

Lower Extremity Arterial Revascularization-Post-Therapy Imaging
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Natsuaki C, Inoguchi T, Maeda Y, et al. Association of borderline ankle-brachial index with mortality and the incidence of peripheral artery disease in diabetic patients. <i>Atherosclerosis</i> . 2014;234(2):360-365.	Observational-Tx	3981 Patients	To investigate the association of ABI with mortality and the incidence of PAD in Japanese diabetic patients.	Cumulative incidence of all-cause death was significantly higher in patients with abnormal and borderline ABI than in those with normal ABI (34.4% vs. 13.5%, $P < 0.0001$ and 26.1% vs. 13.5%, $P < 0.0001$, respectively). In multivariate analysis, the risks for all-cause death in patients with abnormal ABI (HR:2.16; 95%CI:1.46 - 3.14; $P = 0.0002$) and borderline ABI (HR:1.78; 95%CI:1.14 - 2.70; $P = 0.01$) were significantly higher than in those with normal ABI. The incidence of PAD was remarkably higher in patients with borderline ABI than in those with normal ABI (32.2% vs.9.6%, $P < 0.0001$). After adjustment, the risk for PAD was significantly higher in patients with borderline ABI than in those with normal ABI (HR:3.10; 95%CI:1.90 - 4.95; $P < 0.0001$).	2
2. Goodney PP, Beck AW, Nagle J, Welch HG, Zwolak RM. National trends in lower extremity bypass surgery, endovascular interventions, and major amputations. <i>J Vasc Surg</i> . 2009; 50(1):54-60.	Review/Other-Tx	samples of Medicare Part B claims	To examine national trends in lower extremity endovascular interventions, lower extremity bypass surgery, and major amputation in Medicare beneficiaries between 1996 and 2006 using the national Medicare claims database.	Rate of major lower extremity amputation declined significantly (263 to 188 per 100,000; RR 0.71, 95% CI 0.6-0.8) between 1996 and 2006. Endovascular interventions increased more than threefold (from 138 to 455 per 100,000; RR = 3.30; 95% CI: 2.9-3.7) while bypass surgery decreased by 42% (219 to 126 per 100,000; RR = 0.58; 95% CI: 0.5-0.7). Increase in endovascular interventions consisted both of a growth in peripheral angioplasty (from 135 to 337 procedures per 100,000; RR = 2.49; 95% CI: 2.2-2.8) and the advent of percutaneous atherectomy (from 3 to 118 per 100,000; RR = 43.12; 95% CI: 34.8-52.0). Endovascular interventions are now performed much more commonly than bypass surgery in the treatment of lower extremity PAD. Further study needed before any causal link can be established between lower extremity vascular procedures and improved rates of limb salvage in patients with PAD.	4

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3. Alahdab F, Wang AT, Elraiyah TA, et al. A systematic review for the screening for peripheral arterial disease in asymptomatic patients. J Vasc Surg. 2015;61(3 Suppl):42S-53S.	Review/Other-Dx	40 studies	To conduct systematic review of PAD screening studies evaluating ABI as a screening test for PAD in asymptomatic individuals.	We included 40 individual studies, 2 systematic reviews, and 1 individual-patient data meta-analysis. We found no studies comparing ABI screening with no screening in terms of patient-important outcomes (mortality, amputations). The yield of PAD screening averaged 17% (range, 1%-42%) and was 1% to 4% in lower risk populations. Patients with PAD had higher adjusted risk of all-cause mortality (HR, 2.99; 95% confidence interval, 2.16-4.12) and of cardiovascular mortality (HR, 2.35; 95% confidence interval, 1.91-2.89). Data on benefits, harms, and cost-effectiveness of screening were limited; however, ABI screening was associated with additional prognostic information and risk stratification for heart disease. The overall quality of evidence supporting screening was low.	4
4. Hirsch AT, Haskal ZJ, Hertzler NR, et al. ACC/AHA 2005 Practice Guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease): endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation; National Heart, Lung, and Blood Institute; Society for Vascular Nursing; TransAtlantic Inter-Society Consensus; and Vascular Disease Foundation. Circulation. 2006; 113(11):e463-654.	Review/Other-Dx	N/A	Practice Guidelines for the management of patients with peripheral arterial disease -lower extremity, renal, mesenteric, and abdominal aortic.	No results stated in abstract.	4

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5. Adam DJ, Beard JD, Cleveland T, et al. Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial. <i>Lancet</i> . 2005;366(9501):1925-1934.	Experimental-Tx	452 patients	To compare the outcome of bypass surgery and balloon angioplasty in patients by instigating the BASIL trial.	The trial ran for 5.5 years and 195 (86%) of 228 patients assigned to bypass surgery and 216 (96%) of 224 to balloon angioplasty underwent an attempt at their allocated intervention at a median of 6 (3-16) and 6 (2-20) days after randomization, respectively. At the end of follow-up, 248 (55%) patients were alive without amputation (of trial leg), 38 (8%) alive with amputation, 36 (8%) dead after amputation, and 130 (29%) dead without amputation. After 6 months, the two strategies did not differ significantly in amputation-free survival (48 vs 60 patients; unadjusted hazard ratio 1.07, 95% CI: 0.72-1.6; adjusted hazard ratio 0.73, 0.49-1.07).	1
6. Kim ES, Wattanakit K, Gornik HL. Using the ankle-brachial index to diagnose peripheral artery disease and assess cardiovascular risk. <i>Cleve Clin J Med</i> . 2012;79(9):651-661.	Review/Other-Dx	N/A	To describe the technique and value of measuring ankle-brachial index for patients with suspected peripheral artery disease.	No results in abstract.	4

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<p>7. Hyun S, Forbang NI, Allison MA, Denenberg JO, Criqui MH, Ix JH. Ankle-brachial index, toe-brachial index, and cardiovascular mortality in persons with and without diabetes mellitus. <i>J Vasc Surg.</i> 2014;60(2):390-395.</p>	<p>Observational-Tx</p>	<p>469 participants</p>	<p>To determine the nature of the relationship of the toe-brachial index (TBI) and ABI with cardiovascular disease (CVD) mortality and to determine whether the associations are modified in individuals with diabetes.</p>	<p>Among 469 participants (89% men), the mean age was 68.69 years, and 36% had diabetes. The mean ABI was 0.836 and the mean TBI was 0.606. During median 7.0 years of follow-up, there were 158 CVD deaths. The association of the ABI categories with CVD deaths differed in diabetic vs nondiabetic participants (P [.002 for interaction). In contrast, the association of the TBI categories with CVD deaths was similar, irrespective of diabetes status (P = .17 for interaction). Among diabetic patients, a U-shaped relationship was observed between ABI categories and CVD death: those with low (<0.90) and high (>1.30) ABIs were both at higher risk than those with normal ABIs (range, 0.90-1.30). In nondiabetic patients, association of ABI categories with CVD death was linear, such that those with an ABI >1.30 were at the lowest risk, whereas those with an ABI <0.90 were at higher risk. In contrast, the association of TBI categories with CVD death was linear irrespective of diabetes status. High TBI categories consistently predicted low risk, whereas risk was higher with progressively lower TBI categories.</p>	<p>2</p>

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8. Chuter VH, Casey SL. Effect of premeasurement rest time on systolic ankle pressure. J Am Heart Assoc. 2013;2(4):e000203.	Observational-Dx	140 Volunteers	To investigate the effect of premeasurement rest duration on the value of the ankle pressure and subsequent test-retest reliability.	One hundred and forty participants meeting guidelines for peripheral arterial disease screening volunteered for this study. A significant drop in ankle pressure of 5.02 mm Hg occurred between 5 and 10 minutes (P=0.004). No significant change occurred between 10 and 15 minutes (mean change 0.15 mm Hg, P=0.99). Presence of diabetes was associated with a smaller drop between 5 and 15 minutes (mean change 1.85 mm Hg) and predicted 13.4% of the variance in change in ankle pressure (b=3.61, P=0.0001). Test-retest reliability after 5 minutes was excellent (intraclass correlation coefficient: 0.84, 95% CI: 0.76 to 0.91) however increased for measurements taken at 10 and 15 minutes (intraclass correlation coefficient: 0.89 95% CI: 0.83 to 0.94 and 0.89 95% CI: 0.82 to 0.93).	3

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<p>9. Cao P, Eckstein HH, De Rango P, et al. Chapter II: Diagnostic methods. [Review]. Eur J Vasc Endovasc Surg. 42 Suppl 2:S13-32, 2011 Dec.</p>	<p>Review/Other-Dx</p>	<p>N/A</p>	<p>To review diagnostic methods for critical limb ischaemia.</p>	<p>Non-invasive vascular studies can provide crucial information on the presence, location, and severity of critical limb ischaemia (CLI), as well as the initial assessment or treatment planning. Ankle-brachial index with Doppler ultrasound, despite limitations in diabetic and end-stage renal failure patients, is the first-line evaluation of CLI. In this group of patients, toe-brachial index measurement may better establish the diagnosis. Other non-invasive measurements, such as segmental limb pressure, continuous-wave Doppler analysis and pulse volume recording, are of limited accuracy. Transcutaneous oxygen pressure (TcPO₂) measurement may be of value when rest pain and ulcerations of the foot are present. Duplex ultrasound is the most important non-invasive tool in CLI patients combining haemodynamic evaluation with imaging modality. Computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are the next imaging studies in the algorithm for CLI. Both CTA and MRA have been proven effective in aiding the decision-making of clinicians and accurate planning of intervention. The data acquired with CTA and MRA can be manipulated in a multiplanar and 3D fashion and can offer exquisite detail. CTA results are generally equivalent to MRA, and both compare favourably with contrast angiography. The individual use of different imaging modalities depends on local availability, experience, and costs. Contrast angiography represents the gold standard, provides detailed information about arterial anatomy, and is recommended when revascularisation is needed.</p>	<p>4</p>

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10. Hoyer C, Sandermann J, Petersen LJ. The toe-brachial index in the diagnosis of peripheral arterial disease. <i>J Vasc Surg.</i> 2013;58(1):231-238.	Meta-analysis	8 Studies	To provide an overview of the evidence supporting the clinical use of the TBI-based diagnosis of PAD.	Eight studies conducted in a normal population were identified, of which only one study used imaging techniques to rule out arterial stenosis. A reference value of 0.71 was estimated as the lowest limit of normal based on the weighted average in studies with preheating of the limbs. A further seven studies showed correlations of the TBI with angiographic findings. The TBI had a sensitivity of 90% to 100% and a specificity of 65% to 100% for the detection of vessel stenosis. Few studies investigated the value of the TBI as a prognostic marker for cardiovascular mortality and morbidity, and no firm conclusions could be made. Studies have, however, shown correlation between the TBI and comorbidities such as kidney disease, diabetes, and microvasculature disease.	M
11. McCann TE, Scoutt LM, Gunabushanam G. A practical approach to interpreting lower extremity noninvasive physiologic studies. <i>Radiol Clin North Am.</i> 2014;52(6):1343-1357.	Review/Other-Dx	N/A	To describe a practical approach to the technique, interpretation, pitfalls, and limitations of these physiologic studies and provide an algorithmic approach for using these studies in the initial workup of patients with suspected PAD.	No results in abstract.	4
12. Ro du H, Moon HJ, Kim JH, Lee KM, Kim SJ, Lee DY. Photoplethysmography and continuous-wave Doppler ultrasound as a complementary test to ankle-brachial index in detection of stenotic peripheral arterial disease. <i>Angiology.</i> 2013;64(4):314-320.	Observational-Dx	97 Patients	To evaluate the sensitivity and specificity of ankle-brachial index (ABI), photoplethysmography (PPG), and continuous-wave Doppler ultrasound (CWD) in the detection of anatomically stenotic peripheral arterial disease (PAD).	Among 194 legs, 163 (84%) legs had stenotic PAD on CTA. Overall sensitivity of ABI, PPG, and CWD was 69.3%, 81.6%, and 90.8% and specificity was 96.8%, 77.4%, and 64.5%, respectively. Ankle-brachial index showed a statistically significantly decreased sensitivity (14.8%) for below trifurcation level stenosis compared with CWD (92%) and PPG (67%). The sensitivity of ABI was also significantly decreased in single level and moderate stenosis (45.1% and 42.1%, respectively). In contrast, the sensitivity of CWD and PPG was not significantly decreased.	2

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13. Andrews KL, Dib MY, Shives TC, Hoskin TL, Liedl DA, Boon AJ. Noninvasive arterial studies including transcutaneous oxygen pressure measurements with the limbs elevated or dependent to predict healing after partial foot amputation. <i>Am J Phys Med Rehabil.</i> 2013;92(5):385-392.	Observational-Tx	307 Patients	To examine each component of the noninvasive arterial studies to determine optimal cut points to predict healing and to evaluate whether physiologic maneuvers could improve the utility of transcutaneous oxygen pressure (TcPO2) values to predict healing of partial foot amputation.	The TcPO2 values were significantly predictive of healing. Specifically, a cut point TcPO2 value of 38 mm Hg had a sensitivity and a specificity of 71% for predicting healing or failure. The optimal cut point was mostly unaffected by patient characteristics. The addition of noninvasive arterial studies recorded in a position with the limb elevated improved prediction in the subgroup with supine TcPO2 values of 38 mm Hg or lower.	2
14. Pardo M, Alcaraz M, Bernal FL, et al. A solution to ankle-brachial index limitations in peripheral transluminal angioplasty. <i>Radiol Med.</i> 2013;118(8):1373-1378.	Observational-Tx	250 Patients	To evaluate the limitations of the ankle-brachial index (ABI) in the revascularisation of diabetic patients with critical limb ischaemia (CLI) who were undergoing peripheral transluminal angioplasty (PTA) compared with the degree of arterial stenosis and with transcutaneous oxygen tension (TcPO2).	In 42% of the patients studied, ABI could either not be used (9.34% due to no signal; 14.02% because the artery could not be compressed) or was incorrect (18.7% before PTA; 15.9% after PTA). In contrast, TcPO2 was determined in all cases. After PTA, vessel stenosis decreased from 58.33+/-20.07% to 21.87+/-13.57% (p<0.001), whereas ABI increased from 0.79+/-0.57 to 0.95+/-0.47 (p<0.001) and TcPO2 from 27.37+/-10.40 mmHg to 38.23+/-10.25 mmHg (p<0.001). A statistical analysis revealed scant correlation between techniques (TcPO2 and ABI) (r=0.14).	2

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15. van Zitteren M, Vriens PW, Heyligers JM, et al. Self-reported symptoms on questionnaires and anatomic lesions on duplex ultrasound examinations in patients with peripheral arterial disease. J Vasc Surg. 2012;55(4):1025-1034 e1022.	Observational-Dx	701 Patients	To evaluate the association between the clinical presentation of symptomatic PAD including patient characteristics, patients' self-reported exertional leg symptoms, and their cardiovascular risk profile and anatomic lesion location.	Lesions were proximal in 270 (38.5%), distal in 441 (62.9%), and proximal and distal in 94 (13.4%). Patients with proximal lesions were younger (odds ratio [OR], 0.94; P < .0001) and less likely to be obese (OR, 0.34; P < .0001) than those without proximal lesions. Older age (OR, 1.07; P < .0001), male sex (OR, 1.96; P .003), being without a partner (OR, 2.24; P .004), and lower anxiety scores (OR, 0.42; P .003) were associated with distal lesions. Patients with both lesions were more likely to be single (OR, 2.30; P .010) and less likely to be obese (OR, 0.24; P .009). No distinguishing leg symptom pattern was observed for patients with proximal lesions. Intermittent claudication was more frequently reported in those with distal lesions (P .011). Although buttock and thigh pain seemed to be somewhat more present in proximal lesions (P < .01) and calf pain more in distal lesions (P < .001), patients still reported pain at a variety of levels throughout their legs, regardless of the anatomic lesion location.	3
16. Wong TH, Tay KH, Sebastian MG, Tan SG. Duplex ultrasonography arteriography as first-line investigation for peripheral vascular disease. Singapore Med J. 2013;54(5):271-274.	Review/Other-Dx	110 Patients	To compare the results of duplex imaging alone as the first-line investigation against the eventual results of catheter angiography, and to assess the impact of the former on patients' clinical outcomes.	During the study period, 113 duplex imaging studies of the lower limb followed by percutaneous transluminal angioplasty were performed at our hospital for peripheral vascular disease. The iliac artery was visualised in 40 images, but could not be visualised in 73 images. There was a potential change in management in three cases due to radiological differences between the duplex images and angiography films.	4
17. Marti X, Romera A, Vila R, Cairols MA. Role of ultrasound arterial mapping in planning therapeutic options for critical ischemia of lower limbs in diabetic patients. Ann Vasc Surg. 2012;26(8):1071-1076.	Observational-Dx	244 Patients	To assess the role of ultrasound arterial mapping in planning therapeutic options for critical limb ischemia (CLI) in diabetic patients.	Diabetic patients had a significantly higher degree of pathology in all segments, except the common iliac artery. Decisions made after ultrasound mapping matched the final surgical decision 90% and 94% of the time in diabetic patients and nondiabetic patients, respectively. Decisions made on the basis of ultrasound arterial mapping matched decisions made on the basis of arteriography in 86.3%	3

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18. Sultan S, Tawfick W, Hynes N. Ten-year technical and clinical outcomes in TransAtlantic Inter-Society Consensus II infrainguinal C/D lesions using duplex ultrasound arterial mapping as the sole imaging modality for critical lower limb ischemia. <i>J Vasc Surg.</i> 2013;57(4):1038-1045.	Observational-Tx	4783	To evaluate duplex ultrasound arterial mapping (DUAM) as the sole imaging modality when planning for bypass surgery (BS) and endovascular revascularization (EvR) in patients with critical limb ischemia for TransAtlantic Inter-Society Consensus (TASC) II C/D infrainguinal lesions.	From 2002 to 2012, a total of 4783 patients with peripheral arterial disease were referred, of whom 622 critical limb ischemia patients underwent revascularization for TASC C and D lesions (EvR: n [423; BS: n [199). Seventy four percent of EvR and 82% of BS were performed for TASC D (P [.218). The DUAM showed sensitivity of 97% and specificity of 98% in identifying lesions requiring intervention. Of the 520 procedures performed with DUAM alone, there was no difference regarding the number of procedures performed for occlusive or de novo lesions (EvR: 65% and 71%; BS: 87% and 78%; P [.056). Immediate clinical improvement to the Rutherford category #3 was 96% for EvR and 97% for BS (P [.78). Hemodynamic success was 79% for EvR and 77% for BS (P [.72). Six-year freedom from binary restenosis was 71.6% for EvR and 67.4% for BS (P [.724). Six-year freedom from target lesion revascularization was 81.1% for EvR and 70.3% for BS (P [.3571). Six-year sustained clinical improvement was 79.5% for EvR and 66.7% for BS (P [.294). Six-year amputation-free survival was 77.2% for EvR and 74.6% for BS (P [.837). There was a significant difference in risk of major adverse clinical events between EvR and BS (51% vs 70%; P[.034). Only 16.4% of patients required magnetic resonance angiography, which tended to overestimate lesions with 84% agreement with intraoperative findings. Six-year binary restenosis was 71% for DUAM procedures compared with 55% for magnetic resonance angiography procedures (P [.001), which was solely based on the prospective modality.	2

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19. Mustapha JA, Saab F, Diaz-Sandoval L, et al. Comparison between angiographic and arterial duplex ultrasound assessment of tibial arteries in patients with peripheral arterial disease: on behalf of the Joint Endovascular and Non-Invasive Assessment of Limb Perfusion (JENALI) Group. J Invasive Cardiol. 2013;25(11):606-611.	Observational-Dx	49 Patients	To describe a scoring method for the patency of the tibial arterial tree that can be applied to multiple imaging modalities.	Average age of patients was 69.8 years. A total of 846 segments were assessed by both angiography and ultrasound. We found that 648 segments (76.6%) were deemed to be patent by angiography compared to 723 (85.5%) by ultrasound. Critical limb ischemia (CLI; Rutherford score ≥ 4) was described in 26 patients (53%). Average JENALI score for the right lower extremity was 7.0 by angiogram vs 7.7 by ultrasound. The average JENALI score of the left leg was 6.7 by angiogram vs 7.7 by ultrasound. A total of 94 lower extremities were assigned a JENALI score. Ultrasound was accurate in detecting tibial artery patency or occlusion in 80% of segments. The overall sensitivity/specificity of ultrasound detecting tibial artery patency was calculated at 93% and 40% ($P < .05$), respectively. Detection of patency via ultrasound was highest for the anterior tibial artery and the lowest for the peroneal artery. The angiographic and ultrasound JENALI scores better correlated with vessel patency (higher scores) than the lower angiographic and ultrasound JENALI scores.	2

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20. Takimura H, Hirano K, Muramatsu T, et al. Vascular elastography: a novel method to characterize occluded lower limb arteries prior to endovascular therapy. J Endovasc Ther. 2014;21(5):654-661.	Observational-Dx	812 Patients	To examine the effectiveness of vascular elastography (VE) for the assessment of totally occluded lower limb arteries prior to endovascular treatment (EVT).	CTO characteristics could be evaluated in all cases. A VE score ≤ 2 was found in 14 of the 23 lesions < 150 mm in length. A flexible guidewire was sufficient for recanalization in more of the soft lesions than in the hard lesions [6/9 vs. 2/14, respectively]. In 39 lesions > 150 mm, a VE score of 3 was recorded in most lesions proximally, while lesions distally were hard in many cases (VE score 1 or 2). A flexible guidewire alone was sufficient in many soft CTOs (8/13, $p < 0.01$). In 16 cases, hard calcified plaque was indicated by difficulty in penetrating the lesion even with a stiff guidewire; all these cases had a VE score of 1 or 2. A retrograde approach was required only in hard CTOs ($p < 0.01$). The procedure time was significantly longer for the hard lesion group (152.9 \pm 63.2 vs. 87.0 \pm 29.8 minutes, $p = 0.001$). In 11 in-stent occlusions, only VE scores of 3 (n=4) or 4 (n=7) were recorded, indicating soft thrombus, which was aspirated under distal protection in 7 cases.	3
21. Arvela E, Dick F. Surveillance after distal revascularization for critical limb ischaemia. Scand J Surg. 2012;101(2):119-124.	Review/Other-Tx	N/A	To summarize currently available data concerning post-interventional surveillance and aims to appraise available evidence for best clinical practice critically including anti-platelet and antithrombotic therapy, clinical surveillance, use of duplex ultrasound, and indications for and preferred type of repeat interventions for failing and failed reconstructions.	No results in abstract.	4

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22. Troutman DA, Madden NJ, Dougherty MJ, Calligaro KD. Duplex ultrasound diagnosis of failing stent grafts placed for occlusive disease. J Vasc Surg. 2014;60(6):1580-1584.	Observational-Tx	79 Patients	To evaluate whether DU imaging can reliably diagnose failing stent grafts (ie, covered stents) placed for arterial occlusive disease.	We retrospectively classified the following factors as “abnormal DU findings:” focal PSVs >300 cm/s, uniform PSVs <50 cm/s throughout the graft, and a Vr >3.0. Fifteen of 20 patients with one or more of these abnormal DU findings underwent prophylactic intervention (n[8] or occluded without intervention (n[7), whereas only two of 72 with normal DU findings occluded (P [.0001). Excluding the eight patients who underwent prophylactic intervention, seven of 12 patients with abnormal DU findings occluded without intervention vs two of 72 with normal DU findings (P = .0001).	3

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<p>23. Shrikhande GV, Graham AR, Aparajita R, et al. Determining criteria for predicting stenosis with ultrasound duplex after endovascular intervention in infrainguinal lesions. <i>Ann Vasc Surg.</i> 2011;25(4):454-460.</p>	<p>Observational-Dx</p>	<p>143 Patients</p>	<p>To examine the utility of duplex surveillance to identify angioplasty site stenosis after endovascular therapy in the infrainguinal arterial region and to establish criteria to determine the correlation of duplex ultrasound surveillance findings to angiographic findings.</p>	<p>Repeat angiograms were performed on 345 lesions in 143 patients, and 254 lesions in 103 patients had a corresponding duplex ultrasound. Indications for the initial interventions were claudication (n¼ 62, 43.4%), rest pain (n¼ 23, 16.1%), and tissue loss (n¼ 58, 40.5%). A total of 178 superficial femoral artery (SFA) lesions, 59 popliteal lesions, and 17 tibial lesions were identified by surveillance duplex in 103 patients. In all, 70.5% of the intervened vessels that were studied were non-stented and the remaining 29.5% were stented. A total of 65% of the patients had diabetes. On determining correlations for peak systolic velocity (PSV) as measured by duplex ultrasound with degree of angiographic stenosis, strong correlation coefficients for SFA disease (R²¼ 0.84) and popliteal disease (R²¼ 0.88) were found. However, poor correlation was found in patients with tibial disease. When analyzing the lesions on the basis of Vr <2.0, 11 of 86 (12.8%) had >70% angiographic stenosis. In lesions with ratios from 2 to 2.5, 12 of 13 (92.3%) had >70% angiographic stenosis and in lesions with ratios >2.5, 69 of 75 (92.0%) had >70% angiographic stenosis. ROC curve analysis showed that to detect 70% stenosis in the SFA, a PSV 204 cm/sec had a sensitivity of 97.6% and specificity of 94.7%. To detect 70% stenosis in the overall femoropopliteal region, a PSV 223 cm/sec had a sensitivity of 94.1% and specificity of 95.2%.</p>	<p>3</p>

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24. Humphries MD, Pevec WC, Laird JR, Yeo KK, Hedayati N, Dawson DL. Early duplex scanning after infrainguinal endovascular therapy. J Vasc Surg. 2011; 53(2):353-358.	Review/Other-Dx	113 patients	To evaluate whether duplex US findings after infrainguinal endovascular interventions for CLI were predictive of need for reintervention or amputation.	There were 122 infrainguinal interventions for CLI in 113 patients (53% male; mean age 71 years). Risk factors included diabetes: 61%; renal failure: 20%; and smoking (within 1 year): 40%. Duplex US was performed within 30 days of the index procedure in 90 cases. Fifty patients had an abnormal early duplex and 40 patients had a normal duplex. In patients with a normal duplex US the amputation rate was 5% vs 20% in the group with an abnormal duplex (P=.04). Primary patency was 56% in the normal duplex group and 46% in the abnormal duplex group (P=.18). Early duplex US was able to identify a residual stenosis not seen on completion angiography in 56% of cases. Duplex scanning detects residual stenosis missed with conventional angiography after infrainguinal interventions. An abnormal duplex US in the first 30 days after an intervention is associated with an increased risk of amputation. This suggests a possible role for intraprocedural duplex US, as well as routine postprocedure duplex US, close clinical follow-up, and consideration of reintervention for residual abnormalities in patients treated for CLI.	4

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25. Wilson YG, Davies AH, Currie IC, et al. The value of pre-discharge Duplex scanning in infrainguinal graft surveillance. <i>Eur J Vasc Endovasc Surg.</i> 1995;10(2):237-242.	Review/Other-Dx	123 patients	To audit experiences with respect to early Duplex scanning.	46 abnormalities (37% detection rate) were identified on scans within 1 week. In all cases, on-table completion studies with either arteriography and/or flow measurements had failed to identify the anomalies subsequently detected by Duplex. At 1 week, 6 grafts had occluded, 27 had a focal peak mean velocity increase (mean V2/V1 ratio: 2.6; range 1.5-4.3), 4 had low flow velocities, 4 had arteriovenous fistulae, 1 contained mobile thrombus, 2 had retained cusps and 2 had hamstring entrapment. Of 40 patent, but compromised grafts, 18 warranted immediate investigation. Of the 27 patients with velocity disturbances on Duplex, 25 were simply observed but, 8 have since required intervention for definitive stenoses at these sites which, in retrospect, were evident within the first postoperative week.	4
26. Jones DW, Graham A, Connolly PH, Schneider DB, Meltzer AJ. Restenosis and symptom recurrence after endovascular therapy for claudication: does duplex ultrasound correlate with recurrent claudication? <i>Vascular.</i> 2015;23(1):47-54.	Observational-Tx	71 Patients	To evaluate the correlation between duplex ultrasound detected restenosis and symptom recurrence following endovascular therapy for claudication.	We analyzed 183 follow-up visits following treatment in 88 limbs (femoropopliteal (56%) or iliac (44%) arteries). After femoropopliteal intervention, median systolic velocity ratio was higher in patients with symptom recurrence (2.99 symptomatic vs. 1.69 asymptomatic; p<0.001). Elevated systolic velocity ratio or occlusion correlated with symptom recurrence (area under receiver operator characteristic curve=0.82 [95% CI 0.74–0.83]), and systolic velocity ratio>2.5 was 71% sensitive and 72% specific for symptom recurrence.	2

Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
27. Fontcuberta J, Flores A, Orgaz A, et al. Reliability of preoperative duplex scanning in designing a therapeutic strategy for chronic lower limb ischemia. <i>Ann Vasc Surg.</i> 2009; 23(5):577-582.	Observational-Dx	335 consecutive patients	To compare the treatment plan designed on the basis of preoperative duplex scanning evaluation of the CLI with the treatment plan finally carried out, after assessing the findings obtained during surgical or endovascular treatment.	Agreement between both plans were as follows: 80%, 82.7% and 59% in the examinations of the iliac arteries, femoropopliteal or tibial arteries, respectively. The operation plan was more frequently modified due to a duplex scanning failure in procedures involving the distal vessels (10/44 [22.7%], P<0.01). In conclusion, duplex scanning evaluation of patients with occlusive arterial disease of the lower limbs permits the design of both a medical and a surgical or endovascular treatment plan with a high level of agreement with the findings obtained during the revascularization procedure.	3
28. Gargiulo M, Maioli F, Ceccacci T, et al. What's next after optimal infrapopliteal angioplasty? Clinical and ultrasonographic results of a prospective single-center study. <i>J Endovasc Ther.</i> 2008; 15(3):363-369.	Observational-Tx	80 CLI patients	To prospectively evaluate arterial patency and factors influencing outcomes after successful tibial artery angioplasty in patients with CLI.	Mean follow-up was 10.9 months (range 2 days - 29 months). At 12 months, the primary and assisted primary patency rates were 37.9% and 71.2%, respectively. Restenosis was significantly correlated with smoking (HR 3.58, 95% CI 1.15 to 11.18; P=0.02), infected ulcers (HR 2.04, 95% CI 1.02 to 4.09; P=0.04), and posterior tibial artery angioplasty (HR 3.76, 95% CI 1.59 to 8.87; P=0.003). Rates of limb salvage and wound healing at 12 months were 92.7% and 74.9%, respectively. Peroneal angioplasty was significantly correlated with wound healing (HR 1.83, 95% CI 1.04 to 3.25; p = 0.03), and wound healing increased with classes of age (HR 1.60, 95% CI 1.07 to 2.39; p = 0.02). One-year restenosis after optimal tibial artery angioplasty is significant and positively correlated with smoking, infection of trophic lesions, and posterior tibial artery angioplasty. Close US surveillance provides good limb salvage after optimal infrapopliteal angioplasty in patients with CLI.	2
29. Owen AR, Roditi GH. Peripheral arterial disease: the evolving role of non-invasive imaging. <i>Postgrad Med J.</i> 2011;87(1025):189-198.	Review/Other-Dx	N/A	To review the relative merits and limitations of duplex ultrasound, CT angiography, and magnetic resonance angiography are discussed, emerging imaging techniques are described, and complications relating to the use of intravascular contrast agents	No results in abstract.	4

* See Last Page for Key

**Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
30. 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</i> . 2008;190(5):1349-1357.	Experimental-Dx	514 patients randomized to MRA (n=258), DSA (n=177), CTA (n=79)	Multicenter randomized trial to evaluate DSA vs CTA vs MRA for accuracy, impact on treatment planning, cost, and quality of life.	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 US. 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 US than for CTA. The results suggest that both CTA and MRA are clinically more useful than duplex US and that CTA leads to cost savings compared with both MRA and duplex US in the initial imaging evaluation of PAD.	1
31. 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 multidetector computed tomography (MDCT) lower-limb angiography in the evaluation of patients with critical limb ischaemia (CLI) or severe intermittent claudication (IC) in grading disease before endovascular treatment.	For arterial segments with haemodynamically 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%. MDCT angiography 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
32. Jens S, Koelemay MJ, Reekers JA, Bipat S. Diagnostic performance of computed tomography angiography and contrast-enhanced magnetic resonance angiography in patients with critical limb ischaemia and intermittent claudication: systematic review and meta-analysis. <i>Eur Radiol</i> . 2013;23(11):3104-3114.	Meta-analysis	12 CTA, 30 CE-MRA studies, 673 and 1,404 participants, respectively	To evaluate the diagnostic performance of computed tomography angiography (CTA) and contrast-enhanced magnetic resonance angiography (CE-MRA) in detecting haemodynamically significant arterial stenosis or occlusion in patients with critical limb ischaemia (CLI) or intermittent claudication (IC).	Out of 5,693 articles, 12 CTA and 30 CE-MRA studies were included, respectively evaluating 673 and 1,404 participants. Summary estimates of sensitivity and specificity were respectively 96% (95% CI, 93-98%) and 95% (95% CI, 92-97%) for CTA, and 93% (95% CI, 91-95%) and 94% (95% CI, 93-96%) for CE-MRA. Regression analysis showed that the prevalence of CLI in individual studies was not an independent predictor of sensitivity and specificity for either technique. Methodological quality of studies was moderate to good.	M

**Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
33. Meyer BC, Klein S, Krix M, Aschoff AJ, Wacker FK, Albrecht T. Comparison of a standard and a high-concentration contrast medium protocol for MDCT angiography of the lower limb arteries. <i>Rofo</i> . 2012;184(6):527-534.	Experimental-Tx	64 Patients	To prospectively compare a compact bolus (CB) injection protocol using high-iodine concentration contrast medium with a standard bolus (SB) injection protocol at equi-iodine doses for run-off computed tomographic angiography (CTA).	Overall arterial CD was significantly higher with the compact bolus (CB: 279 +/- 57HU, SB: 234 +/- 32HU, p = 0.0017). Segmental CD was significantly higher (p< 0.05) in 7 of 16 evaluated segments. Patency-based comparison revealed superior AO in vessels with relevant (50 - 99 %) stenoses (CB: 4.54 vs. SB: 4.18, p = 0.04). Contrast bolus overriding without pathological reasons, i. e., acute occlusions, was noted in one patient in each group. Venous overlay was observed less frequently in the CB group (CB vs. SB: 12 vs. 19 patients, n. s.; 29 of 64 legs [45 %] vs. 44 of 64 legs [69 %], p = 0.01).	2
34. Ouwendijk R, Kock MC, van Dijk LC, van Sambeek MR, Stijnen T, Hunink MG. Vessel wall calcifications at multi-detector row CT angiography in patients with peripheral arterial disease: effect on clinical utility and clinical predictors. <i>Radiology</i> . 2006;241(2):603-608.	Observational-Dx	145 patients	To evaluate retrospectively the effect of vessel wall calcifications on the clinical utility of MDCTA performed in patients with PAD and to identify clinical predictors for the presence of vessel wall calcifications.	The number of calcified segments was a significant predictor of the need for additional imaging (P=.001) and of the confidence scores (P<.001). The number of calcified segments discriminated between patients who required additional imaging after CTA and those who did not (area under the receiver operating characteristic curve, 0.66; 95% CI: 0.54, 0.77). Age, diabetes mellitus, and cardiac disease were significant predictors of the number of calcified segments in both the univariable and multivariable analyses (P<.05).	4
35. 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 computed tomography (DECT) multidetector computed tomography (MDCT) angiography improves vascular contrast beyond MDCT angiography and digital subtraction angiography (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, DECT showed higher CNR compared to DSA and MDCT (P < .05); distal to the popliteal arteries, DSA achieved higher CNR (P < .05). Analyses of contrast homogeneity showed minimal CV above the knee for MDCT (<=9%) and for DSA below the knee (<=7%). Stenotic vasculature comprised 33 segments. Significant correlations of stenosis severity were found comparing DECT and MDCT with DSA as reference standard showing a 0.04-fold mean underestimation of stenoses on MDCT and no detectable mean variation on DECT compared with DSA.	3

**Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
36. Lee JJ, Chung JW, Hong H, et al. Subtraction CT angiography of the lower extremities: single volume subtraction versus multi-segmented volume subtraction. Acad Radiol. 2011;18(7):902-909.	Observational-Dx	101 Patients	To validate the hypothesis that a multisegmented approach during subtraction computed tomography (CT) angiography of the lower extremities can improve bone removal efficiency by suppressing regional motion. Intravenous contrast was administered in this study.	Multisegmented volume subtraction MIP images demonstrated significantly better bone removal for the following bone segments: pelvis (P < .0001), hip (P = .0002), thigh (P = .0258), knee (P = .0004), ankle (P = .0008), metatarsal bone (P < .0001), and toes (P < .0001). Overall bone subtraction score and subjective image qualities determined by performing side-by-side comparisons were better for the multisegmented volume subtraction method.	3
37. Sommer WH, Bamberg F, Johnson TR, et al. Diagnostic accuracy of dynamic computed tomographic angiographic of the lower leg in patients with critical limb ischemia. Invest Radiol. 2012;47(6):325-331.	Observational-Dx	29 Patients	To assess the diagnostic accuracy of dynamic computed tomographic angiography (dyn-CTA) in patients with critical lower leg ischemia.	Compared with s-CTA, dyn-CTA resulted in significantly higher arterial contrast enhancement (68% vs 46% optimal contrast; P < 0.01) and higher diagnostic confidence (64% vs 48% fully confident, respectively, P < 0.05). Dyn-CTA had a slightly higher sensitivity for the detection of significant stenosis (98.0% vs 96.6%), and for the detection of occlusion (95.4% vs 94.4%). Specificity for dyn-CTA was higher than for s-CTA, both for detection of stenosis (97.1% vs 92.2%) and especially for the detection of vessel occlusions (99.3% vs 94.4%; P < 0.05).	1
38. Swanberg J, Nyman R, Magnusson A, Wanhainen A. Selective intra-arterial dual-energy CT angiography (s-CTA) in lower extremity arterial occlusive disease. Eur J Vasc Endovasc Surg. 2014;48(3):325-329.	Observational-Dx	10 Patients	To report a preliminary experience of s-CTA in patients with critical limb ischemia and renal insufficiency with respect to safety, feasibility, and diagnostic accuracy.	A median 17 mL (range 10-19 mL) contrast media (400 mg I/mL) was used. The median baseline plasma creatinine was 163 μmol/L (range 105-569) pre s-CTA versus 153 μmol/L (range 105-562) post s-CTA (p = .24). There was no puncture site complication. Among the patients selected for intervention (n = 6 with 30 arterial segments) the s-CTA findings correlated well with the DSA findings; the diagnostic sensitivity was 100%, the specificity 89%, and the accuracy 93%.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
39. Penzkofer T, Slebocki K, Grommes J, et al. High-pitch carbon dioxide contrasted CT angiography: pilot study. Cardiovasc Intervent Radiol. 2014;37(2):362-370.	Observational-Dx	5 Patients	To evaluate CO2 computed tomography angiography (CO2-CTA) of the iliac and lower limb arteries in patients with contraindications for iodinated contrast agent (ICA).	CO2-CTA was feasible in all patients without adverse side effects, except for CO2 injection-associated pain. Objective vessel analysis revealed no significant difference in diameters as determined by CO2-CTA and CO2-FLA (0.44 +/- 0.4 and 0.46 +/- 0.41 mm, p = 0.93). CO2-CTA had on average a higher image-quality score (2.6 +/- 1.0 vs. 2.3 +/- 1.0, p = 0.009). While for pelvic and upper leg CO2-CTA advantageous (3.1 +/- 0.74 vs. 2.7 +/- 0.9, p = 0.0014) at good quality scores, for calf vessels no significant improvement was visible (1.9 +/- 1.0 vs. 1.7 +/- 0.9, p = 0.49) and scores were poorer.	3
40. Healy DA, Boyle EM, Clarke Moloney M, et al. Contrast-enhanced magnetic resonance angiography in diabetic patients with infra-genicular peripheral arterial disease: systematic review. Int J Surg. 2013;11(3):228-232.	Meta-analysis	3 articles (83 Patients)	To analyse the literature to determine the accuracy of contrast enhanced magnetic resonance angiography (CE-MRA) in differentiating extent of disease in patients with infragenicular PAD and diabetes, using digital subtraction angiography (DSA) as the gold standard.	Only three studies (83 patients) provided data regarding the infragenicular vessels. The pooled sensitivity of MRA was 86% while the pooled specificity of MRA was 93%.	M
41. Li J, Zhao JG, Li MH. Lower limb vascular disease in diabetic patients: a study with calf compression contrast-enhanced magnetic resonance angiography at 3.0 Tesla. Acad Radiol. 2011;18(6):755-763.	Observational-Dx	61 Patients	To retrospectively analyze the significance of 3.0-T contrast-enhanced (CE) magnetic resonance angiography (MRA) with calf compression in the lower limbs of diabetic patients with peripheral vascular disease.	Image quality in the calf and foot was better in the group with calf pressure than the conventional group without applied pressure (P = .001 [calf], 0.008 [foot]). Significantly more runoff vessels in the calf were detected with MRA than with DSA (P = .0043 [conventional], 0.0031 [pressure]). The kappa values were 0.928 in the conventional group and 0.979 in the pressure group, but in the conventional group, the diagnostic accuracy of CE-MRA was lower than that of DSA (P = .002). Diagnostic accuracy in the pressure group was significantly higher than that in the conventional group (P = .009). The overall sensitivity and specificity for >50% stenosis or occlusion was 93.8% and 98.5%, respectively, in the conventional group and 98.7% and 99.6%, respectively, in the pressure group. With calf compression, venous overlap (P = .0396, .0425) and deep vein overlap (P = .022, .022) were significantly reduced in the leg and foot.	2

Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Hadizadeh DR, Marx C, Gieseke J, Schild HH, Willinek WA. High temporal and high spatial resolution MR angiography (4D-MRA). <i>Rofo</i> . 2014;186(9):847-859.	Review/Other-Dx	N/A	To provide an overview of the development of TR-MRA methods and the 4D-MRA techniques as they are currently used in the diagnosis, treatment and follow-up of vascular diseases in various parts of the body.	No results in abstract.	4
43. Kinner S, Quick HH, Maderwald S, Hunold P, Barkhausen J, Vogt FM. Triple-TWIST MRA: high spatial and temporal resolution MR angiography of the entire peripheral vascular system using a time-resolved 4D MRA technique. <i>Eur Radiol</i> . 2013;23(1):298-306.	Observational-Dx	10 Patients	To develop a triple injection protocol for high-resolution MRA of the entire peripheral vascular system, applying time-resolved (TR) four-dimensional (4D) MRA sequences.	Three-station TR-MRA proved feasible and was comparable with DSA in 282 vessel segments, with underestimation grade of stenosis in four segments and overestimation in four segments, respectively. In 32/38 patients no venous overlay was noted; in six patients there was mild venous overlay. Image quality was rated excellent or good in most cases.	3
44. Knobloch G, Gielen M, Lauff MT, et al. ECG-gated quiescent-interval single-shot MR angiography of the lower extremities: initial experience at 3 T. <i>Clin Radiol</i> . 2014;69(5):485-491.	Observational-Dx	25 Patients	To evaluate the feasibility of unenhanced electrocardiography (ECG)-gated quiescent-interval single-shot magnetic resonance angiography (QISS-MRA) of the lower extremities at 3 T.	QISS-MRA and CE-MRA of all patients were considered for analysis, resulting in 807 evaluated vessel segments for each MRA technique. Readers 1 and 2 rated image quality of QISS-MRA as diagnostic in 97.3% and 97% of the vessel segments, respectively. CE-MRA was rated diagnostic in all vessel segments. Image quality of the proximal vessel segments, including the infrarenal aorta, iliac arteries, and common femoral artery, was significantly lower on QISS-MRA compared to CE-MRA [image quality score across readers: 2 (1,3) versus 1 (1,1) $p < 0.001$]. In the more distal vessel segments, image quality of QISS-MRA was excellent and showed no significant difference compared to CE-MRA [image quality score across readers: 1 (1,1) versus 1 (1,1) $p = 0.036$]. Diagnostic performance of QISS-MRA was as follows (across readers): sensitivity: 87.5% (95% CI: 80.2-92.4%); specificity: 96.1% (95% CI: 93.6-97.6%); diagnostic accuracy: 94.9% (95% CI: 92.6-96.5%).	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
45. Ko SF, Sheu JJ, Lee CC, et al. TRICKS magnetic resonance angiography at 3-tesla for assessing whole lower extremity vascular tree in patients with high-grade critical limb ischemia: DSA and TASC II guidelines correlations. ScientificWorldJournal. 2012;2012:192150.	Observational-Dx	58 Lower Extremities	To assess the clinical feasibility of three-station three-dimensional (3D) T-MRA at 3-tesla, with low doses for each station, for the evaluation of the entire vascular tree of the lower extremity in patients with high-grade CLI with DSA and TASC II correlation.	Among 870 vascular segments, excellent agreement was observed between T-MRA and DSA (mean $\kappa = 0.883$) in revealing stenosis (mean stenosis score, 2.1 ± 1.3 versus 2.0 ± 1.3). T-MRA harbored overall high sensitivity (99.5%), specificity (93.6%), positive predictive value (95.4%), negative predictive value (99.6%), and accuracy (97.7%) in depicting significant stenosis.	3
46. Bertschinger K, Cassina PC, Debatin JF, Ruehm SG. Surveillance of peripheral arterial bypass grafts with three-dimensional MR angiography: comparison with digital subtraction angiography. AJR. 2001;176(1):215-220.	Observational-Dx	39 patients with 45 lower limb grafts	To use contrast-enhanced 3D MRA to assess the patency of peripheral arterial bypass grafts of the lower extremity.	Sensitivity and specificity values for MRA regarding the assessment of grafts were 100% for 87 evaluable segments for which DSA correlation was available: stenosis (n=10), occlusions (n=9), ectasia or aneurysms (n=8). Six segments could not be assessed because of the presence of intravascular stents or metallic clips.	2
47. Hakyemez B, Koroglu M, Yildiz H, Erdogan C, Atasoy S, Yurdaeken K. Table-moving contrast-enhanced magnetic resonance angiography in the evaluation of lower extremity peripheral arterial bypass grafts. JBR-BTR. 2006;89(2):67-71.	Observational-Dx	22 lower extremity peripheral arterial grafts in 18 patients	To investigate the utility of table-moving contrast-enhanced 3D MRA in the evaluation of lower extremity peripheral arterial bypass grafts.	Preoperative diagnosis were occlusive arterial segments in 14 cases, 4 aneurysms in 2 cases (3 aneurysms in one case) and traumatic femoral artery injury in 2 cases. 1.5T superconductive magnet was used with torso-phase and whole body coil system on MRI examinations. Lower extremity peripheral arterial grafts were evaluated and anastomosis sites were classified into five groups as normal, insignificant stenosis (<50%), significant stenosis (>50%), occlusion and ectatic or aneurysmatic appearance. Contrast-enhanced MRA imaging of 66 segments of 22 graft patients were of high quality. No difficulties were confronted in the radiological evaluation of peripheral bypass grafts. Graft stenosis as detected in five grafts. Stenotic segments were at the proximal (n=4) and distal (n=3) anastomosis sites. Total occlusion was shown in three grafts. Ectasia or aneurysm was seen in only one graft. In lower extremity peripheral bypass graft patients, table-moving contrast enhanced MRA can be used in the evaluation and follow-up of the vascular lesions.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
48. Link J, Steffens JC, Brossmann J, Graessner J, Hackethal S, Heller M. Iliofemoral arterial occlusive disease: contrast-enhanced MR angiography for preinterventional evaluation and follow-up after stent placement. <i>Radiology</i> . 1999; 212(2):371-377.	Observational-Dx	67 patients (41 stented segments)	Prospective study to evaluate the efficacy of CE-MRA for the diagnosis of PAOD and follow-up after stent placement.	24 occlusions were correctly diagnosed with CE-MRA. Of the 59 stenoses, 36 were >50% and 23 were =50%. Sensitivity and specificity for the detection of stenoses >50% were 100% and 83%, respectively. Patency of the different stents was determined correctly with CE-MRA. Some stents caused signal intensity dropout, which made MR evaluation of stents difficult. Generally, these signal intensity artifacts were most severe in stainless steel stents and mild in some nitinol stents.	2
49. Suttmeier B, Teichgraber U, Thomas A, et al. Non-invasive ECG-triggered 2D TOF MR angiography of the pelvic and leg arteries in an open 1.0-tesla high-field MRI system in comparison to conventional DSA. <i>Biomed Tech (Berl)</i> . 2014;59(1):29-37.	Review/Other-Dx	41 Segments (7 Patients)	To assess the visualization of the pelvic and leg arteries in general rather than the performance of TOF-MRA in terms of stenosis detection and grading.	In the 41 consolidated segments, correlations were good, very good, and excellent in 25 segments (n=10>0.5, n=4>0.7, and n=11>0.8), moderate to poor in seven segments (n=4>0.3 and 0<n=3<=0.3), without in two, inverse in three, and nonmeasurable in four segments. Correlations were best for the main arteries above the knee, and these arteries were most consistently visualized.	4
50. 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 gadolinium chelates, with particular emphasis on the potential mechanisms of nephrogenic systemic fibrosis.	Gadolinium-based paramagnetic contrast agents are relatively safe when used in clinically recommended doses. However, with the rapidly expanding body of literature linking Gadolinium-based paramagnetic contrast agents and NSF, awareness of the potential side effects and adverse reactions from Gadolinium is now an important requirement for practicing radiologists. In addition to the ongoing accumulation and analyses of clinical NSF data, it is also essential for the practicing radiologist to understand the biochemical characteristics of the extracellular Gadolinium-chelates.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Liu X, Zhang N, Fan Z, et al. Detection of infragenual arterial disease using non-contrast-enhanced MR angiography in patients with diabetes. <i>J Magn Reson Imaging</i> . 2014;40(6):1422-1429.	Observational-Dx	45 Patients	To evaluate the diagnostic performance of a newly developed non-contrast-enhanced MR angiography (NCE-MRA) technique using flow-sensitive dephasing (FSD) prepared steady-state free precession (SSFP) for detecting calf arterial disease in patients with diabetes.	A total of 264 calf arterial segments were obtained in the 45 patients with 88 legs. The percentage of diagnostic arterial segments was all 98% for NCE- and CE-MRA. The image quality, SNR, CNR was 3.3, 177, 138, and 3.5, 103, 99, for NCE-MRA and CE-MRA, respectively. The average sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of NCE-MRA were 97%, 96%, 90%, 99%, and 96%, respectively on a per-segment basis and 90%, 84%, 82%, 91%, and 87%, respectively, on a per-patients basis.	2
52. Thierfelder KM, Meimarakis G, Nikolaou K, et al. Non-contrast-enhanced MR angiography at 3 Tesla in patients with advanced peripheral arterial occlusive disease. <i>PLoS One</i> . 2014;9(3):e91078.	Observational-Dx	21 Patients	The aim of this study was to assess the diagnostic performance of ECG-gated non-contrast-enhanced quiescent interval single-shot (QISS) magnetic resonance angiography at a magnetic field strength of 3 Tesla in patients with advanced peripheral arterial occlusive disease (PAOD).	With CE-MRA as the reference standard, HR-QISS showed high sensitivity (94.1%), specificity (97.8%), positive (95.1%), and negative predictive value (97.2%) for the detection of significant ($\geq 50\%$) stenosis. Interreader agreement for stenosis assessment of both HR-QISS and CE-MRA was excellent (kappa-values of 0.951 and 0.962, respectively). As compared to CR-MRA, image quality of HR-QISS was significantly lower for the distal aorta, the femoral and iliac arteries (each with $p < 0.01$), while no significant difference was found in the popliteal ($p = 0.09$) and lower leg arteries ($p = 0.78$).	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Diop AD, Braidy C, Habouchi A, et al. Unenhanced 3D turbo spin-echo MR angiography of lower limbs in peripheral arterial disease: a comparative study with gadolinium-enhanced MR angiography. AJR Am J Roentgenol. 2013;200(5):1145-1150.	Observational-Dx	51 Patients	To assess the feasibility and diagnostic performance of an unenhanced MR angiography sequence (Syngo Native Space, Siemens Healthcare) to detect and quantify lower-limb peripheral arterial disease (PAD), with gadolinium-enhanced MR angiography (CE-MRA) as the reference standard.	Examination duration was longer for Native sequence (mean, 39.6 min, vs 10 min for CE-MRA). Image quality was significantly better for CE-MRA, with 92% of images listed as good to excellent for CE-MRA, compared to 53% for Native. Sensitivity, specificity, negative predictive value (NPV), and accuracy of Native were respectively 75%, 95%, 89%, and 88% for all mixed levels; 52%, 97%, 88%, and 87% for aortoiliac level; 87%, 99%, 95%, and 92% for femoropopliteal level; and 82%, 87%, 87%, and 85% for subpopliteal level. If we considered only patients with Leriche and Fontaine stage II arteriopathy, Native results were slightly better, with respective specificities and NPVs of 96% and 91% for all mixed levels; 98% and 90% for aortoiliac level; 98% and 93% for femoropopliteal level; and 91% and 90% for subpopliteal level.	3
54. Atanasova IP, Kim D, Storey P, Rosenkrantz AB, Lim RP, Lee VS. Sagittal fresh blood imaging with interleaved acquisition of systolic and diastolic data for improved robustness to motion. Magn Reson Med. 2013;69(2):321-328.	Observational-Dx	14 Patients	To improve robustness to patient motion of "fresh blood imaging" (FBI) for lower extremity noncontrast MR angiography.	In 10 volunteers, imaged while performing controlled movements, interleaved FBI demonstrated better tolerance to subject motion than sequential FBI. In one patient with peripheral arterial disease, interleaved FBI offered better depiction of collateral flow by reducing sensitivity to inadvertent motion.	2
55. Hansmann J, Morelli JN, Michaely HJ, et al. Nonenhanced ECG-gated quiescent-interval single shot MRA: image quality and stenosis assessment at 3 tesla compared with contrast-enhanced MRA and digital subtraction angiography. J Magn Reson Imaging. 2014;39(6):1486-1493.	Observational-Dx	16 Patients	To evaluate the diagnostic accuracy of a nonenhanced electrocardiograph-gated quiescent-interval single shot MR-angiography (QISS-MRA) at 3 Tesla with contrast-enhanced MRA (CE-MRA) and digital subtraction angiography (DSA) serving as reference standard.	With the exception of the calf station, image quality with QISS-MRA was rated statistically significantly less than that of CE-MRA ($P < 0.05$, $P = 0.17$, and $P = 0.6$, respectively). A greater percentage of segments were not accessible with QISS-MRA (19.5-20.1%) in comparison to CE-MRA (10.9%). Relative to DSA, sensitivity for QISS-MRA was high (100% versus 91.2% for CE-MRA, $P = 0.24$) in the evaluated segments; however, specificity (76.5%) was substantially less than that of CE-MRA (94.6%, $P = 0.003$).	2

**Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
56. Kassamali RH, Hoey ET, Ganeshan A, Littlehales T. A comparative analysis of noncontrast flow-spoiled versus contrast-enhanced magnetic resonance angiography for evaluation of peripheral arterial disease. <i>Diagn Interv Radiol</i> . 2013;19(2):119-125.	Observational-Dx	13 Patients	To obtain initial data to assess the performance of a novel noncontrast spoiled magnetic resonance (MR) angiography technique (fresh-blood imaging [FBI]) compared to gadolinium-enhanced MR (Gd-MR) angiography for evaluation of the aortoiliac and lower extremity arteries.	A total of 385 arterial segments were analyzed; 34 segments were excluded due to degraded image quality (1.3% of Gd-MR vs. 8% of FBI-MR angiography images). FBI-MR angiography had comparable accuracy to Gd-MR angiography for assessment of the above knee vessels with high kappa statistics (large arteries, 0.91; small arteries, 0.86) and high sensitivity (large arteries, 98.1%; small arteries, 88.6%) and specificity (large arteries, 97.2%; small arteries, 97.6%) using Gd-MR angiography as the gold standard.	3
57. Hodnett PA, Ward EV, Davarpanah AH, et al. Peripheral arterial disease in a symptomatic diabetic population: prospective comparison of rapid unenhanced MR angiography (MRA) with contrast-enhanced MRA. <i>AJR Am J Roentgenol</i> . 2011;197(6):1466-1473.	Observational-Dx	25 diabetic patients	To evaluate the accuracy of the rapid technique of quiescent-interval single-shot (QISS) unenhanced MR angiography (MRA) compared with CEMRA for the diagnosis in diabetic patients referred with symptomatic chronic PAD.	For this study, 775 segments were analyzed. On a per-segment basis, the mean values of the diagnostic accuracy of unenhanced MRA compared with reference CEMRA for two reviewers, reviewers 1 and 2, were as follows: sensitivity, 87.4% and 92.1%; specificity, 96.8% and 96.0%; positive predictive value, 90.8% and 94.0%; and negative predictive value, 95.5% and 94.6%. Substantial agreement was found when overall DSA results were compared with QISS unenhanced MRA (kappa = 0.68) and CEMRA (kappa = 0.63) in the subgroup of patients who also underwent DSA. There was almost perfect agreement between the two readers for stenosis scores, with Cohen's kappa values being greater than 0.80 for both MRA techniques.	2
58. Grozinger G, Pohmann R, Schick F, et al. Perfusion measurements of the calf in patients with peripheral arterial occlusive disease before and after percutaneous transluminal angioplasty using MR arterial spin labeling. <i>J Magn Reson Imaging</i> . 2014;40(4):980-987.	Review/Other-Dx	10 Patients	To evaluate muscle perfusion in patients with peripheral arterial occlusive disease (PAOD) before and after percutaneous transluminal angioplasty (PTA) of the limb by means of MR arterial spin labeling (ASL) perfusion measurements during reactive hyperemia.	Between baseline and post-PTA, Phyp increased in both muscle groups. At the same time, TTP and Thyph decreased in both muscle groups. At the same time the clinically assessed ankle brachial index (ABI) increased from 0.56 +/- 0.10 to 0.83 +/- 0.15. The impaired pain-free walking distance improved in all patients.	4

Lower Extremity Arterial Revascularization-Post-Therapy Imaging
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Pollak AW, Meyer CH, Epstein FH, et al. Arterial spin labeling MR imaging reproducibly measures peak-exercise calf muscle perfusion: a study in patients with peripheral arterial disease and healthy volunteers. JACC Cardiovasc Imaging. 2012;5(12):1224-1230.	Observational-Dx	35 Patients	To determine if ASL MR imaging using a pulsed ASL technique would reliably and reproducibly quantify calf muscle perfusion measured at peak plantar flexion exercise and whether ASL MR imaging could differentiate patients with PAD from normal subjects.	Peak exercise calf perfusion of 15 NL (age: 54 9 years) was higher than in 15 PAD patients (age: 64 5 years, ankle brachial index: 0.70 0.14) (80 23 ml/min – 100 g vs. 49 16 ml/min/100 g, p 0.001). Five NL performed exercise matched to PAD patients and again demonstrated higher perfusion (84 25 ml/min – 100 g, p 0.002). As a measure of reproducibility, intraclass correlation coefficient between repeated studies was 0.87 (95% confidence interval [CI]: 0.61 to 0.96). Interobserver reproducibility was 0.96 (95% CI: 0.84 to 0.99).	2
60. Versluis B, Nelemans PJ, Brans R, et al. Functional MRI in peripheral arterial disease: arterial peak flow versus ankle-brachial index. PLoS One. 2014;9(2):e88471.	Observational-Dx	183 Patients	The purpose of this study was to compare the success rate of successful arterial peak flow (APF) and ankle-brachial index (ABI) measurements in patients with suspected or known peripheral arterial disease (PAD).	APF was successfully measured in 91% of the patients, whereas the ABI could be determined in 71% of the patients (p<0.01). Success rates of APF and ABI were significantly higher in patients with intermittent claudication (95% and 80%, respectively) than in patients with critical ischemia (87% and 62%, respectively).	2
61. Versluis B, Nelemans PJ, Wildberger JE, Schurink GW, Leiner T, Backes WH. Magnetic resonance imaging-derived arterial peak flow in peripheral arterial disease: towards a standardized measurement. Eur J Vasc Endovasc Surg. 2014;48(2):185-192.	Observational-Dx	259 Patients	To determine the best location to measure the arterial peak flow (APF) in patients with peripheral arterial disease in order to facilitate clinical standardization.	Mean APF values in patients with PAD were reduced by 42%, 55% and 59% compared with non-PAD patients for the CFA, SFA, and PA, respectively (p < .01). The AUC's were 0.84, 0.92, and 0.93 for the CFA, SFA, and PA, respectively.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
62. Langham MC, Li C, Englund EK, et al. Vessel-wall imaging and quantification of flow-mediated dilation using water-selective 3D SSFP-echo. <i>J Cardiovasc Magn Reson.</i> 2013;15:100.	Review/Other-Tx	2 Patients	To introduce a new, efficient method for vessel-wall imaging of carotid and peripheral arteries by means of a flow-sensitive 3D water-selective SSFP-echo pulse sequence.	The SSFP-echo pulse sequence, which does not have a dedicated blood signal suppression preparation, achieved low blood signal permitting discrimination of the carotid and peripheral arterial walls with in-plane spatial resolution ranging from 0.5 to 0.69 mm and slice thickness of 2 to 3 mm, i.e. comparable to conventional 2D vessel-wall imaging techniques. The results of the simulations were in good agreement with analytical solution and observations for both vascular territories examined. Scan time ranged from 2.5 to 5 s per slice yielding a contrast-to-noise ratio between the vessel wall and lumen from 3.5 to 17. Mean femoral FMD in the four subjects was 9%, in good qualitative agreement with literature values.	4
63. Koziel K, Attenberger UI, Lederle K, Haneder S, Schoenberg SO, Michaely HJ. Peripheral MRA with continuous table movement: imaging speed and robustness compared to a conventional stepping table technique. <i>Eur J Radiol.</i> 2011;80(2):537-542.	Observational-Dx	82 Patients	To investigate the potential of continuous table movement (CTM)-MRA for reduction of acquisition time and to evaluate the image quality in comparison to conventional stepping table (CST) MRA. Intravenous contrast was administered in this study.	The mean imaging time for the CTM-MRA was 34% less than with the CST-MRA (18.2 min vs. 27.5 min; $p < 0.0001$). Even with inclusion of the TWIST sequence the combined CTM-/TWIST-MRA protocol was 26% faster (20.3 min vs. 27.5 min; $p < 0.0001$). The image quality was slightly better with CTM-MRA (CTM-MRA mean score 3.3+/-0.5, mean score CST-MRA 2.9+/-0.6). Venous overlay was significantly lower using the CTM-MRA approach (CTM-MRA mean score 2.8+/-0.4; CST-MRA mean score 2.2+/-0.7; $p < 0.0001$).	3
64. Egglin TK, O'Moore PV, Feinstein AR, Waltman AC. Complications of peripheral arteriography: a new system to identify patients at increased risk. <i>J Vasc Surg.</i> 1995;22(6):787-794.	Observational-Dx	549 consecutive patients	To evaluate if the literature on arteriographic complications collected in the mid 1970s still remain valid and determine if patient subgroups at increased risk could be identified.	Rate of major complications 2.9%. Patients studied for claudication or limb threatening ischemia had intermediate risk (2.0%). Previous reports overestimated the risk of arteriography for trauma or aneurysm but underestimate the risk for patients with other common conditions.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
65. Lin JS, Olson CM, Johnson ES, Whitlock EP. The ankle-brachial index for peripheral artery disease screening and cardiovascular disease prediction among asymptomatic adults: a systematic evidence review for the U.S. Preventive Services Task Force. <i>Ann Intern Med.</i> 2013;159(5):333-341.	Meta-analysis	418 full-text articles	To review the evidence on the ability of the ankle-brachial index (ABI) to predict cardiovascular disease (CVD) morbidity and mortality independent of Framingham Risk Score (FRS) factors in asymptomatic adults and on the benefits and harms of treating screen-detected adults with PAD.	One large meta-analysis (n = 43,919) showed that the ABI could reclassify 10-year risk for coronary artery disease (CAD), but it did not report measures of appropriate reclassification (the net reclassification improvement [NRI]). Four heterogeneous risk prediction studies showed that the magnitude of the NRI was probably small when the ABI was added to the FRS to predict CAD or CVD events. Of 2 treatment trials meeting inclusion criteria, 1 large trial (n = 3,350) showed that low-dose aspirin did not prevent CVD events in persons with a screen-detected low ABI but may have increased the risk for major bleeding events.	M
66. Hartmann A, Gehring A, Vallbracht C, et al. Noninvasive methods in the early detection of restenosis after percutaneous transluminal angioplasty in peripheral arteries. <i>Cardiology.</i> 1994; 84(1):25-32.	Observational-Dx	56 patients (59 lesions)	Prospective study of several noninvasive methods to evaluate the early detection of restenosis after PTA in peripheral arteries.	Noninvasive follow-up after PTA in peripheral arteries requires exercise testing with determination of ankle-arm index or segmental arterial pulse oscillography for the early detection of restenosis. The resting ABI and clinical history are not accurate in follow-up. However, because of reduced specificity, repeat CT is necessary for accurate evaluation.	3
67. Eslahpazir BA, Allemang MT, Lakin RO, et al. Pulse volume recording does not enhance segmental pressure readings for peripheral arterial disease stratification. <i>Ann Vasc Surg.</i> 2014;28(1):18-27.	Observational-Dx	76 Patients	To assess the corresponding diagnostic values for pulse volume recordings (PVRs), segmental pressure readings (SPs), and Doppler waveform traces (DWs) when subjected to interpretation by 4 vascular specialists.	Interobserver variance for all modalities was high, except for SP. When surveying for any stenosis (<50% and 50%), sensitivity (range 25e75%) was lower than specificity (range 50e84%) for all modalities. When surveying for critical stenosis only (50%), sensitivity (range 27e54%) was also lower than specificity (range 68e92%). Accuracy for detecting any stenosis with SP+DW was significantly higher than with PVR alone (66 ± 7% vs. 56 ± 12%, P ¼ 0.017). There was a significant reduction in accuracy when including incompressible readings within the SP-only analysis compared with exclusion of incompressible vessels (P ¼ 0.0006). However, the effect of vessel incompressibility on accuracy was removed with the addition of DW (P ¼ 0.17) to the protocol.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
68. Bandyk DF, Cato RF, Towne JB. A low flow velocity predicts failure of femoropopliteal and femorotibial bypass grafts. <i>Surgery</i> . 1985;98(4):799-809.	Review/Other-Dx	42 femorotibial, 24 femoropopliteal, 3 femoropopliteal (isolated segment) in situ saphenous vein bypasses	To analyze the prognostic value of Doppler-derived blood flow velocity measurements for predicting the patency of femoropopliteal and femorotibial bypass grafts.	At operation peak systolic flow velocity was greater (p less than 0.01) in femoropopliteal grafts (90 +/- 22 cm/sec) compared with femorotibial grafts (68 +/- 19 cm/sec) and isolated segment femoropopliteal (58 +/- 16 cm/sec) grafts. Diastolic forward flow, indicative of low outflow resistance, was present in all successful grafts at operation and in the immediate postoperative period, but decreased thereafter. Early graft occlusion was associated with a low peak systolic flow velocity (<40 cm/sec) and absent diastolic forward flow. Postoperative decrease in PSV to <45 cm/sec identified grafts with impending failure due to intrinsic graft lesions or progression of atherosclerosis. A low blood flow velocity threatens graft patency and should prompt an angiographic evaluation to identify correctable graft lesions or an outflow tract suitable for sequential grafting for the purpose of augmenting flow velocity.	4
69. Scali ST, Beck AW, Nolan BW, et al. Completion duplex ultrasound predicts early graft thrombosis after crural bypass in patients with critical limb ischemia. <i>J Vasc Surg</i> . 2011;54(4):1006-1010.	Observational-Dx	116 Patients	To determine if intraoperative distal graft end-diastolic velocity (EDV) using completion duplex ultrasound (CDU) predicts patency of crural bypass in patients with critical limb ischemia (CLI).	Primary, primary-assisted, and secondary patency for all crural bypasses were 62%, 66%, and 70% at 1 year, respectively. When stratified by tertiles of distal graft EDV (0 - <5 cm/s, 5-15 cm/s, >15 cm/s), 1-year primary patency rates were 32%, 64%, and 84% (P = .001). Low (0 - < 5 cm/s) distal graft EDV (hazard ratio [HR], 3.3 confidence interval [CI], 1.74-6.41; P < .001), poor-quality conduit (HR, 2.5; CI, 1.19-5.21; P = .016), age <70 (HR, 2.08; CI, 1.06-4.00; P = .031), and lack of statin use (HR, 2.04; CI, 1.04-4.00; P = .038) were independent predictors of graft failure. While the modified Rutherford score correlated with distal graft EDV (P = .05), it was not an independent predictor of patency (P = .58). Predictors of low EDV (<5 cm/s) included single-vessel runoff (odds ratio [OR], 3.33; CI, 1.14-9.71; P = .027), poor conduit (OR, 2.94; CI, 1.16-7.41; P = 0.024), and diabetes (OR, 2.86; CI, 1.14-7.21; P = .025).	3

* See Last Page for Key

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
70. Carter A, Murphy MO, Halka AT, et al. The natural history of stenoses within lower limb arterial bypass grafts using a graft surveillance program. <i>Ann Vasc Surg.</i> 2007;21(6):695-703.	Observational-Dx	212 infrainguinal lower limb grafts in 197 patients	To clarify the natural history of midterm graft failure as a consequence of myointimal hyperplasia and to identify which patients and grafts are at a higher risk of failure and at what time points this is most prevalent.	During the program, 21.6% of grafts occluded. Overall, 16% of grafts underwent a salvage procedure, 40.5% of which were carried out at the 6-month time point. There were 56.6% of occlusions preceded by a stenotic lesion. Primary occlusions accounted for 95.9% in the prosthetic group and 66.5% in the femorocrural group. As a group, vein grafts were more likely to develop a progressive stenosis prior to occlusion, with 58.3% in this group predated by a stenotic lesion. Fewer than 75% of stenoses were common and had a variable natural history, with over 40% resolving or failing to progress. Throughout the study period, 56.2% of grafts remained stenosis-free.	3
71. Calligaro KD, Doerr K, McAfee-Bennett S, Krug R, Raviola CA, Dougherty MJ. Should duplex ultrasonography be performed for surveillance of femoropopliteal and femorotibial arterial prosthetic bypasses? <i>Ann Vasc Surg.</i> 2001;15(5):520-524.	Observational-Dx	89 infrainguinal grafts in 66 patients	To determine if Duplex US could reliably detect failing prosthetic infrainguinal arterial bypasses and if there were differences in predictability between femoropopliteal and femorotibial prosthetic grafts.	The results support the routine use of Duplex US as a part of a graft surveillance protocol for femorotibial, but not femoropopliteal, prosthetic grafts.	3
72. Weitzel WF, Kim K, Henke PK, Rubin JM. High-resolution ultrasound speckle tracking may detect vascular mechanical wall changes in peripheral artery bypass vein grafts. <i>Ann Vasc Surg.</i> 2009;23(2):201-206.	Review/Other-Dx	2 subjects	To assess the use of high-resolution, phase-sensitive US speckle tracking to measure the local vessel-wall strain in two subjects with artery-vein bypass grafts.	While conventional US imaging can be used to elucidate the mechanical properties of tissues within the body, it is constrained by comparatively lower resolution and inferential, rather than direct, measurements of strain and by the small strain normally produced under physiological pressure in highly nonlinear structures such as arteries. One of our subjects was examined both before and after developing stenosis 3 months postsurgery. The strain values for this individual were found to be significantly lower, indicating a stiffer vessel wall at the stenotic region than at a nonstenotic region under both physiological and equalized pressure. These results suggest the possibility of noninvasive detection of neointimal hyperplasia preceding anastomotic stenosis.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
73. Adam DJ, Gillies TE, Kelman J, Allan PL, Chalmers RT. Vascular surgical society of great britain and ireland: duplex surveillance does not enhance infrainguinal prosthetic bypass graft patency. Br J Surg. 1999;86(5):705.	Observational-Dx	220 grafts (141 above-knee popliteal, 69 below-knee popliteal, 10 tibial)	To compare the fate of infrainguinal PTFE grafts before and after stopping duplex surveillance.	During the first study interval, an 'abnormal' scan was reported in 66/220 grafts. For clinical reasons (no further reconstruction feasible), no intervention was undertaken in 56 patients. Of these, 34 grafts occluded and 17 amputations were performed. An intervention to maintain patency was performed in 10 patients. In 154 patients with 'normal' scans, 53 grafts occluded and 21 amputations were performed. During the second study interval, 20 grafts occluded and 12 amputations were performed. In 6 patients, an attempt was made to re-establish patency and this was successful in two. Kaplan-Meier 36-month primary and secondary patency rates were 48% and 51% respectively for the group that underwent duplex surveillance, and 58% and 60% for the group that was followed without duplex imaging.	4
74. Davies AH, Hawdon AJ, Sydes MR, Thompson SG. Is duplex surveillance of value after leg vein bypass grafting? Principal results of the Vein Graft Surveillance Randomised Trial (VGST). Circulation. 2005;112(13):1985-1991.	Experimental-Dx	594 patients	To assess the benefits of duplex compared with clinical vein graft surveillance in terms of amputation rates, quality of life, and healthcare costs in patients after femoropopliteal and femorocrural vein bypass grafts.	The clinical and duplex surveillance groups had similar amputation rates (7% for each group) and vascular mortality rates (3% vs 4%) over 18 months. More patients in the clinical group had vein graft stenosis at 18 months (19% vs 12%, P=0.04), but primary patency, primary assisted patency, and secondary patency rates, respectively, were similar in the clinical group (69%, 76%, and 80%) and the duplex group (67%, 76%, and 79%). There were no apparent differences in health-related quality of life, but the average health service costs incurred by the duplex surveillance program were greater by 495 pound sterling (95% CI: 83 pound sterling to 807 pound sterling) per patient.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Hobbs SD, Pinkney T, Sykes TC, Fox AD, Houghton AD. Patency of infra-inguinal vein grafts--effect of intraoperative Doppler assessment and a graft surveillance program. J Vasc Surg. 2009;49(6):1452-1458.	Observational-Dx	468 infra-inguinal bypass procedures	To assess the value of intraoperative graft flow and resistance measurements and a graft surveillance program to predict at-risk infra-inguinal bypass grafts.	Overall primary and primary-assisted graft patency was 81% and 83% at 6 weeks and 42% and 64% at 3 years. Grafts failing by 6 weeks had significantly lower flow (130.5 mL/min vs 150.5 mL/min, P=.009) and higher resistance (0.67 peripheral resistance units vs 0.57 peripheral resistance units, P=.004) than those remaining patent. However, OpDop measured flow and resistance was a poor predictor of graft failure in individual cases (area under the receiver operating characteristic curve, 0.57). While there was no statistical difference in primary 18-month patency rates between grafts undergoing surveillance and those undergoing clinical follow up (55% vs 76%, P=.133), primary-assisted 18-month patency rates were significantly higher in the surveillance group (83% vs 77%, P=.042).	3
76. Ferris BL, Mills JL, Sr., Hughes JD, Durrani T, Knox R. Is early postoperative duplex scan surveillance of leg bypass grafts clinically important? J Vasc Surg. 2003;37(3):495-500.	Review/Other-Dx	224 bypass grafts placed in 204 patients	To review all infrainguinal vein bypass grafts prospectively entered into a surveillance protocol that included an early (<6 weeks) duplex scan study.	Early scans were abnormal (PSV, >200 cm/sec) in 58 grafts (26%). 6 grafts of the 58 (10.3%; 2.7%) with an early abnormal duplex scan and unrepaired defects occluded during the follow-up period. 30 grafts were revised on the basis of the initial early scan; 23 of these revisions were performed for critical or rapidly progressive lesions in the first 3 postoperative months. 7 lesions progressed more slowly and were repaired at a mean of 8 months after surgery. Interestingly, 22 flow abnormalities (37%) resolved or stabilized despite a PSV of more than 300 cm/sec in six cases (27%). Clear duplex scan evidence of regression or progression of these early flow abnormalities occurred within 3 months in 51/58 cases (88%). A total of 68 grafts (30%) were revised during the entire study period; 30 of these (44%) were on the basis of the early abnormal scan.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
77. Bosma J, Montauban van Swijndregt AD, Vahl AC, Wisselink W. The utility of contrast enhanced MR angiography as a first stage diagnostic modality for treatment planning in lower extremity arterial occlusive disease. <i>Acta Chir Belg.</i> 2011;111(2):73-77.	Observational-Dx	128 Patients	To evaluate the applicability of contrast enhanced magnetic resonance angiography (ce-MRA) as a first stage imaging tool for individual treatment planning in patients with lower extremity arterial occlusive disease.	In 28 extremities (15%) ce-MRA was found inconclusive and additional imaging was performed. In the remaining patients (85% of the extremities (n = 154), treatment was initiated as planned. However, in 19 (11%) of these patients, the treatment plan was altered. In 7 of them, procedural findings did not correspond with those at the time of ce-MRA, including 6 patients (3%) with a falsely diagnosed stenosis or occlusion. In total, 62 patients received non-operative treatment (34%), 65 an endovascular procedure (36%), 49 open surgical reconstruction (27%) and 6 a combined treatment.	3
78. Jeon CH, Han SH, Chung NS, Hyun HS. The validity of ankle-brachial index for the differential diagnosis of peripheral arterial disease and lumbar spinal stenosis in patients with atypical claudication. <i>Eur Spine J.</i> 2012;21(6):1165-1170.	Observational-Dx	42 Patients	To determine the diagnostic validity of ankle-brachial index (ABI) for the differential diagnosis of PAD and LSS when the etiology of claudication is uncertain.	Sixty-two legs of 42 atypical claudication patients were analyzed. Mean patient age was 65.8 ± 8.2 years (38-85) and 29 (69.0%) had diabetes mellitus. Mean ABI was 0.73 ± 0.14 (0.53-0.94) in the PAD group and 0.92 ± 0.18 (0.52-1.10) in the LSS group ($P < 0.001$). Of the 33 legs with a low ABI (ABI < 0.9), 29 legs were diagnosed as true positives for PAD by CTA and 4 were false positives, and of the 29 legs with a high ABI, 5 were false negatives and 24 were true negatives. The sensitivity and specificity of ABI for the diagnosis of PAD in patients with atypical claudication were 85.3 and 85.7%, respectively, and its positive and negative predictive values were 87.9 and 82.8%.	3
79. Hodgkiss-Harlow KD, Bandyk DF. Interpretation of arterial duplex testing of lower-extremity arteries and interventions. <i>Semin Vasc Surg.</i> 2013;26(2-3):95-104.	Review/Other-Dx	N/A	To detail the characteristic features of normal and abnormal duplex-acquired velocity spectra necessary for test interpretation and disease classification.	No results in abstract.	4
80. Iglesias J, Pena C. Computed tomography angiography and magnetic resonance angiography imaging in critical limb ischemia: an overview. <i>Tech Vasc Interv Radiol.</i> 2014;17(3):147-154.	Review/Other-Dx	N/A	To describe the rise in noninvasive vascular imaging with CTA and MRA in patients with critical limb ischemia (CLI).	No results in abstract	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
81. Rutherford RB. Acute limb ischemia. In: Cronenwett JL, Rutherford RB, eds. Decision Making in Vascular Surgery. Philadelphia, PA: WB Saunders; 2001:168-171.	Review/Other-Dx	N/A	N/A	N/A	4
82. Rolston DM, Saul T, Wong T, Lewiss RE. Bedside ultrasound diagnosis of acute embolic femoral artery occlusion. J Emerg Med. 2013;45(6):897-900.	Review/Other-Tx	1 Patient	To report evidence on use of bedside ultrasound for the detection of acute limb ischemia.	No results in abstract.	4
83. Normahani P, Standfield NJ, Jaffer U. Sources of Delay in the Acute Limb Ischemia Patient Pathway. Ann Vasc Surg. 2017;38:279-285	Observational-Tx	66 patients: 67 cases of Acute limb ischemia	To identify sources of delay in the patient pathway, from onset of symptoms to treatment, of those presenting with Acute limb ischemia.	Median time from onset of symptom to arrival at our institution was 11.35 hr (interquartile range [IQR] 6.27-72). Median cumulative time taken from arrival to vascular team review was 40 min (22.5-120), to imaging being performed was 4.75 hr (2.42-17.25), and to intervention being performed was 10.2 hr (4-31). There were significantly longer delays to presentation in those transferred from inpatient beds as compared with those transferred from the emergency department of other hospitals (66 hr [10.3-98] vs. 8 hr [5.6-14.9], P = 0.007). In total, 84.6% of patients underwent preoperative arterial imaging. Time taken from arrival to diagnostic arterial imaging was significantly longer in patients presenting out-of-hours (15 hr [6.5-20.75]) as compared with patients presenting in-hours (3.5 hr [2-6.5], P = 0.014) or during the weekend (2 hr [2-3], P = 0.022). Time from presentation to intervention was significantly shorter in patients presenting over the weekend (3.9 hr [2.6-5.1]) as compared with those presenting in-hours (14.2 hr [6.2-29], P = 0.006) and out-of-hours (16 hr [10-33], P = 0.021). Out-of-hours, a significant portion of the delay, was attributable to imaging (median time to imaging 15 hr).	3
84. Rutherford RB. Clinical staging of acute limb ischemia as the basis for choice of revascularization method: when and how to intervene. Semin Vasc Surg. 2009;22(1):5-9.	Review/Other-Dx	N/A	To discuss management techniques for acute lower extremity ischemia.	No results in abstract.	4

**Lower Extremity Arterial Revascularization-Post-Therapy Imaging
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
85. Creager MA, Kaufman JA, Conte MS. Clinical practice. Acute limb ischemia. N Engl J Med. 2012;366(23):2198-2206.	Review/Other-Dx	1 Patient	To present a clinical overview of strategies for acute limb ischemia.	No results in abstract.	4
86. Walker TG. Acute limb ischemia. Tech Vasc Interv Radiol. 2009;12(2):117-129	Review/Other-Dx	N/A	To describe imaging and management techniques for acute limb ischemia.	No results in abstract	4
87. 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. JAMA. 2009; 301(4):415-424.	Meta-analysis	20 studies; 957 patients and 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.	M

Lower Extremity Arterial Revascularization-Post-Therapy Imaging
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
88. Shue B, Damle RN, Flahive J, et al. The increased use of computed tomography angiography and magnetic resonance angiography as the sole imaging modalities prior to infrainguinal bypass has had no effect on outcomes. <i>Ann Vasc Surg.</i> 2015;29(6):1245-1254.	Observational-Tx	3123 Bypasses	To determine whether the utilization of CTA and MRA compared with contrast angiography as the primary preoperative imaging modality is associated with any differences in the outcomes of lower extremity bypass surgery.	In 3123 infrainguinal bypasses, CTA/MRA alone was used in 462 cases (15%) and angiography was used in 2661 cases (85%). Use of CTA/MRA alone increased over time, with 52 (11%) bypasses performed between 2003 and 2005, 189 (41%) bypasses performed between 2006 and 2009, and 221 (48%) bypasses performed between 2010 and 2012 (P < 0.001). Patients with CTA/MRA alone, compared with patients with angiography, more frequently underwent bypass for claudication (33% vs. 26%, P ¼ 0.001) or acute limb ischemia (13% vs. 5%, P < 0.0001), more frequently had prosthetic conduits (39% vs. 30%, P ¼ 0.001), and less frequently had tibial/pedal targets (32% vs. 40%, P ¼ 0.002). After adjusting for these and other confounders, multivariable analysis demonstrated that the use of CTA/MRA alone was not associated with a significant difference in 1 year primary patency (hazard ratio [HR] 0.95, 95% confidence interval [CI] 0.78e1.16), secondary patency (HR 1.30, 95% CI 0.99e1.72), or MALE (HR 1.08, 95% CI 0.89e1.32).	2
89. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: http://www.acr.org/~media/ACR/Documents/AppCriteria/RadiationDoseAssessmentIntro.pdf .	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	N/A	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