

Follow-up of Lower Extremity Arterial Bypass Surgery
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
1. Barnes RW, Thompson BW, MacDonald CM, et al. Serial noninvasive studies do not herald postoperative failure of femoropopliteal or femorotibial bypass grafts. <i>Ann Surg</i> 1989; 210(4):486-493; discussion 493-484.	13	232	5-year retrospective study to determine if serial noninvasive studies can predict postoperative graft failure in femoral-popliteal or femoral-tibial bypass grafts.	The 5-year cumulative primary graft patency rates were 60% and 62%, respectively in patients with stable and interval drops in ankle/arm pressure indices (API). An interval drop of .2 was considered hemodynamically significant. Significant drop in postoperative API does not predict patients with impending femoral-popliteal or femoral-tibial graft failure. Routine noninvasive surveillance and prophylactic intervention on detected asymptomatic lesions in leg bypass grafts may not be justified.	2
2. Berkowitz HD, Greenstein SM. Improved patency in reversed femoral-infrapopliteal autogenous vein grafts by early detection and treatment of the failing graft. <i>J Vasc Surg</i> 1987; 5(5):755-761.	13	94 patients 102 femoral-infrapopliteal bypasses	To describe series of 102 femoral-infrapopliteal bypass grafts. Patients were followed at 3-month intervals during the first 18 months and at 6 month intervals thereafter with noninvasive testing to document return of ischemic symptoms or loss of peripheral pulses.	22 primary graft or anastomotic stenoses were discovered in 19 grafts. The secondary patency rate in these patients following balloon angioplasty or surgery was 70%. This was significantly higher than the primary patency rate obtained in the patients who had no intervention. 23% differential represents graft salvage obtained by careful patient surveillance.	2
3. Gupta AK, Bandyk DF, Cheanvechai D, Johnson BL. Natural history of infrainguinal vein graft stenosis relative to bypass grafting technique. <i>J Vasc Surg</i> 1997; 25(2):211-220; discussion 220-215.	9	322 patients 338 infrainguinal vein bypass	To determine whether incidence of vein graft stenosis is related to bypass grafting technique. Graft patency and revision/failure rates were compared to grafting technique, need for operative revision, and intraoperative duplex scan results.	3-year primary and secondary graft patency rates were higher for in situ bypass grafts compared with reversed, non-reversed translocated or other vein bypass grafts. Bypass grafts modified at operation on the basis of a duplex find were twice as likely to require subsequent revision as grafts with a normal intraoperative scan.	2
4. Idu MM, Buth J, Hop WC, Cuypers P, van de Pavoordt ED, Tordoir JM. Factors influencing the development of vein-graft stenosis and their significance for clinical management. <i>Eur J Vasc Endovasc Surg</i> 1999; 17(1):15-21.	13	300 patients 300 infrainguinal bypass grafts	Prospective multicenter study to assess the influence of pre-existing clinical factors, particular surgical technical factors on the development of stenotic lesions.	Minimum graft diameter was the only factor correlated significantly with the development of a significant graft stenosis (defined as a peak systolic velocity ratio (PSVR) >2.5) during follow-up. There was an inverse correlation between vein graft diameter and development of stenoses.	1

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5. Rzcuidlo EM, Walsh DB, Powell RJ, et al. Prediction of early graft failure with intraoperative completion duplex ultrasound scan. <i>J Vasc Surg</i> 2002; 36(5):975-981.	13	45 tibial/pedal vein bypass grafts	Retrospective study to determine intraoperative hemodynamic parameters that predicts early failure of intragenicular vein grafts with intraoperative completion duplex US.	Intraoperative hemodynamic parameters were significantly different between grafts that remained patent or thrombosed. Only low distal end diastolic velocity (EDV) was predictive of early graft failure. Distal bypass EDV <8 cm/s predicted early graft thrombosis with 76% sensitivity and 75% specificity, 71% PPV, 78% NPV. Absence of diastolic flow (EDV of 0 cm/s) predicted early graft failure with 100% specificity and 100% PPV.	3
6. Wixon CL, Mills JL, Westerband A, Hughes JD, Ihnat DM. An economic appraisal of lower extremity bypass graft maintenance. <i>J Vasc Surg</i> 2000; 32(1):1-12.	15 (Cost analysis)	141 patients 155 infrainguinal bypass grafts	Retrospective review to appraise the economic impact of US surveillance and resultant revisions of lower extremity bypass grafts.	Revision of duplex identified stenoses was significantly less costly than revision after graft thrombosis. Compared with the cost of limb amputation, limb salvage related expenses appear to be justified.	2
7. MacKenzie KS, Hill AB, Steinmetz OK. The predictive value of intraoperative duplex for early vein graft patency in lower extremity revascularization. <i>Ann Vasc Surg</i> 1999; 13(3):275-283.	13	78 patients	Retrospective study to evaluate the ability of intraoperative duplex to identify technical abnormalities and improve early graft patency.	Intraoperative duplex scans identified subgroups of grafts which had low or high risk of early postoperative graft failure.	2
8. Avino AJ, Bandyk DF, Gonsalves AJ, et al. Surgical and endovascular intervention for infrainguinal vein graft stenosis. <i>J Vasc Surg</i> 1999; 29(1):60-70; discussion 70-61.	13	144 vein graft stenoses	To evaluate the stenosis-free patency of open repair and percutaneous transluminal balloon angioplasty of vein graft stenoses that were detected during duplex surveillance.	Cumulative assisted graft patency rate was 91% at 1-year and 80% at 3-years. Stenosis-free patency rate at 2 years was identical for surgical and endovascular interventions.	2
9. Berkowitz HD, Fox AD, Deaton DH. Reversed vein graft stenosis: early diagnosis and management. <i>J Vasc Surg</i> 1992; 15(1):130-141; discussion 141-132.	4	72 vein grafts	Report on reversed vein grafts with stenotic lesions discovered and treated before graft occlusion.	This approach to graft surveillance has been highly successful in detecting vein graft stenoses. When stenoses are found, the initial choice for therapy is generally balloon angioplasty. However, if there is recurrent stenosis subsequent to balloon angioplasty, the authors recommend surgical intervention.	2
10. Dougherty MJ, Calligaro KD, DeLaurentis DA. Revision of failing lower extremity bypass grafts. <i>Am J Surg</i> 1998; 176(2):126-130.	9	72 patients 85 lower extremity grafts	Retrospective study to compare patients with Duplex detected abnormalities who underwent revision and those who did not undergo revision.	Cumulative primary patency was significantly better at 1-year in the group not undergoing revision. Assisted primary patency, secondary patency and limb salvage rates did not differ between the groups. This report presents a contrarian view to prophylactic graft revision identified by duplex surveillance.	2

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11. Landry GJ, Moneta GL, Taylor LM, Jr., Edwards JM, Yeager RA, Porter JM. Long-term outcome of revised lower-extremity bypass grafts. <i>J Vasc Surg</i> 2002; 35(1):56-62; discussion 62-53.	13	245	To determine the results of surgical revisions of lower extremity vein grafts follow-up with duplex US for as long as 10 years.	Excellent assisted primary patency and limb-salvage rates can be achieved for as long as 10 years in grafts that requires revision. Data support aggressive regimen of duplex scanning surveillance.	2
12. Mills JL, Harris EJ, Taylor LM, Jr., Beckett WC, Porter JM. The importance of routine surveillance of distal bypass grafts with duplex scanning: a study of 379 reversed vein grafts. <i>J Vasc Surg</i> 1990; 12(4):379-386; discussion 387-379.	10	379 infringuinal reversed vein grafts	Prospective multicenter trial to assess the utility of routine duplex US surveillance of distal bypass grafts in patients with reversed vein grafts.	2.1% of 280 grafts with graft flow velocity (GFV) measurements > 45 cm per/sec failed within 6-months of a normal surveillance exam. GFV measurements < 45 cm per/sec in 99 grafts led to arteriography in 75 in which 50 stenotic lesions were identified. Only 25% of grafts identified as failing by duplex scan were associated with a reduction of ankle-brachial index of greater than 0.15. Duplex surveillance is more reliable in identifying failing vein grafts than the ABI.	1
13. 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.	10	69 grafts	To analyze the prognostic value of Doppler-derived blood flow velocity measurements for predicting the patency of femoropopliteal and femorotibial bypass grafts.	Postoperative decrease in peak systolic velocity to less than 45 cm per/sec identified grafts with impending failure due to intrinsic graft lesions or progression of atherosclerosis. A low blood flow velocity threatened graft patency and prompted angiographic evaluation to identify correctable graft lesions or an outflow tract suitable for sequential grafting for the purpose of augmenting blood flow.	2
14. Bandyk DF, Kaebnick HW, Bergamini TM, Moldenhauer P, Towne JB. Hemodynamics of in situ saphenous vein arterial bypass. <i>Arch Surg</i> 1988; 123(4):477-482.	10	128 saphenous vein arterial bypasses	Report on the use of Doppler derived blood flow velocity and limb blood pressure measurements in characterizing the hemodynamics of in situ saphenous vein arterial bypasses.	Doppler flowmeter signal spectral analysis at surgery and duplex scanning after surgery can locate unsuspected technical errors and identify grafts with low blood flow that are at increased risk for graft failure. There is low specificity of postoperative limb blood pressure in relation to the status of runoff vessels. Similarly, arteriography, the standard method for identifying technical problems at surgery, is not ideally suited for assessment of in situ saphenous vein bypasses. Valve sites with incomplete cusp incision are not reliably identified and multiple exposures are often needed for evaluation.	2

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15. Bandyk DF, Kaebnick HW, Stewart GW, Towne JB. Durability of the in situ saphenous vein arterial bypass: a comparison of primary and secondary patency. <i>J Vasc Surg</i> 1987; 5(2):256-268.	10	182 patients 192 in situ saphenous vein bypasses	Evaluate the results of in situ saphenous vein arterial bypass grafts to determine the primary and secondary patency rates (patency maintained by thrombectomy, thrombolysis, and revision).	Doppler velocity wave form analysis was an invaluable diagnostic method for locating technical problems at surgery and identifying bypass grafts at risk for a failure after surgery. This leads to earlier surgical intervention and improved secondary patency.	2
16. Belkin M, Schwartz LB, Donaldson MC, Mannick JA, Whittemore AD. Hemodynamic impact of vein graft stenoses and their prediction in the vascular laboratory. <i>J Vasc Surg</i> 1997; 25(6):1016-1021; discussion 1022.	9	12 patients 12 bypass grafts	Prospective study to compare preoperative duplex findings to intra-operative hemodynamic measurements and pre-op angiograms.	Repair of stenosed segment of graft resulted in decrease pressure gradient across lesion. Peak systolic flow velocity ratio correlated with intra-operative pressure gradient. There was less correlation between angiographic stenosis, PSVR, and intra-op gradient.	2
17. Mills JL, Fujitani RM, Taylor SM. The characteristics and anatomic distribution of lesions that cause reversed vein graft failure: a five-year prospective study. <i>J Vasc Surg</i> 1993; 17(1):195-204; discussion 204-196.	13	227 reversed vein grafts	Prospective study to identify the incidence, characteristics and anatomic distribution of lesions that cause graft failure in the intermediate postoperative period; 3-18 months after surgery.	Duplex surveillance with arteriographic confirmation identified 29 patent hemodynamically failing grafts. Duplex surveillance is necessary by the 21% incident of potentially remediable graft failure. A significant portion of these failures occurred during the intermediate postoperative period, usually as a result of focal intrinsic vein graft lesions.	2
18. Treiman GS, Lawrence PF, Bhirangi K, Gazak CE. Effect of outflow level and maximum graft diameter on the velocity parameters of reversed vein bypass grafts. <i>J Vasc Surg</i> 1999; 30(1):16-25.	13	114 patients 114 grafts	Prospective study to define a normal range of distal graft velocity (DGV) and PSV adjusting for differences in outflow and maximum graft diameter for reversed saphenous vein bypass grafts.	Grafts with larger diameters had lower DGV. Grafts with more proximal outflow arteries had higher DSV. PSV did not show a significant difference when adjusted for graft diameter.	2
19. Ihlberg L, Luther M, Tierala E, Lepantalo M. The utility of duplex scanning in infrainguinal vein graft surveillance: results from a randomised controlled study. <i>Eur J Vasc Endovasc Surg</i> 1998; 16(1):19-27.	8	179 patients 185 primary infrainguinal vein grafts	Prospective controlled randomized trial to evaluate the utility and efficacy of duplex scanning as an adjunct to clinical follow-up of infrainguinal vein bypass surgery.	One year cumulative assisted primary patency rates in the ABI (clinical) and duplex groups were 74% and 65%; secondary patency rates were 84% and 71%; limb salvage rates were 88% vs 81%. Study failed to show any beneficial effect of duplex scanning at 1-year.	1
20. Lundell A, Lindblad B, Bergqvist D, Hansen F. Femoropopliteal-crural graft patency is improved by an intensive surveillance program: a prospective randomized study. <i>J Vasc Surg</i> 1995; 21(1):26-33; discussion 33-24.	8	156 patients	Prospective randomized study to evaluate whether intensive surveillance with duplex improves patency of infrainguinal grafts.	Study showed significant improvement in patency for vein bypass grafts at 3 years. There was no significant improvement in the patency of e-polytetrafluoroethylene infrainguinal grafts. Most revisions occurred during the first postoperative year.	1

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21. Bergamini TM, George SM, Jr., Massey HT, et al. Intensive surveillance of femoropopliteal-tibial autogenous vein bypasses improves long-term graft patency and limb salvage. <i>Ann Surg</i> 1995; 221(5):507-515; discussion 515-506.	9	615 vein bypasses	To determine the impact of an intensive surveillance program on patency and limb salvage. Authors compared clinically indicated procedures with intensive surveillance.	Primary patency at 5 years was similar for bypasses treated by intensive surveillance (56%) and those treated with clinically indicated procedures (67%). Secondary patency and limb salvage at 5 years was significantly improved ($p < 0.02$) for bypasses followed by intensive surveillance (80% and 94%) compared with clinically indicated procedures (67% and 73%).	2
22. 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). <i>Circulation</i> 2005; 112(13):1985-1991.	8	594	Prospective, multicenter, randomized controlled trial to assess the benefits of duplex compared with clinical vein graft surveillance in terms of amputation rates, quality of life, and healthcare costs.	Primary, primary assisted and secondary patency rates were similar between the clinical group (69%, 76%, and 80%) and the duplex group (67%, 76%, and 79%).	1
23. Landry GJ, Moneta GL, Taylor LM, Jr., et al. Duplex scanning alone is not sufficient imaging before secondary procedures after lower extremity reversed vein bypass graft. <i>J Vasc Surg</i> 1999; 29(2):270-280; discussion 280-271.	9	1,129 reversed vein bypass grafts	To evaluate the need for preoperative arteriogram after duplex surveillance discovers an abnormality. Duplex scan results were compared with preoperative arteriograms.	Arteriography significantly contributed to operative planning in 42% of bypass graft revisions.	2
24. Toursarkissian B, D'Ayala M, Shireman PK, Schoolfield J, Sykes MT. Lower extremity bypass graft revision in diabetics. <i>Vasc Surg</i> 2001; 35(5):369-377.	9	42 infrainguinal vein bypasses	Retrospective study to evaluate the value of routine angiography before graft revision in diabetics; factors that predict patients in whom angiography alters management; and the incidence of recurrent stenosis and factors that might predict it.	Angiograms revealed additional findings in 76% of cases and altered operative plans in 71%. Duplex identified 4 lesions not seen on angiography.	3
25. Bendib K, Berthezene Y, Croisille P, Villard J, Douek PC. Assessment of complicated arterial bypass grafts: value of contrast-enhanced subtraction magnetic resonance angiography. <i>J Vasc Surg</i> 1997; 26(6):1036-1042.	9	23 patients 40 vascular grafts	Prospective study to evaluate aortoiliac and lower extremity bypass grafts with contrast-enhanced MRA (CE-MRA) by comparing results with conventional angiography.	When compared to conventional angiography, CE-MRA had a sensitivity of 91% and a specificity of 92% for diagnosis of graft stenoses and occlusions. Limitations include metallic clip artifacts, incorrect bolus timing, and field of view problems.	2
26. Dorenbeck U, Seitz J, Volk M, et al. Evaluation of arterial bypass grafts of the pelvic and lower extremities with gadolinium-enhanced magnetic resonance angiography: comparison with digital subtraction angiography. <i>Invest Radiol</i> 2002; 37(2):60-64.	9	15 patients 4 readers	To compare contrast-enhanced MRA with DSA in the assessment of patency and stenoses in bypass grafts.	93.3% of graft segments evaluated for stenosis were classified identically. Sensitivity of MRA for detecting stenoses $\geq 25\%$ was 100% and specificity 90%. CE Although MRA overestimates stenoses slightly; it has better yield results than DSA.	2

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27. Loewe C, Cejna M, Lammer J, Thurnher SA. Contrast-enhanced magnetic resonance angiography in the evaluation of peripheral bypass grafts. <i>Eur Radiol</i> 2000; 10(5):725-732.	10	27 patients 38 bypass grafts	To determine the potential of contrast-enhanced MRA in the evaluation of peripheral bypass grafts. DSA was standard of reference.	MRA agreed with DSA in detection of stenoses in 94.7% with a sensitivity of 100% and specificity of 91.3%. Limitations include decreased sensitivity for distal vessels and metallic clip artifacts.	3
28. Loewe C, Cejna M, Schoder M, et al. Contrast material-enhanced, moving-table MR angiography versus digital subtraction angiography for surveillance of peripheral arterial bypass grafts. <i>J Vasc Interv Radiol</i> 2003; 14(9 Pt 1):1129-1137.	9	39	Compare MRA with DSA to assess the accuracy of moving-table MRA in the evaluation of peripheral bypass grafts.	Compared to DSA, the accuracy, sensitivity and specificity of MRA in the detection of bypass graft stenoses were 89.9%, 90.0% and 98.3%, respectively. For detection of stenoses in the native vessels in limbs with bypass grafts these values were 87.5%, 95.6%, and 94.0%.	3
29. Reid SK, Pagan-Marin HR, Menzoian JO, Woodson J, Yucel EK. Contrast-enhanced moving-table MR angiography: prospective comparison to catheter arteriography for treatment planning in peripheral arterial occlusive disease. <i>J Vasc Interv Radiol</i> 2001; 12(1):45-53.	9	13	To prospectively compare contrast-enhanced moving-table MRA to catheter arteriography in endovascular and surgical treatment planning in patients with peripheral arterial occlusive disease.	Treatment plans were identical in 71%. MRA sensitivity was 100% with a PPV of 92%.	3
30. Bertschinger K, Cassina PC, Debatin JF, Ruehm SG. Surveillance of peripheral arterial bypass grafts with three-dimensional MR angiography: comparison with digital subtraction angiography. <i>AJR</i> 2001; 176(1):215-220.	9	39 patients 45 lower limb grafts 2 observers	Blinded study to compare MRA to DSA for evaluating peripheral arterial bypass grafts.	MRA sensitivity and specificity was 100% and 100%. Six segments out of 93 were not evaluated due to intravascular stents or metallic clips.	2
31. Meissner OA, Verrel F, Tato F, et al. Magnetic resonance angiography in the follow-up of distal lower-extremity bypass surgery: comparison with duplex ultrasound and digital subtraction angiography. <i>J Vasc Interv Radiol</i> 2004; 15(11):1269-1277.	9	24 patients 26 bypass grafts 3 readers	Prospective study to determine the agreement and accuracy of contrast enhanced MRA and US in failing lower extremity grafts. DSA served as the gold standard for cases of discrepancy.	Image quality was rated as excellent in 92% with venous contamination in 20%. 93% concordance between MRA and US. US overlooked 4 high-grade stenoses, not seen on US, but confirmed on DSA.	2
32. Andreisek G, Pfammatter T, Goepfert K, et al. Peripheral arteries in diabetic patients: standard bolus-chase and time-resolved MR angiography. <i>Radiology</i> 2007; 242(2):610-620.	9	31 patients 2 readers	Prospectively determine the diagnostic performance of standard bolus-chase MRA with time resolved imaging of contrast kinetics (TRICKS) in the evaluation of peripheral vascular disease in diabetic patients. DSA used as the standard reference.	A significantly higher number of calf and foot segments were considered diagnostic on TRICKS compared to bolus-chase MRA. Furthermore, 62% of pedal segments not seen on DSA were diagnostic on TRICKS imaging. TRICKS MRA of the calf and pedal vessels is superior to routine bolus chase MRA.	2

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33. Lapeyre M, Kobeiter H, Desgranges P, Rahmouni A, Becquemin JP, Luciani A. Assessment of critical limb ischemia in patients with diabetes: comparison of MR angiography and digital subtraction angiography. <i>AJR</i> 2005; 185(6):1641-1650.	9	31 patients 2 readers	Prospective study to evaluate the accuracy of hybrid MRA compared to DSA in diabetic patients with critical limb ischemia.	Hybrid MRA consisted of dedicated high resolution contrast enhanced imaging of the calf and foot station, followed by a three station bolus chase MRA. MRA sensitivity 90%-96% and specificity 98%-99%. 81% of the runoff vessels in the calf/feet were non-diagnostic on bolus chase MRA, but the hybrid technique resulted in significantly higher sensitivity and specificity of calf analysis (100% and 91%).	2
34. Zhang HL, Khilnani NM, Prince MR, et al. Diagnostic accuracy of time-resolved 2D projection MR angiography for symptomatic infrapopliteal arterial occlusive disease. <i>AJR</i> 2005; 184(3):938-947.	10	52 patients 59 symptomatic legs 3 observers	Retrospective study to evaluate the diagnostic accuracy of time-resolved 2D projection MRA in detecting calf and pedal arterial occlusive disease. DSA was standard of reference.	Time-resolved MRA and DSA were both performed within 30 days. The time-resolved MRA demonstrated no venous contamination. Sensitivity between readers was 83%-87% and specificity 86%-93%. In 21% of segments graded differently between MRA and DSA, MRA was shown to be more accurate.	2
35. Catalano C, Fraioli F, Laghi A, et al. Infrarenal aortic and lower-extremity arterial disease: diagnostic performance of multi-detector row CT angiography. <i>Radiology</i> 2004; 231(2):555-563.	9	50 patients 3 readers	To compare CTA with DSA in the evaluation of the infrarenal aorta and lower extremity arterial system.	Sensitivity, specificity and accuracy of MDCT were 96%, 93% and 94% respectively. Excellent interobserver agreement for treatment recommendations.	2
36. Godshall CJ. Computed tomographic angiography allows accurate planning of the setting and technique of open and percutaneous vascular interventions. <i>Am J Surg</i> 2005; 190(2):218-220.	13	85	Review prospectively maintained database to evaluate the efficacy of cross-sectional imaging as the primary imaging modality to plan interventions for arterial and venous pathology.	85 patients had 90 procedures, most of which were based on CTA (56/85). Pre-procedure plan matched successful percutaneous therapy in 88% and surgery in 98%. CTA supplemented with other non-invasive studies results in safe and effective planning for open and endovascular therapies.	3
37. Martin ML, Tay KH, Flak B, et al. Multidetector CT angiography of the aortoiliac system and lower extremities: a prospective comparison with digital subtraction angiography. <i>AJR</i> 2003; 180(4):1085-1091.	9	41 patients 3 observers	Prospective study to determine the accuracy of CTA in the evaluation of patients with peripheral vascular disease as compared with DSA.	CTA sensitivity and specificity for lesions resulting in greater than 75% stenosis was 92.2% and 96.8%. There was significant inter-technique agreement of 97%. Furthermore, 110/1,425 segments seen on CTA but not on DSA were located in the calves.	2
38. Ofer A, Nitecki SS, Linn S, et al. Multidetector CT angiography of peripheral vascular disease: a prospective comparison with intraarterial digital subtraction angiography. <i>AJR</i> 2003; 180(3):719-724.	9	18	Prospective study to determine the accuracy of CTA in the evaluation of patients with peripheral vascular disease. CTA was compared with DSA.	The degree of agreement between treatable and non-treatable lesions was 92%. Overall sensitivity and specificity of CTA was 90.9% and 92.4%.	3

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39. Rubin GD, Schmidt AJ, Logan LJ, Sofilos MC. Multi-detector row CT angiography of lower extremity arterial inflow and runoff: initial experience. <i>Radiology</i> 2001; 221(1):146-158.	13	24	To assess the patterns of lower extremity opacification using a four slice MDCT.	Attenuation measurements were 253 in the abdominal aorta, 357 in the popliteal artery and 253 in the tibial arteries. Maximum venous enhancement was 99 HU. Lower extremity inflow and runoff vessels can be reliably demonstrated in patients with peripheral vascular disease.	3
40. Soto JA, Munera F, Morales C, et al. Focal arterial injuries of the proximal extremities: helical CT arteriography as the initial method of diagnosis. <i>Radiology</i> 2001; 218(1):188-194.	9	139 patients 142 arterial segments	To compare CTA with conventional angiography in the detection of peripheral arterial traumatic injury.	Excellent correlation with sensitivity of 95% and a specificity of 98.7% for CT arteriography. Study shows the potential of peripheral arterial imaging with IV contrast-enhanced CTA. Study was not used in planning distal bypass procedures. No systematic study of vessels below the knee.	2
41. Willmann JK, Mayer D, Banyai M, et al. Evaluation of peripheral arterial bypass grafts with multi-detector row CT angiography: comparison with duplex US and digital subtraction angiography. <i>Radiology</i> 2003; 229(2):465-474.	9	65 patients 85 arterial bypass grafts 2 readers	Prospective study to assess the technical feasibility of MDCTA in the assessment of peripheral arterial bypass grafts and to evaluate its accuracy and reliability in the detection of graft-related complications by comparing it with US and DSA.	Image quality of CTA was rated as good or excellent in 98%. There was excellent agreement between readers and between CTA and duplex US in the detection of graft stenosis, aneurysmal changes, and arteriovenous fistulas. There was no statistically significant difference in sensitivity and specificity between CTA and duplex, compared to DSA.	2
42. Scherthaner R, Fleischmann D, Lomoschitz F, Stadler A, Lammer J, Loewe C. Effect of MDCT angiographic findings on the management of intermittent claudication. <i>AJR</i> 2007; 189(5):1215-1222.	13	58	Retrospective study to assess the reliability of treatment decisions based on MDCT in patients with stage IIb peripheral arterial occlusive disease.	The correct invasive treatment plan was determined based on CTA in 28 of 29 patients. One treatment was modified, because a common femoral artery stenosis was overlooked. All patients with conservative treatment plans were followed out to a mean of 501 days with no additional intervention.	3
43. Albrecht T, Foert E, Holtkamp R, et al. 16-MDCT angiography of aortoiliac and lower extremity arteries: comparison with digital subtraction angiography. <i>AJR</i> 2007; 189(3):702-711.	9	50 CTA: 2 observers DSA: 2 observers	Prospective, blinded study to compare CTA with DSA in patients with significant peripheral arterial disease.	The sensitivity and specificity of CTA for detection of stenoses greater than 50% was 90.1%-93.3% and 95.6%-96.5% respectively. The patient management based on CTA agreed with DSA in 49 of 50 patients. Statistically improved visualization of the pedal vessels on CTA.	2

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44. Ota H, Takase K, Igarashi K, et al. MDCT compared with digital subtraction angiography for assessment of lower extremity arterial occlusive disease: importance of reviewing cross-sectional images. <i>AJR</i> 2004; 182(1):201-209.	10	24	Retrospective study to evaluate the efficacy of MDCT in the assessment of peripheral arterial occlusive disease. DSA was the standard of reference.	MDCT sensitivity, specificity and accuracy for detection of stenosis graded more than mild was 99.2%, 99.1%, and 99.1%. Author emphasized the importance of reviewing the axial source data, as well as the reformats for optimized accuracy.	3
45. Kock MC, Adriaensen ME, Pattynama PM, et al. DSA versus multi-detector row CT angiography in peripheral arterial disease: randomized controlled trial. <i>Radiology</i> 2005; 237(2):727-737.	8	145	Prospective randomized control trial to evaluate patient outcomes and costs associated with DSA and MDCT when evaluating patients with peripheral vascular disease.	Physician confidence was slightly higher for DSA (8.2) compared to CTA (7.2). No difference in the quality-of-life, but the costs associated with DSA was significantly higher than CTA. Authors concluded that the use of MDCT instead of DSA as the initial diagnostic imaging test for peripheral vascular disease provides sufficient information and reduces cost.	1
46. Willmann JK, Baumert B, Schertler T, et al. Aortoiliac and lower extremity arteries assessed with 16-detector row CT angiography: prospective comparison with digital subtraction angiography. <i>Radiology</i> 2005; 236(3):1083-1093.	9	39 2 readers	To prospectively compare the accuracy of CTA with DSA in the assessment of peripheral vascular disease. DSA was the reference standard.	CTA sensitivity and specificity was 96% and 97% respectively. Excellent sensitivity and specificity for the small infrapopliteal arteries. Radiation dose was also found to be statistically lower for CTA compared with DSA.	2
47. Ouwendijk R, de Vries M, Pattynama PM, et al. Imaging peripheral arterial disease: a randomized controlled trial comparing contrast-enhanced MR angiography and multi-detector row CT angiography. <i>Radiology</i> 2005; 236(3):1094-1103.	8	157	Random, prospective trial to evaluate the clinical utility, patient outcomes, and costs of MRA vs. CTA when evaluating peripheral vascular disease.	Mean confidence was similar between modalities; CTA 8.0 and MRA 7.7. There were no differences in patient outcomes, but cost for MRA was significantly higher.	1
48. 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.	8	514	Randomized multicenter trial to compare the costs and effects of three non-invasive imaging tests as the initial imaging test in the workup of peripheral vascular disease.	Clinical utility and confidence was significantly higher for both CTA and MRA compared to duplex US. Clinical outcomes and quality-of-life were similar for CTA and MRA. Cost was again higher for MRA. The study suggests that both CTA and MRA are clinically more useful than duplex US with a cost savings when using CTA in the evaluation of peripheral vascular disease.	1
49. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/SecondaryMainMenu/Categories/quality_safety/contrast_manual.aspx .	15	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	3

Evidence Table Key

Study Type Key

Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
 - a. Cohort
 - b. Cross-sectional
 - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews

8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.