, particularly in patients with impaired renal function. Technical refinements are still required to perfect this novel MR application, particularly for the assessment of distal calf and pedal vessels and for the evaluation of patients with arrhythmias and those with impaired cardiac function.	4
27. Lanzman RS, Blondin D, Schmitt P, et al. Non-enhanced 3D MR angiography of the lower extremity using ECG-gated TSE imaging with non-selective refocusing pulses--initial experience. <i>Rofo.</i> 2010;182(10):861-867.	Observational-Dx	8 healthy volunteers; 3 patients with PAD	To evaluate nonenhanced 3D MRA using turbo spin echo imaging with nonselective refocusing pulses for the visualization of the arteries of the lower extremity.	The mean subjective image quality was significantly lower for the iliac arteries compared to the femoral arteries and arteries of the lower leg ($P<0.0001$). The subjective image quality for acquisition scheme S 1 was significantly lower than the image quality for S 3 and S 4 for the iliac arteries ($P<0.01$), while the subjective image quality for acquisition scheme S 2 was significantly lower than S 3 and S 4 for the femoral arteries and the arteries of the lower leg ($P<0.01$). The relative signal to noise-ratio was significantly higher for acquisition schemes S 3 and S 4 as compared to S 1 and S 2 ($P<0.0001$) for all regions. Non-selective refocusing pulses MRA disclosed 7 significant stenoses in 3 PAD patients. ECG-gated nonselective refocusing pulses MRA is a promising imaging technique for nonenhanced assessment of the arteries of the lower extremity.	2
28. Lim RP, Hecht EM, Xu J, et al. 3D nongadolinium-enhanced ECG-gated MRA of the distal lower extremities: preliminary clinical experience. <i>J Magn Reson Imaging.</i> 2008;28(1):181-189.	Observational-Dx	36 patients	To report the initial experience implementing a noncontrast-enhanced ECG gated fast spin echo MRA technique for assessment of the calf arteries.	Accuracy 79.4%, sensitivity 85.4% and specificity 75.8. When technically successful, noncontrast enhanced-MRA using ECG-gated fast spin echo can provide accurate imaging of the calf and pedal arteries. However, further development and optimization are needed to improve the robustness of the technique.	3

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29. Klasen J, Blondin D, Schmitt P, et al. Nonenhanced ECG-gated quiescent-interval single-shot MRA (QISS-MRA) of the lower extremities: comparison with contrast-enhanced MRA. <i>Clin Radiol.</i> 2012;67(5):441-446.	Observational-Dx	27 patients	To evaluate ECG-gated quiescent-interval single-shot-MRA for nonenhanced assessment of PAOD using CE-MRA as the reference standard.	25/27 patients were considered for analysis. Subjective image quality of quiescent-interval single-shot-MRA was significantly lower for the distal aorta, pelvic arteries, and femoral arteries as compared to CE-MRA ($P<0.01$), while no significant difference was found for other vascular segments. The degree of stenosis was overestimated with quiescent-interval single-shot-MRA in 23/365 (6.3%) segments and underestimated in 2/365 (0.5%) segments. As compared to CE-MRA, quiescent-interval single-shot-MRA had a high sensitivity (98.6%), specificity (96%) as well as PPV and NPV (88.7% and 99.6%, respectively) for the detection of significant stenosis ($\geq 50\%$).	3
30. Mohrs OK, Petersen SE, Heidt MC, et al. High-resolution 3D non-contrast-enhanced, ECG-gated, multi-step MR angiography of the lower extremities: comparison with contrast-enhanced MR angiography. <i>Eur Radiol.</i> 2011;21(2):434-442.	Observational-Dx	50	To determine the diagnostic value of noncontrast-enhanced, 3D-high-resolution, ECG-gated, multi-step non-CE-MRA of the lower extremities using a modified turbo-spin-echo technique in comparison to 1.0-molar CE-MRA in patients with suspected PVD.	Examination time was shorter for CE-MRA (12 +/- 4 min) compared with non-CE-MRA (28 +/- 6 min, $P<0.001$). The image quality of the aorta-iliac, femoral and combined popliteal and lower leg arteries was inferior for non-CE-MRA (2.8 +/- 0.8/3.3 +/- 0.8/3.3 +/- 0.9) vs CE-MRA (4.7 +/- 0.8/4.8 +/- 0.6/4.8 +/- 0.7) on a 5-point scale with 5 for maximum quality ($P<0.01$). CE-MRA offered more assessable data sets than non-CE-MRA (98% vs 90%). For detecting stenosis $>50\%$ or occlusions of pelvic and femoral arteries using non-CE-MRA the sensitivity, specificity, PPV and NPV were 94%, 86%, 67% and 98% and for popliteal and lower leg arteries 93%, 87%, 69% and 98%, respectively.	2

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31. Mihai G, Chung YC, Kariisa M, Raman SV, Simonetti OP, Rajagopalan S. Initial feasibility of a multi-station high resolution three-dimensional dark blood angiography protocol for the assessment of peripheral arterial disease. <i>J Magn Reson Imaging</i> . 2009;30(4):785-793.	Observational-Dx	6 volunteers and 14 PAD patients	To evaluate the feasibility of a multi-station 3D T1-weighted turbo spin echo dark-blood Sampling Perfection with Application optimized Contrasts using different flip angle Evolution sequence (T1w-SPACE), to assess aorta, iliac, and superficial femoral arteries (inflow vessels) by comparing it with a multi-station CE-MRA with identical resolution.	Quantitative comparison of lumen areas with T1w-SPACE and CE-MRA revealed strong correlation between the two techniques and strong inter-observer agreement for each of the two imaging methods ($r > 0.9$; $P < 0.001$). Localized vessel wall area measurements obtained in PAD patients were significantly greater compared with those obtained in normal volunteers (mean difference 43.75 +/- 12.46 mm ² ; $P < 0.001$). Stenosis severity obtained from T1w-SPACE localized measurements showed significant arterial area stenosis in PAD patients. T1w-SPACE imaging of inflow vessels is feasible, and in addition to CE-MRA has the ability to assess atherosclerotic plaque and vascular remodeling.	3
32. Bonel HM, Saar B, Hoppe H, et al. MR angiography of infrapopliteal arteries in patients with peripheral arterial occlusive disease by using Gadofosveset at 3.0 T: diagnostic accuracy compared with selective DSA. <i>Radiology</i> . 2009;253(3):879-890.	Observational-Dx	22 calves in 20 patients 352 arterial segments	To prospectively compare the diagnostic accuracy of steady-state, high-spatial-resolution MRA of the lower leg, performed with a blood pool contrast agent, with selective DSA as the reference standard in patients with symptomatic PAD.	MRA was successful and occurred without serious adverse events in all patients. 7 significantly stenosed and 40 occluded segments were rated equally in both modalities. In 3 cases, the tibial arteries were shown to be occluded or significantly stenosed at DSA but appeared normal or significantly stenosed at MRA. The respective average segment sensitivity, specificity, and accuracy were 98.3% (59/60), 98% (113.7/116), and 98.1% (172.7/176) for DSA and 100% (60/60), 100% (116/116), and 100% (176/176) for MRA. Steady-state MRA was especially useful for the distal peroneal artery and the proximal anterior tibial artery. MRA performed with blood pool agents has accuracy comparable with that of selective DSA in the lower leg but with less risk involved.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
33. Grijalba FU, Esandi MC. Comparison of gadofosveset-enhanced three-dimensional magnetic resonance angiography with digital subtraction angiography for lower-extremity peripheral arterial occlusive disease. <i>Acta Radiol.</i> 2010;51(3):284-289.	Observational-Dx	30 patients	To assess whether gadofosveset-enhanced 3D MRA could replace DSA for the evaluation of lower-extremity PAOD.	Although interobserver agreement for both was excellent, it was higher for DSA (kappa=0.92) than for MRA (kappa=0.86) for reporting the principal and secondary lesions in all segments. For different anatomic locations, the interobserver agreement of MRA and DSA was as follows: aortoiliac (kappa=0.93, k=0.95), femoropopliteal (kappa=0.86, k=0.90), and infrapopliteal (kappa=0.78, k=0.85). The lowest agreement was found for MRA on infrapopliteal segments (kappa=0.78). In four (13.3%) cases, MRA showed lesions that were not found by DSA. 5 (16.6%) aneurysm cases, not observed by DSA, were shown by MRA. Gadofosveset-enhanced 3D MRA can be proposed for first-line imaging in the management of lower-limb PAOD patients and permits the selective use of DSA as a second-line examination when MRA fails or in an endovascular approach.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>34. Nielsen YW, Eiberg JP, Logager VB, Just S, Schroeder TV, Thomsen HS. Whole-body magnetic resonance angiography with additional steady-state acquisition of the infragenicular arteries in patients with peripheral arterial disease. <i>Cardiovasc Intervent Radiol.</i> 2010;33(3):484-491.</p>	<p>Observational-Dx</p>	<p>20 consecutive patients</p>	<p>To determine if addition of infragenicular steady-state MRA to first-pass imaging improves diagnostic performance compared with first-pass imaging alone in patients with PAD undergoing whole-body MRA.</p>	<p>Using DSA as the gold standard, sensitivities and specificities for detecting significant arterial stenoses (≥50% luminal narrowing) with first-pass whole-body MRA, steady-state MRA, and combined first-pass and steady-state MRA were calculated. Kappa statistics were used to determine intermodality agreement between MRA and DSA. Overall sensitivity and specificity for detecting significant arterial stenoses with first-pass whole-body MRA was 0.70 (95% CI 0.61 to 0.78) and 0.97 (0.94 to 0.99), respectively. In first-pass whole-body MRA, the lowest sensitivity was in the infragenicular region, with a value of 0.42 (0.23 to 0.63). Combined analysis of first-pass whole-body MRA and steady-state MRA increased sensitivity to 0.81 (0.60 to 0.93) in the infragenicular region, with specificity of 0.94 (0.88 to 0.97). Sensitivity and specificity for detecting significant arterial stenoses with isolated infragenicular steady-state MRA was 0.47 (0.27 to 0.69) and 0.86 (0.78 to 0.91), respectively. Intermodality agreement between MRA and DSA in the infragenicular region was moderate for first-pass whole-body MRA (kappa = 0.49), fair for steady-state MRA (kappa = 0.31), and good for combined first-pass/ steady-state MRA (kappa = 0.71). Addition of infragenicular steady-state MRA to first-pass whole-body MRA improves diagnostic performance.</p>	<p>2</p>

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
35. Rapp JH, Wolff SD, Quinn SF, et al. Aortoiliac occlusive disease in patients with known or suspected peripheral vascular disease: safety and efficacy of gadofosveset-enhanced MR angiography--multicenter comparative phase III study. <i>Radiology</i> . 2005;236(1):71-78.	Observational-Dx	274 patients	To prospectively determine the safety and efficacy of the gadolinium-based blood pool MRI contrast agent gadofosveset in patients known to have or suspected of having PVD.	Gadofosveset-enhanced MRA showed significant improvement ($P<.001$) compared with unenhanced MRA for each of the readers for diagnosis of clinically significant ($\geq 50\%$) stenosis. Specificity and accuracy were significantly greater for 3 readers, and sensitivity increased significantly for 2 readers. For all readers, the area under the ROC curve for both quantitative and qualitative measures of significant disease increased ($P<.001$) for gadofosveset-enhanced MRA vs 2D time-of-flight MRA. All readers also expressed more confidence in diagnosis ($P<.001$) and found fewer images to be uninterpretable (0.5% vs 11.0%). The most common adverse events were as follows: feeling hot, 12 (4.4%) patients; nausea, 10 (3.6%) patients; headache, nine (3.3%) patients; and burning sensation, 8 (2.9%) patients. Only 4 serious adverse events were reported, in 3 patients, and all events were rated as unlikely related to the drug. On the basis of substantial improvements over noncontrast MRA in efficacy and a minimal and transient side-effect profile, gadofosveset was found to be safe and effective for MRA in patients known or suspected to have PVD.	1
36. Scherthaner R, Stadler A, Lomoschitz F, et al. Multidetector CT angiography in the assessment of peripheral arterial occlusive disease: accuracy in detecting the severity, number, and length of stenoses. <i>Eur Radiol</i> . 2008;18(4):665-671.	Observational-Dx	50 consecutive patients	To evaluate the accuracy of MDCTA in the morphologic assessment of PAOD compared to DSA.	High kappa values for exact stenoses gradation (0.74–1), lesion length (0.74–1), and number of lesions (0.71–1) were reached by MDCTA, indicating high agreement with DSA. Noninvasive MDCTA is an accurate tool for the assessment of all treatment-relevant morphologic information of PAOD (gradation, length, and number of stenoses) compared to DSA.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
37. Cernic S, Pozzi Mucelli F, Pellegrin A, Pizzolato R, Cova MA. Comparison between 64-row CT angiography and digital subtraction angiography in the study of lower extremities: personal experience. <i>Radiol Med.</i> 2009;114(7):1115-1129.	Observational-Dx	53 patients 1,440 segments	To evaluate the potential of 64-row multislice CT vs DSA in detecting significant lesions of lower-extremity inflow and runoff arteries.	Compared with DSA, CTA yielded 97.2% sensitivity, 97% specificity, 92.5% PPV, 98.9% NPV, 97.1% diagnostic accuracy and 95.4% concordance on the degree of stenosis. 64-row multislice CT proved to be helpful in detecting hemodynamically significant lesions in PAOD and improved the results obtained with 4- and 16-slice MDCT. In addition, owing to the high spatial resolution and rigorous technique, no variations in the data obtained below the knee were detected, overcoming a limitation of earlier generations of CT scanners.	3
38. Shareghi S, Gopal A, Gul K, et al. Diagnostic accuracy of 64 multidetector computed tomographic angiography in peripheral vascular disease. <i>Catheter Cardiovasc Interv.</i> 2010;75(1):23-31.	Observational-Dx	28 consecutive patients	To evaluate the diagnostic accuracy of 64 MDCT for the detection of hemodynamically significant disease within the lower extremity peripheral vasculature as compared to DSA.	For all segments evaluated, the overall diagnostic accuracy for detecting grade III and IV lesions was 98% with a sensitivity of 99% and a specificity of 98%. For the aorto-iliac segments, the diagnostic accuracy was 98% with a sensitivity of 100% and a specificity of 99%. For the femoro-popliteal segments, the overall accuracy was 98% with a sensitivity of 100% and a specificity of 99%. For the infra-popliteal segments, the overall accuracy was 98% with a sensitivity of 97% and a specificity of 99%. One segment could not be visualized by MDCT compared to 49 segments that could not be visualized by DSA. This study demonstrates excellent diagnostic accuracy of 64 MDCT in the detection of hemodynamically significant disease of the lower extremities. More segments are visualized using 64 MDCT than DSA, allowing more complete visualization of the vascular tree. CTA should be considered in the diagnostic evaluation of symptomatic patients with PVD.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
39. Fotiadis N, Kyriakides C, Bent C, Vorvolakos T, Matson M. 64-section CT angiography in patients with critical limb ischaemia and severe claudication: comparison with digital subtractive angiography. <i>Clin Radiol</i> . 2011;66(10):945-952.	Observational-Dx	41 consecutive patients	To assess the utility of 64 section MDCT lower-limb angiography in the evaluation of patients with CLI or severe intermittent claudication in grading disease before endovascular treatment.	For arterial segments with hemodynamically significant disease (stenosis $\geq 50\%$), the overall sensitivity, specificity, and accuracy of MDCT in patients with severe claudication and CLI was 99% (95% CI: 98%–100%), 98% (95% CI: 97%–100%) and 98% (95% CI: 97%–99%), respectively. The PPV was 97% and the NPV was 99%. MDCTA is a useful tool in the assessment of patients with severe claudication and CLI and can be reliably used to grade disease severity and plan treatment.	2
40. Edwards AJ, Wells IP, Roobottom CA. Multidetector row CT angiography of the lower limb arteries: a prospective comparison of volume-rendered techniques and intra-arterial digital subtraction angiography. <i>Clin Radiol</i> . 2005;60(1):85-95.	Observational-Dx	44 patients	Prospective comparative study to assess whether MDCTA of the lower limb arteries, compared with conventional DSA could replace invasive arteriography in patients with symptomatic PAD.	The authors found agreement for the degree of stenosis in 88.8% and 85.4% of 1024 segments analyzed for 2 observers. The sensitivity for treatable lesions ($>50\%$ stenosis) was 79.1% and 72% with a specificity of 93.3% and 92.6%. DSA failed to visualize 7.3% of segments that were visible with MDCTA. These segments were exclusively downstream to long segment occlusions.	3
41. Portugaller HR, Schoellnast H, Hausegger KA, Tiesenhausen K, Amann W, Berghold A. Multislice spiral CT angiography in peripheral arterial occlusive disease: a valuable tool in detecting significant arterial lumen narrowing? <i>Eur Radiol</i> . 2004;14(9):1681-1687.	Observational-Dx	50 patients	To evaluate the potential of multislice CTA in detecting hemodynamically significant ($\geq 70\%$) lesions of lower extremity inflow and runoff arteries.	In 46 patients, 260 lesions were found (95 stenoses, 165 occlusions). For detecting $\geq 70\%$ lesions in all vessel regions, sensitivity and specificity were 84% and 78% (STVR), 89% and 74% (MIP), and 92% and 83% (MIP+axial CT), respectively, with a significantly lower sensitivity of STVR ($P < 0.05$) and a significantly lower specificity of MIP studies ($P < 0.01$). Sensitivity and specificity were, respectively, 81% and 93% (STVR), 88% and 75% (MIP), and 92% and 95% (MIP+axial CT) at aortoiliac arteries, 92% and 73% (STVR), 95% and 70% (MIP) and 98% and 70% (MIP+axial CT) at femoropopliteal arteries, as well as 82% and 64% (STVR), 86% and 74% (MIP), and 90% and 74% (MIP+axial CT) at infrapopliteal arteries. Specificity of MIP-CTA was significantly lower in the aortoiliac region ($P < 0.01$), whereas STVR revealed significantly lower specificity at infrapopliteal arteries ($P < 0.05$).	2

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Ouwendijk R, de Vries M, Stijnen T, et al. Multicenter randomized controlled trial of the costs and effects of noninvasive diagnostic imaging in patients with peripheral arterial disease: the DIPAD trial. <i>AJR Am J Roentgenol.</i> 2008;190(5):1349-1357.	Experimental-Dx	514 patients	Multicenter, randomized trial to compare the costs and effects of three noninvasive imaging tests as the initial imaging test in the diagnostic workup of patients with PAD.	With adjustment for potentially predictive baseline variables, the learning curve, and hospital setting, a significantly higher confidence and less additional imaging were found for MRA and CTA compared with duplex sonography. No statistically significant differences were found in improvement in functional patient outcomes and quality of life among the groups. The total costs were significantly higher for MRA and duplex sonography than for CTA.	1
43. Schertler T, Wildermuth S, Alkadhi H, Kruppa M, Marincek B, Boehm T. Sixteen-detector row CT angiography for lower-leg arterial occlusive disease: analysis of section width. <i>Radiology.</i> 2005;237(2):649-656.	Observational-Dx	17 patients	To compare the diagnostic accuracy of CTA data with DSA in patients with occlusive PAD.	Arterial visibility was superior with CT as compared with DSA ($P < .008$). Sensitivity for stenosis detection did not differ between the CT reconstructions, whereas specificity was significantly improved when CT data set 3 was used ($P < .017$). Stenosis length did not differ significantly between CT angiography and DSA. Accuracy of stenosis detection was 88.2%, 90.8%, and 96.1% with CT data sets 1, 2, and 3, respectively. CT angiography has excellent diagnostic accuracy in the assessment of lower-leg PAD provided that the thinnest possible section width is used.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Meyer BC, Werncke T, Hopfenmuller W, Raatschen HJ, Wolf KJ, Albrecht T. Dual energy CT of peripheral arteries: effect of automatic bone and plaque removal on image quality and grading of stenoses. <i>Eur J Radiol.</i> 2008;68(3):414-422.	Observational-Dx	50 consecutive patients	To evaluate the effect of automatic bone and plaque removal on image quality and grading of steno-occlusive lesions in patients undergoing dual energy CTA of lower extremity.	Residual bone fragments (ribs: 46%, patella: 25%, spine: 4%, pelvis: 2%, tibia 2% of patients) were only observed with automatically bone-subtracted images. The time needed to manually remove these residual bones was 2.1+/-1.1 min and was significantly lower than the duration of manual bone removal (6.8+/-2.0 min, $P<0.0001$, paired t-test). A total of 1159 arteries were analyzed. Compromising vessel erosions were observed less frequently in the automatically bone-subtracted images-B dataset (10.6%) than in the manual bone subtraction dataset (15.2%, $P<0.001$, Wilcoxon's signed rank test). A total of 817 steno-occlusive lesions were assessed. While the agreement of grading of steno-occlusive lesions was good at the levels of the aorta and the pelvic arteries (kappa=0.70 in both, Cohen's kappa statistics), it was moderate at the level of the thigh arteries (kappa=0.57) and poor at the level of the calf (kappa=0.16)	2
45. Brockmann C, Jochum S, Sadick M, et al. Dual-energy CT angiography in peripheral arterial occlusive disease. <i>Cardiovasc Intervent Radiol.</i> 2009;32(4):630-637.	Observational-Dx	20 patients	To examine the accuracy of dual-energy CTA for the assessment of symptomatic PAOD of the lower extremity by using the dual-energy bone removal technique compared with a commercially available conventional bone removal tool. Patients had selective DSA and dual-energy CTA of the pelvis and lower extremities.	359 vascular segments were analyzed. Compared with DSA, sensitivity, specificity, and accuracy, respectively, of CTA was 97.2%, 94.1%, and 94.7% by the dual-energy bone removal technique. Conventional bone removal tool had sensitivity of 77.1%, a specificity of 70.7%, and an accuracy of 72.0%. Dual energy-CTA is feasible and accurate. Results obtained by dual energy-CTA are superior to the conventional bone removal technique and less dependent on vessel wall calcifications.	2

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
46. Huang SY, Nelson RC, Miller MJ, et al. Assessment of vascular contrast and depiction of stenoses in abdominopelvic and lower extremity vasculature: comparison of dual-energy MDCT with digital subtraction angiography. <i>Acad Radiol.</i> 2012;19(9):1149-1157.	Observational-Dx	25 patients	To assess whether dual-energy CT MDCTA improves vascular contrast beyond MDCTA and DSA while preserving the ability to precisely characterize stenoses, using DSA as reference standard.	Patent vasculature comprised 230 vessel segments. From infrarenal aorta to distal femoral arteries, dual-energy CT showed higher contrast-to-noise ratio compared to DSA and MDCT ($P<.05$); distal to the popliteal arteries, DSA achieved higher contrast-to-noise ratio ($P<.05$). Analyses of contrast homogeneity showed minimal coefficient of variation above the knee for MDCT ($\leq 9\%$) and for DSA below the knee ($\leq 7\%$). Stenotic vasculature comprised 33 segments. Significant correlations of stenosis severity were found comparing dual-energy CT and MDCT with DSA as reference standard showing a 0.04-fold mean underestimation of stenoses on MDCT and no detectable mean variation on dual-energy CT compared with DSA.	3
47. Thomas C, Korn A, Ketelsen D, et al. Automatic lumen segmentation in calcified plaques: dual-energy CT versus standard reconstructions in comparison with digital subtraction angiography. <i>AJR Am J Roentgenol.</i> 2010;194(6):1590-1595.	Observational-Dx	25 patients	To compare the accuracy of visual grading of stenoses after plaque removal with visual grading in standard reconstructions. DSA was used as a reference standard.	The average postprocessing time was 45 seconds. After plaque removal, all 25 relevant and 4 nonrelevant stenoses were correctly detected. 6 relevant stenoses were overestimated as complete occlusions. With the standard reconstructions, 2 nonrelevant stenoses were overestimated as relevant. Correlation coefficients ($r(2)$) for the grading of stenoses after plaque removal and with standard reconstructions vs DSA were 0.7694 and 0.4329, respectively. Vessel contrast enhancement correlated weakly ($r(2) = 0.2072$) with the accuracy of plaque removal. Dual-energy CT with plaque removal automatically delivers CT luminograms with a high sensitivity for the detection of relevant stenoses and a higher correlation to DSA than standard reconstructions but frequently leads to an overestimation of high-grade stenoses as occlusions. Thus, dual-energy CT plaque and bone removal should be used complementary to standard reconstructions, and not exclusively.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
48. Kau T, Eicher W, Reiterer C, et al. Dual-energy CT angiography in peripheral arterial occlusive disease-accuracy of maximum intensity projections in clinical routine and subgroup analysis. <i>Eur Radiol.</i> 2011;21(8):1677-1686.	Observational-Dx	58 patients	To evaluate the accuracy of dual-energy CTA MIPs in symptomatic PAOD.	DSA serving as the reference standard. In DSA, 52.3% of segments were significantly stenosed or occluded. Agreement of dual-energy CTA MIPs with DSA was good in the aorto-iliac and femoro-popliteal regions ($\kappa=0.72$; $\kappa=0.66$), moderate in the crural region ($\kappa=0.55$), slight in pedal arteries ($\kappa=0.10$) and very good in bypass segments ($\kappa=0.81$). Accuracy was 88%, 78%, 74%, 55% and 82% for the respective territories and moderate (75%) overall, with good sensitivity (84%) and moderate specificity (67%). Sensitivity and specificity was 82% and 76% in claudicants and 84% and 61% in patients with CLI. While correlating well with DSA above the knee, accuracy of dual-energy CTA MIPs appeared to be moderate in the calf and largely insufficient in calcified pedal arteries, especially in patients with CLI.	2
49. Willmann JK, Mayer D, Banyai M, et al. Evaluation of peripheral arterial bypass grafts with multi-detector row CT angiography: comparison with duplex US and digital subtraction angiography. <i>Radiology.</i> 2003;229(2):465-474.	Observational-Dx	65 consecutive patients	To assess the technical feasibility of MDCTA in the assessment of peripheral arterial bypass grafts and to evaluate its accuracy and reliability in the detection of graft-related complications, including graft stenosis, aneurysmal changes, and arteriovenous fistulas.	CTA and duplex US were compared with conventional DSA, and there was no statistically significant difference ($P>.25$) in sensitivity or specificity between CTA and duplex US for both readers for detection of hemodynamically significant bypass stenosis or occlusion, aneurysmal changes, or arteriovenous fistulas. MDCTA may be an accurate and reliable technique after duplex US in the assessment of peripheral arterial bypass grafts and detection of graft-related complications, including stenosis, aneurysmal changes, and arteriovenous fistulas.	1

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
50. Utsunomiya D, Oda S, Funama Y, et al. Comparison of standard- and low-tube voltage MDCT angiography in patients with peripheral arterial disease. <i>Eur Radiol.</i> 2010;20(11):2758-2765.	Observational-Dx	80 consecutive patients: Group 1 120 kVp and 1.8 ml/kg contrast agent (300 mgI/ml); Group 2; 80 kVp and 1.2 ml/kg	To investigate the effect of low-tube-voltage CTA with a reduced volume of contrast agent on qualitative and quantitative parameters and the radiation dose in patients with PAD.	There were no significant intergroup differences in mean arterial attenuation (120 vs 80 kVp: 331.6±61.6 vs 354.9±61.9 HU) and in the mean difference between maximum and minimum attenuation (120 vs 80 kVp: 52.2±25.5 vs 61.5±27.5 HU). While the mean contrast-to-noise ratio was significantly higher at 120 than 80 kVp (38.4±18.8 vs 31.1±15.3), the mean figure of merit was not significantly different (120 vs 80 kVp: 1.3±1.5 vs 1.2±1.2), and there was no significant intergroup difference in visual scores. The mean dose-length product was significantly lower at 80 than 120 kVp (1,024.3±151.3 vs 1,464.7±208.7 mGy·cm). The 80-kVp protocol allows for reduction of the radiation dose by approximately 30% and the volume of contrast agent by more than 30% without deterioration of vascular enhancement and image quality.	2
51. Krnic A, Vucic N, Sucic Z. Duplex scanning compared with intra-arterial angiography in diagnosing peripheral arterial disease: three analytical approaches. <i>Vasa.</i> 2006;35(2):86-91.	Observational-Dx	30 patients 60 lower limbs	To assess the reliability of duplex scanning, as compared with DSA, in diagnosing PAD of the lower limbs.	Different duplex reliabilities in detecting significant arterial disease across lower limbs segments. Kappa values (0.35-0.64) shows duplex insufficient accuracy in grading the severity of stenosis. Weighted kappa values (0.45-0.72) confirmed duplex ability to approximate the grade of stenosis.	2
52. Leiner T, Kessels AG, Nelemans PJ, et al. Peripheral arterial disease: comparison of color duplex US and contrast-enhanced MR angiography for diagnosis. <i>Radiology.</i> 2005;235(2):699-708.	Observational-Dx	295 patients	To prospectively compare the diagnostic accuracies of color duplex US and contrast material-enhanced MRA and to assess interobserver agreement regarding CE-MRA findings in patients suspected of having PAD.	249 patients had at least 1 hemodynamically significant stenotic lesion at CE-MRA, duplex US, or both examinations. 152 patients underwent intra-arterial DSA. The quadratic weighted kappa for agreement regarding the presence of 50% or greater stenosis at CE-MRA was 0.89 (95% CI: 0.87, 0.91). Sensitivity of duplex US was 76% (95% CI: 69%, 82%); specificity, 93% (95% CI: 91%, 95%); and accuracy, 89%. Sensitivity and specificity of CE-MRA were 84% (95% CI: 78%, 89%) and 97% (95% CI: 95%, 98%), respectively; accuracy was 94%. Sensitivity ($P=.002$) and specificity ($P=.03$) of CE-MRA were significantly higher.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Menke J, Luthje L, Kastrup A, Larsen J. Thromboembolism in atrial fibrillation. <i>Am J Cardiol.</i> 2010;105(4):502-510.	Review/Other-Tx	10 evidence-based practice guideline documents and 61 further sources	To present thromboembolic disease as a single entity, ranging from stroke through mesenteric ischemia to acute limb ischemia.	In atrial fibrillation, the average annual stroke risk is increased by 2.3% (lethality 30%). The annual incidence of acute mesenteric ischemia is 0.14% (lethality 70%), and that of acute limb ischemia is 0.4% (lethality 16%). In total, approximately 80% of embolism-related deaths are from stroke and 20% from other systemic thromboembolism. The ischemic symptoms generally have an acute onset but may mimic other diseases, particularly in mesenteric ischemia. Early diagnosis and treatment can limit or even prevent tissue infarction. Guideline-recommended therapy with aspirin or warfarin reduces the thromboembolic risk. Suitable patients may optimize their warfarin therapy by self-monitoring of the international normalized ratio. New oral and parenteral anticoagulants with more stable pharmacokinetics are being developed.	4
54. Gale SS, Scissons RP, Salles-Cunha SX, et al. Lower extremity arterial evaluation: are segmental arterial blood pressures worthwhile? <i>J Vasc Surg.</i> 1998;27(5):831-838; discussion 838-839.	Experimental-Dx	81 patients	Comparative study to determine whether segmental arterial blood pressures are useful for lower extremity arterial evaluation.	Compared with arteriography, the accuracy of waveform analysis was 83% for severe disease at and proximal to the CFA, 79% for superficial femoral disease, 64% for popliteal disease, and 73% for tibial disease. Adding ankle pressures alone improved the accuracy significantly ($P<0.01$) to 88% (common femoral), 86% (superficial femoral), 70% (popliteal), and 85% (tibial). Accuracy was inferior when segmental blood pressure data replaced ankle pressures alone: 86% (common femoral), 85% (superficial femoral), 70% (popliteal), and 80% (tibial).	2
55. Sprynger M, Fassotte C, Verhaeghe R. The ankle-brachial pressure index and a standardized questionnaire are easy and useful tools to detect peripheral arterial disease in non-claudicating patients at high risk. <i>Int Angiol.</i> 2007;26(3):239-244.	Review/Other-Dx	4536 patients	Observational study to evaluate the prevalence of asymptomatic PAD using ankle-brachial pressure index and questionnaire.	Ankle-brachial pressure index detects PAD in a considerable number of asymptomatic patients.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.
- M = Meta-analysis

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CE-MRA = Contrast-enhanced magnetic resonance angiography

CI = Confidence interval

CLI = Critical limb ischemia

CT = Computed tomography

CTA = Computed tomography angiography

DSA = Digital-subtraction angiography

ECG = Electrocardiogram

Gd-BOPTA = Gadobenate dimeglumine

MDCT = Multidetector computed tomography

MDCTA= Multidetector computed tomography angiography

MIP = Maximum intensity projection

MRA = Magnetic resonance angiography

NPV = Negative predictive value

PAD = Peripheral arterial disease

PAOD = Peripheral arterial occlusive disease

PPV = Positive predictive value

PVD = Peripheral vascular disease

ROC = Receiver-operator characteristic

STVR = Semitransparent volume rendering technique

US = Ultrasound