Abdominal Aortic Aneurysm Interventional Planning and Follow-up
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Parodi JC, Palmaz JC, Barone HD. Transfemoral intraluminal graft implantation for abdominal aortic aneurysms. Ann Vasc Surg. 1991; 5(6):491-499.	Review/Other-Dx	5 patients	To report on the initial clinical trials exploring the feasibility of exclusion of an AAA by placement of an intraluminal, stent-anchored, Dacron prosthetic graft using retrograde cannulation of the common femoral artery under local or regional anesthesia.	Experiments showed that when a balloon-expandable stent was sutured to the partially overlapping ends of a tubular, knitted Dacron graft, friction seals were created which fixed the ends of the graft to the vessel wall. This excludes the aneurysm from circulation and allows normal flow through the graft lumen. It is believed that further developments and more clinical trials are needed before this technique becomes widely used.	4
2. Greco G, Egorova NN, Gelijns AC, et al. Development of a novel scoring tool for the identification of large >/=5 cm abdominal aortic aneurysms. Ann Surg. 2010; 252(4):675-682.	Observational-Dx	3.1 million people	To evaluate more than 3 million screened individuals and develop a scoring tool to identify >/=5-cm diameter AAAs in the entire population at risk.	Smoking had a profound influence on the risk of AAA, which increased with number of cigarettes smoked and years of smoking, and decreased following smoking cessation. Novel findings included a protective effect of exercise, normal weight, and Black/Hispanic race/ethnicity. Using these and other factors, the scoring system provided good predictive accuracy (C-statistic = 0.82), when tested against the validation subset of the study cohort. The model predicts the presence of 121,000 >/=5 cm AAA in the US population (prevalence: 0.14%). Demonstrating the inadequacy of the current screening recommendations, only 35% of these aneurysms were among males aged 65 to 75 years. Based on the largest cohort of patients ever screened for AAA, the authors developed a screening strategy that can identify large AAAs in a broad population of individuals at risk.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
3. Schmidt T, Muhlberger N, Chemelli-Steingruber IE, et al. Benefit, risks and cost-effectiveness of screening for abdominal aortic aneurysm. Rofo. 2010; 182(7):573-580.	Review/Other-Dx	N/A	To summarize the current evidence from published health economic models for the long-term effectiveness and cost-effectiveness of screening programs for AAA	8 cost-effectiveness models published between 1993 and 2007 comparing AAA screening and lack of screening in men over 60. One model yielded a loss of life-years at additional costs. The remaining seven models yielded gains in life expectancy ranging from 0.02 to 0.28LYs. Gains in quality-adjusted life expectancy reported by six of the seven models ranged from 0.015 to 0.059 QALYs. Incremental costs ranged from 96 to 721 Euros. Incremental cost-effectiveness ratios (ICER) ranged from 1443 to 13 299 Euros per LY or QALY gained. CONCLUSION: Based on our analysis, the introduction of a screening program to identify AAA will probably gain additional life years and quality of life at acceptable extra costs. The target population for a screening program should be men 65 years and older.	4
4. Brewster DC, Cronenwett JL, Hallett JW, Jr., Johnston KW, Krupski WC, Matsumura JS. Guidelines for the treatment of abdominal aortic aneurysms. Report of a subcommittee of the Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. J Vasc Surg. 2003; 37(5):1106-1117.	Review/Other-Tx	N/A	Guidelines for the treatment of AAA.	Until long-term outcome of endoluminal repair is better defined and results of randomized trials available, the choice between endovascular and open repair will continue to rely heavily on patient preference.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
5. Nelson PR, Kracjer Z, Kansal N, et al. A multicenter, randomized, controlled trial of totally percutaneous access versus open femoral exposure for endovascular aortic aneurysm repair (the PEVAR trial). J Vasc Surg. 2014;59(5):1181-1193.	Experimental-Tx	151 patients	To assess the safety and effectiveness of totally percutaneous endovascular aortic aneurysm repair (PEVAR) with use of a 21F endovascular stent graft system and either an 8F or 10F suture-mediated closure system (the PEVAR trial, NCT01070069).	Baseline characteristics were similar among groups. Procedural technical success was 94% (PG), 88% (PS), and 98% (FE). One-month primary treatment success was 88% (PG), 78% (PS), and 78% (FE), demonstrating noninferiority vs FE for PG (P = .004) but not for PS (P = .102). Failure rates in the access closure substudy analyses demonstrated noninferiority of PG (6%; P = .005), but not of PS (12%; P = .100), vs FE (10%). Compared with FE, PG and PS yielded significantly shorter times to hemostasis and procedure completion and favorable trends in blood loss, groin pain, and overall quality of life. Initial noninferiority test results persist to 6 months, and no aneurysm rupture, conversion to open repair, device migration, or stent graft occlusion occurred.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
6. Oderich GS, Greenberg RK, Farber M, et al. Results of the United States multicenter prospective study evaluating the Zenith fenestrated endovascular graft for treatment of juxtarenal abdominal aortic aneurysms. J Vasc Surg. 2014;60(6):1420-1428 e1421-1425.	Observational-Tx	67 Patients	To evaluate the safety and effectiveness of the Zenith fenestrated endovascular graft (Cook Medical, Bloomington, Ind) for treatment of juxtarenal abdominal aortic aneurysms (AAAs).	There were 54 male and 13 female patients with a mean age of 74 +/- 8 years enrolled. Mean aneurysm diameter was 60 +/- 10 mm. A total of 178 visceral arteries required incorporation with small fenestrations in 118, scallops in 51, and large fenestrations in nine. Of these, all 118 small fenestrations (100%), eight of the scallops (16%), and one of the large fenestrations (11%) were aligned by stents. Technical success was 100%. There was one postoperative death within 30 days (1.5%). Mean length of hospital stay was 3.3 +/- 2.1 days. No aneurysm ruptures or conversions were noted during a mean follow-up of 37 +/- 17 months (range, 3-65 months). Two patients (3%) had migration >/= 10 mm with no endoleak, both due to cranial progression of aortic disease. Of a total of 129 renal arteries targeted by a fenestration, there were four (3%) renal artery occlusions and 12 (9%) stenoses. Fifteen patients (22%) required secondary interventions for renal artery stenosis/occlusion in 11 patients, type II endoleak in three patients, and type I endoleak in one patient. At 5 years, patient survival was 91% +/- 4%, and freedom from major adverse events was 79% +/- 6%; primary and secondary patency of targeted renal arteries was 81% +/- 5% and 97% +/- 2%, freedom from renal function deterioration was 91% +/- 5%, and freedom from secondary interventions was 63% +/- 9%.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
7. Tambyraja AL, Fishwick NG, Bown MJ, Nasim A, McCarthy MJ, Sayers RD. Fenestrated aortic endografts for juxtarenal aortic aneurysm: medium term outcomes. Eur J Vasc Endovasc Surg. 2011;42(1):54-58.	Review/Other-Tx	29 Patients	To examine the medium term outcomes of patients undergoing FEVAR for asymptomatic juxtarenal abdominal aortic aneurysm (AAA).	Twenty-nine patients were analysed on an intention to treat basis. There were 27 men and two women of median (range) age 74 (54e86) years. Mean (SD) aneurysm diameter was 68 (7) mm. Median (range) ASA score was 3 (2e4). No procedures required conversion to an open procedure, but one procedure was abandoned. Seventy-nine visceral vessels were perfused through a fabric fenestration or scallop. All vessels remained patent at completion angiography. No patients died within 30-days of surgery. During follow up there were four (14%) deaths at a median (range) of 17 (8e21) months after aneurysm repair. None of these deaths were aneurysm related. Eighteen (62%) patients suffered one or more graft related complications, of whom 11 (38%) required one or more early or late reintervention.	4
8. Ahanchi SS, Carroll M, Almaroof B, Panneton JM. Anatomic severity grading score predicts technical difficulty, early outcomes, and hospital resource utilization of endovascular aortic aneurysm repair. J Vasc Surg. 2011; 54(5):1266-1272.	Review/Other-Dx	108 patients	Retrospective study to calculate the ASG score using M2S three-dimensional image rendering software and provide the practical translation of this score into early outcomes charges of EVAR.	Operative outcomes significantly different in the low-score group vs high-score group were number of endograft implants (three vs four, P = .001), operative time (113 vs 210 minutes, P < .0001), blood loss (227 vs 866 mL, P = .0002), and contrast volume (100 vs 131 mL, P = .032). In the low-score group compared with the high-score group, access site adjuncts were 14% vs 50% (P < .0001), and intraoperative adjuncts were 54% vs 80% (P = .004). Most adjuncts (75%) were endovascular. No EVARs were converted to open. Mean hospital stay was 2 days for the low-score group and 5 days for the high-score group (P = .012). The 30-day operative mortality was zero. No aneurysm-related deaths occurred during follow-up. In the low-score vs high-score groups, mean operating room supply charge was $16,646 vs $25,765 (P = .006), and the mean total hospital charge was $70,956 vs $105,153 (P = .016).	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
9. Dillavou ED, Muluk SC, Makaroun MS. Improving aneurysm-related outcomes: nationwide benefits of endovascular repair. J Vasc Surg. 2006; 43(3):446-451; discussion 451-442.	Review/Other-Tx	N/A	To evaluate a national Medicare database to establish the effect of EVAR introduction into the United States.	Elective AAA repairs averaged 87.7 per 100,000 Medicare patients between 2000 and 2003, with EVAR has steadily increasing to 41% of elective repairs in 2003. From 2000 to 2003, overall elective AAA mortality declined from 5.0% to 3.7% (P<.001), while open repair mortality remained unchanged. Average elective repair hospital charges were not different between groups, but Medicare reimbursement was lower for EVAR, with a higher proportion cases classified as DRG 111. EVAR is replacing open surgery without an increase in overall case volume. EVAR is responsible for overall decrease in operative mortality even in ruptured aneurysms while decreasing utilization variables. Reimbursement to hospitals is shrinking, however.	4
10. Lovegrove RE, Javid M, Magee TR, Galland RB. A meta-analysis of 21,178 patients undergoing open or endovascular repair of abdominal aortic aneurysm. Br J Surg. 2008; 95(6):677-684.	Meta-analysis	42 studies 21,178 patients	A random-effects meta-analysis to compare operative outcomes, postoperative complications, 30-day mortality and long-term patient survival after AAA surgery.	In the elective setting (20,715 patients), the endovascular method was associated with a shorter stay in intensive care (weighted mean differences –36 hours; P<0.001) and a shorter total postoperative stay (weighted mean differences –5.4 days; P<0.001). Cardiac (OR 1.76; P=0.002) and respiratory (OR 4.01; P<0.001) complications were more common after open surgery. In the endovascular group, 30-day mortality was lower (OR 0.46; P<0.001). Endovascular surgery was also associated with an improved long-term aneurysm-related mortality (HR 0.39; P<0.001). The EVAR offers a clear benefit in terms of reduction in postoperative adverse events and 30-day mortality. In the longer term, it is also associated with a reduction in aneurysm-related mortality, but not in all-cause mortality.	M

Abdominal Aortic Aneurysm Interventional Planning and Follow-up
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
11. Schermerhorn ML, O'Malley AJ, Jhaveri A, Cotterill P, Pomposelli F, Landon BE. Endovascular vs. open repair of abdominal aortic aneurysms in the Medicare population. N Engl J Med. 2008; 358(5):464-474.	Observational-Tx	22,830 matched patients	To evaluate perioperative rates of death and complications, long-term survival, rupture, and reinterventions after open repair as compared with EVAR of AAA in propensity-score-matched cohorts of Medicare beneficiaries undergoing repair during the 2001-2004 period, with follow-up until 2005.	Perioperative mortality was lower after endovascular repair than after open repair (1.2% vs 4.8%, P<0.001). Late survival was similar in the two cohorts, although the survival curves did not converge until after 3 years. By 4 years, surgery for laparotomy-related complications was more likely among patients who had undergone open repair (9.7%, vs 4.1% among those who had undergone EVAR; P<0.001), as was hospitalization without surgery for bowel obstruction or abdominal-wall hernia (14.2% vs 8.1%, P<0.001). As compared with open repair, EVAR is associated with lower short-term rates of death and complications. The survival advantage is more durable among older patients. Late reinterventions related to AAA are more common after EVAR but are balanced by an increase in laparotomy-related reinterventions and hospitalizations after open surgery.	2
12. De Bruin JL, Baas AF, Buth J, et al. Long-term outcome of open or endovascular repair of abdominal aortic aneurysm. N Engl J Med. 2010; 362(20):1881-1889.	Experimental-Tx	351 total patients	Multicenter, randomized, controlled trial to obtain information regarding the comparative outcome more than 2 years after surgery.	6-years after randomization, the cumulative survival rates were 69.9% for open repair and 68.9% for endovascular repair (difference, 1.0 percentage point; 95% confidence interval [CI], -8.8 to 10.8; P=0.97). The cumulative rates of freedom from secondary interventions were 81.9% for open repair and 70.4% for endovascular repair (difference, 11.5 percentage points; 95% CI, 2.0 to 21.0; P=0.03). Six years after randomization, endovascular and open repair of abdominal aortic aneurysm resulted in similar rates of survival. The rate of secondary interventions was significantly higher for endovascular repair.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
13. Greenhalgh RM, Brown LC, Powell JT, Thompson SG, Epstein D, Sculpher MJ. Endovascular versus open repair of abdominal aortic aneurysm. N Engl J Med. 2010; 362(20):1863-1871.	Experimental-Tx	1,252 total patients	Randomized trial to evaluate endovascular versus open repair or abdominal aortic aneurysm.	The 30-day operative mortality was 1.8% in the endovascular-repair group and 4.3% in the open-repair group (adjusted odds ratio for endovascular repair as compared with open repair, 0.39; 95% confidence interval [CI], 0.18 to 0.87; P=0.02). The endovascular-repair group had an early benefit with respect to aneurysm-related mortality, but the benefit was lost by the end of the study, at least partially because of fatal endograft ruptures (adjusted hazard ratio, 0.92; 95% CI, 0.57 to 1.49; P=0.73). By the end of follow-up, there was no significant difference between the two groups in the rate of death from any cause (adjusted hazard ratio, 1.03; 95% CI, 0.86 to 1.23; P=0.72). The rates of graft-related complications and reinterventions were higher with endovascular repair, and new complications occurred up to 8 years after randomization, contributing to higher overall costs. In this large, randomized trial, endovascular repair of abdominal aortic aneurysm was associated with a significantly lower operative mortality than open surgical repair. However, no differences were seen in total mortality or aneurysm-related mortality in the long term. Endovascular repair was associated with increased rates of graft-related complications and reinterventions and was more costly.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
14. Mestres G, Zarka ZA, Garcia-Madrid C, Riambau V. Early abdominal aortic endografts: a decade follow-up results. Eur J Vasc Endovasc Surg. 2010; 40(6):722-728.	Observational-Tx	61 patients	To report the results of long-term follow-up of abdominal aortic aneurysms (AAAs) treated with endografts more than a decade ago.	The primary technical success rate was 98.4%. The majority of used devices were Vanguard (65.0%), and in a bifurcated configuration (86.7%). At 10-year follow-up, the estimated cumulative follow-up rate was 82.0%; complications occurred in 74.6% of the patients and re-interventions were required in 56.9%. The Vanguard endograft was related to a higher incidence of re-interventions (P=0.012). The combined in-hospital or AAA-related mortality rate was 5.0% at 30 days and 8.2% at a 10-year follow-up (1.8% and 5.0% in elective cases, respectively). Early abdominal endografts are associated with high incidence of complications (74.6%) and re-interventions (56.9%) at a 10-year follow-up; however, the mortality rate related to the procedure or aneurysm is low (5.0% in elective cases). Early endografts need lifelong strict surveillance.	2
15. Pitoulias GA, Schulte S, Donas KP, Horsch S. Secondary endovascular and conversion procedures for failed endovascular abdominal aortic aneurysm repair: can we still be optimistic? Vascular. 2009; 17(1):15-22.	Observational-Tx	625 patients	To evaluate the incidence, etiology, and outcome of secondary endovascular and "open" conversion procedures after failed endovascular abdominal aortic aneurysm repair (EVAR).	The overall main causes for reinterventions were proximal migration (n = 60; 9.7%), progressive kinking of the stent graft (n = 59; 9.6%), and late type III endoleak (n = 12; 1.9%). Multivariate logistic regression analysis showed that factors significantly correlated with secondary procedures were the abdominal aortic aneurysm's maximum diameter, the proximal neck's width and length, and particularly the commercial withdrawal of the stent graft ($p < .001$). The morbidity and mortality rates of secondary endovascular or peripheral interventions were 0%. The mortality rate of acute secondary conversions was 20% (n = 1) and of elective secondary conversions was 8.8% (n = 3). The morbidity rates for acute and elective conversions were 0% and 65%, respectively. The aneurysm-related mortality rate in our series was below 1%.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
16. Sweet MP, Fillinger MF, Morrison TM, Abel D. The influence of gender and aortic aneurysm size on eligibility for endovascular abdominal aortic aneurysm repair. J Vasc Surg. 2011; 54(4):931-937.	Observational-Dx	140 patients	To compare the eligibility of men and women with infrarenal abdominal aortic aneurysms (AAAs) for on-label endovascular aneurysm repair (EVAR) as part of the clinician-Food & Drug Administration (FDA) collaborative effort, the Characterization of Human Aortic Anatomy Project (CHAP).	Neck length, diameter, and angulation differ for women (P < .001) even after adjustment for patient age and AAA size. EVAR eligibility based on device Instructions for Use (IFU) criterion is affected by gender. Neck length <15 mm was found in 47% of men and 63% of women. Neck angulation exceeding 60 degrees was found in 12% of men and 26% of women. Minimum iliac diameter of 6 mm was found in 35% of men and 55% of women. Only 32% of men and 12% of women met all three neck criterion and had iliac lumen diameters >6 mm. Logistic regression modeling shows that older patient age (odds ratio [OR], 0.84 per decade), increased aneurysm diameter (OR, 0.70 per cm), and female gender (OR, 0.4) are each independently associated with decreased odds of meeting all device IFU neck criterion (P < .05). EVAR eligibility by neck criterion does not decline significantly until AAA size exceeds 5.5 cm in women and 6.5 cm in men. Women are significantly less likely to meet device IFU criterion for EVAR. Aortic neck criteria and iliac access are important for men and women, but more women than men fail to meet IFU criterion. Devices that accommodate shorter infrarenal AAA neck length will have the greatest impact on expanding on-label EVAR regardless of gender. Lower profile devices and those that accommodate higher neck angulation are expected to expand EVAR eligibility further for women. EVAR eligibility is unlikely to be lost as AAAs enlarge to 5.5 cm in women and 6.5 cm in men. Observation of small AAAs until they reach the standard threshold size for repair should not compromise EVAR eligibility.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
17. Truijers M, Resch T, Van Den Berg JC, Blankensteijn JD, Lonn L. Endovascular aneurysm repair: state-of-art imaging techniques for preoperative planning and surveillance. J Cardiovasc Surg (Torino). 2009; 50(4):423-438.	Review/Other-Dx	N/A	To discuss the benefits of EVAR.	Up-to-date knowledge of noninvasive vascular imaging and image processing is crucial for EVAR planning and is essential for the development of follow-up programs involving reduced risk of harmful side effects.	4
18. AbuRahma AF, Campbell J, Stone PA, et al. The correlation of aortic neck length to early and late outcomes in endovascular aneurysm repair patients. J Vasc Surg. 2009; 50(4):738-748.	Observational-Dx	238 patients	To analyze the correlation of aortic neck length to early and late outcomes.	The mean follow-up was 24.7 months (range, 1-87 months). The initial technical success was 99%. The perioperative complication rates for groups L1, L2, and L3 were 13%, 21%, and 24%, respectively (P = .289). Proximal type I early endoleaks occurred in 12%, 42%, and 53% in groups L1, L2, and L3, respectively (P < .001). Intraoperative proximal aortic cuffs were needed to seal proximal type I endoleaks in 10%, 38%, and 47% in L1, L2, and L3 groups, respectively (P < .0001). However, the rate of late reintervention was comparable in all groups. Postoperatively, the size of the abdominal aortic aneurysm decreased or remained unchanged in 95%, 94%, and 88% in L1, L2, and L3, respectively (P = .660). Rates of freedom from late type I endoleak at 1, 2, and 3 years were 84%, 82%, and 80% for L1; 68%, 54%, and 54% for L2; and 71%, 71%, and 53% for L3 (P = .0263). Rates of freedom from late intervention at 1, 2, and 3 years were 96%, 94%, and 92% for L1; and 94%, 83%, and 83% for L2; and 93%, 93%, and 93% for L3 (P = .5334). EVAR can be used for patients with a short aortic neck; however, it was associated with a significantly higher rate of early and late type I endoleaks, resulting in an increased use of proximal aortic cuffs for sealing the endoleaks.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
19. Arko FR, Filis KA, Seidel SA, et al. How many patients with infrarenal aneurysms are candidates for endovascular repair? The Northern California experience. J Endovasc Ther. 2004; 11(1):33-40.	Review/Other-Dx	220 patients 28 community hospitals	To determine how many patients with AAA meet the anatomical selection criteria for AneuRx stent-graft repair in community hospitals of Northern California.	55% of patients (n=122) considered for EVAR in community hospitals in Northern California met the anatomical selection criteria for the AneuRx stent-graft. Men appeared to be twice as likely to meet the eligibility requirements as women. Unfavorable infrarenal neck anatomy was the primary exclusion criterion for EVAR in this community setting.	4
20. Yeung JJ, Hernandez-Boussard TM, Song TK, Dalman RL, Lee JT. Preoperative thrombus volume predicts sac regression after endovascular aneurysm repair. J Endovasc Ther. 2009; 16(3):380-388.	Observational-Dx	100 patients	To examine whether preoperative aneurysm thrombus volume correlated with abdominal aortic aneurysm (AAA) sac regression following endovascular aneurysm repair (EVAR).	AAA thrombus was classified as minimal in 24%, moderate in 23%, and severe in 53%. Thrombus area averaged 11%+/-13%, 41%+/-14%, and 72+/-12% in each group, respectively. By multivariate analysis, minimal thrombus (OR = 1.47) and greater AAA diameter (OR = 1.3) were independent predictors of sac regression at 1, 6, and 12 months (all p<0.05). Presence of neck plaque and endoleak were also independent predictors of sac expansion (p<0.05). Patients with severe preoperative thrombus were less likely to demonstrate sac regression even in the absence of endoleak. Thrombus judgment (subjective) and percent clot area (objective) were strongly correlated (R = 0.82, p<0.05). Interobserver agreement on thrombus judgment was 86%. Thrombus burden on preoperative CTA is a strong independent predictor of sac regression following EVAR. If validated by prospective studies, relative thrombus burden should be incorporated into postoperative surveillance algorithms to define procedural success and optimize the timing and cost-effectiveness of cross-sectional imaging.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
21. Timaran CH, Lipsitz EC, Veith FJ, et al. Endovascular aortic aneurysm repair with the Zenith endograft in patients with ectatic iliac arteries. Ann Vasc Surg. 2005; 19(2):161-166.	Observational-Dx	352 patients from Zenith study	To determine whether large or ecstatic common iliac arteries are a risk factor for early and late endograft failure.	Median follow-up was ~ 24 months. Freedom from iliac-related secondary intervention was not significantly different between the groups (KM, log-rank test, P=0.98) with rates at 1, 12, and 24 months of 98%, 97%, and 95% for patients with ecstatic common iliac arteries, and 100%, 95%, and 95% for patients with normal iliac arteries, respectively. The maximum common iliac arteries diameter was not a significant predictor of freedom from iliac-related secondary intervention (HR, 0.98; 95% CI, 0.7-1.4; p = 0.98). In patients with large common iliac arteries, indications for iliac-related secondary intervention included distal type I endoleak (1, 0.6%), type III endoleak (1, 0.6%), graft limb occlusion (4, 2.6%), and device stenosis (1, 0.6%). The Zenith endograft is effective for EVAR in patients with ecstatic common iliac arteries. Moreover, the presence of large common iliac arteries was not associated with an increased risk of adverse iliac-related outcome or subsequent iliac-related secondary intervention. Long-term surveillance, however, is mandatory, as iliac-related secondary interventions may be necessary.	3
22. Iezzi R, Cotroneo AR. Endovascular repair of abdominal aortic aneurysms: CTA evaluation of contraindications. Abdom Imaging. 2006; 31(6):722-731.	Review/Other-Dx	N/A	To review CTA anatomic contraindications for EVAR.	Multidetector CTA represents the current standard of reference in the evaluation of the abdominal aorta and iliac axis anatomy because it provides all the details needed for selection of patients who are suitable for endograft and the choice of the appropriate device.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
23. Lee JT, Lee GK, Chandra V, Dalman RL. Comparison of fenestrated endografts and the snorkel/chimney technique. J Vasc Surg. 2014;60(4):849-856; discussion 856-847.	Observational-Dx	N/A	To compare the early learning curve at a single institution of fenestrated repair vs the snorkel technique.	Patient demographics and AAA morphology on preoperative imaging were similar between the groups. Operative time tended to be similar in the 3- to 4-hour range, with more fluoroscopy time and less contrast material used in f-EVAR than in sn-EVAR ($P < .05$) because of differing strategies of renal premarking. Larger delivery systems for f-EVAR required a higher rate of iliac conduits (40% vs 0%). Perioperative complications, short-term renal patency rates, and evidence of acute kidney injury were similar.	3

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24. Manunga JM, Gloviczki P, Oderich GS, et al. Femoral artery calcification as a determinant of success for percutaneous access for endovascular abdominal aortic aneurysm repair. J Vasc Surg. 2013;58(5):1208-1212.	Observational-Tx	752 patients	To determine the outcomes and predictive factors for success during percutaneous endovascular aneurysm repair (PEVAR) using vascular closure devices (VCDs).	391 femoral arteries in 222 patients (29.5%; 197 men, 25 women), with a mean age of 74.8 years (range, 51-93.7 years), underwent PEVAR (169 bilateral and 53 unilateral percutaneous access). Patients with >50% anterior femoral artery calcifications or those with previous femoral artery reconstructions were not offered PEVAR. Technical success of PEVAR was 96.4% (377 of 391), with an average of two VCDs used per groin. Fourteen intraoperative failures were managed with open femoral conversion using primary repair (five) or patch angioplasty (nine). In nine patients, the procedure was converted from local to general anesthesia. Four patients required a perioperative blood transfusion. There were no significant differences in body mass index (P = .26), femoral artery size preprocedure (P = .33) or postprocedure (P = .37), sheath size (>/= 20 F vs </= 18 F), or type of VCD used between the success and failure groups. Pairwise comparisons revealed increased failure rate (P < .001) between patients with <50% anterior wall calcification vs none, <50% anterior wall calcification vs <50% posterior wall calcification, and none vs >50% posterior calcification. There was no significant difference (P = .53) between patients with <50% posterior wall calcification and those with no calcification. The 30-day mortality of the entire group was 0.9% (2 of 222 patients). No deaths occurred after conversion to open femoral closure. At a mean follow-up of 30 months (range, 1-85.2 months), there were no long-term groin complications or iliac limb occlusions.	2

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
25. Endovascular aneurysm repair versus open repair in patients with abdominal aortic aneurysm (EVAR trial 1): randomised controlled trial. Lancet. 2005; 365(9478):2179-2186.	Experimental-Tx	1,082 total patients EVAR and fit for an open repair to EVAR (n=543), open repair (n=539)	A randomized controlled trial to instigate EVAR trial 1 to compare these two treatments in terms of mortality, durability, health-related quality of life, and costs for patients with large AAA.	94% (1,017/1,082) of patients complied with their allocated treatment and 209 died by the end of follow-up on December 31, 2004 (53 of aneurysm-related causes). 4 years after randomization, all-cause mortality was similar in the two groups (about 28%; HR 0.90, 95% CI, 0.69-1.18, P=0.46), although there was a persistent reduction in aneurysm-related deaths in the EVAR group. Compared with open repair, EVAR offers no advantage with respect to all-cause mortality and health-related quality of life, is more expensive, and leads to a greater number of complications and reinterventions. However, it does result in a 3% better aneurysm-related survival. The continuing need for interventions mandates ongoing surveillance and longer follow-up of EVAR for detailed cost-effectiveness assessment.	1
26. Schanzer A, Greenberg RK, Hevelone N, et al. Predictors of abdominal aortic aneurysm sac enlargement after endovascular repair. Circulation. 2011; 123(24):2848-2855.	Observational-Dx	10,228 total patients	To evaluate compliance with anatomic guidelines for EVAR and the relationship between baseline aortoiliac arterial anatomy and post-EVAR AAA sac enlargement.	59% had a maximum AAA diameter below the 55-mm threshold at which intervention is recommended over surveillance. Only 42% of patients had anatomy that met the most conservative definition of device instructions for use; 69% met the most liberal definition of device instructions for use. The 5-year post-EVAR rate of AAA sac enlargement was 41%. Independent predictors of AAA sac enlargement included endoleak, age >/= 80 years, aortic neck diameter >/= 28 mm, aortic neck angle >60 degrees , and common iliac artery diameter >20 mm. In this multicenter observational study, compliance with EVAR device guidelines was low and post-EVAR aneurysm sac enlargement was high, raising concern for long-term risk of aneurysm rupture.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
27. Ronsivalle S, Faresin F, Franz F, Rettore C, Zanchetta M, Olivieri A. Aneurysm sac "thrombization" and stabilization in EVAR: a technique to reduce the risk of type II endoleak. J Endovasc Ther. 2010; 17(4):517-524.	Observational-Tx	404 patients	To evaluate the reduction in type II endoleak risk after introducing a new prevention method, "thrombization" or clotting of the aneurysm sac, during endovascular aneurysm repair (EVAR) versus the standard EVAR technique.	The 2 treatment groups were similar with regard to aneurysm morphology. No allergic or anaphylactic reactions were encountered related to the fibrin glue. Over median follow-up times of 72 months in group 1 and 26 months in group 2, there were 34 (15.2%) endoleaks in group 1 versus 4 (2.2%) in group 2 (p<0.0001). The incidence of type II endoleak was 0.25/100 person-months for group 1 versus 0.07/100 person-months for group 2. The preventive sac thrombization technique was significantly associated with a reduced risk of type II endoleak (HR 0.13, 95% CI 0.05 to 0.36; p<0.0001) regardless of the type of stent-graft fixation (infrarenal versus suprarenal).	2
28. Ilyas S, Shaida N, Thakor AS, Winterbottom A, Cousins C. Endovascular aneurysm repair (EVAR) follow-up imaging: the assessment and treatment of common postoperative complications. Clin Radiol. 2015;70(2):183-196.	Review/Other-Dx	N/A	To educate on surveillance techniques after endovascular abdominal aortic aneurysm repair (EVAR) to prevent rupture or lower-limb ischaemia.	No results reported.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
29. Brewster DC, Jones JE, Chung TK, et al. Long-term outcomes after endovascular abdominal aortic aneurysm repair: the first decade. Ann Surg. 2006; 244(3):426-438.	Observational-Tx	873 patients	To evaluate a 12-year experience with EVAR to document late outcomes.	Mean follow up was 27 months. 39.3% of patients had 2 or more major comorbidities, and 19.5% would be categorized as unfit for open repair. Thirty-day mortality was 1.8%. By Kaplan-Meier analysis, freedom from AAA rupture was 97.6% at 5 years and 94% at 9 years. Significant predictors of reintervention included use of first-generation devices (OR, 1.2; P<0.01) and late onset endoleak (OR, 64; P<0.001). Current generation stent grafts correlated with significantly improved outcomes. Cumulative freedom from conversion to open repair was 93.3% at 5 through 9 years, with the need for prior reintervention (OR, 16.7; P=0.001) its most important predictor. EVAR using contemporary devices is a safe, effective, and durable method to prevent AAA rupture and aneurysm-related death. Assuming suitable AAA anatomy, these data justify a broad application of EVAR across a wide spectrum of patients.	2

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
30. Bastos Goncalves F, Baderkhan H, Verhagen HJ, et al. Early sac shrinkage predicts a low risk of late complications after endovascular aortic aneurysm repair. Br J Surg. 2014;101(7):802-810.	Observational-Tx	840 Patients	To evaluate the role of early AAA sac dynamics in determining long-term outcome after EVAR.	Some 597 EVARs (71.1 per cent of all EVARs) were included. No shrinkage was observed in 284 patients (47.6 per cent), moderate shrinkage (5-9 mm) in 142 (23.8 per cent) and major shrinkage (at least 10 mm) in 171 patients (28.6 per cent). Four years after the index imaging, the rate of freedom from complications was 84.3 (95 per cent confidence interval 78.7 to 89.8), 88.1 (80.6 to 95.5) and 94.4 (90.1 to 98.7) per cent respectively. No shrinkage was an independent risk factor for late complications compared with major shrinkage (hazard ratio (HR) 3.11; $P < 0.001$). Moderate compared with major shrinkage (HR 2.10; $P = 0.022$), early postoperative complications (HR 3.34; $P < 0.001$) and increasing abdominal aortic aneurysm baseline diameter (HR 1.02; $P = 0.001$) were also risk factors for late complications. Freedom from secondary interventions and direct endoleaks was greater for patients with major sac shrinkage.	2
31. Veith FJ, Baum RA, Ohki T, et al. Nature and significance of endoleaks and endotension: summary of opinions expressed at an international conference. J Vasc Surg. 2002; 35(5):1029-1035.	Review/Other-Dx	N/A	International conference summary.	The current endoleak classification system with some important modifications is adequate. Types I and II endoleak occur after 0% to 10% and 10% to 25% of EVAR, respectively. Many (30%-100%) type II endoleaks will seal and have no detrimental effect, which never or rarely occurs with type I endoleaks. Not all endoleaks can be visualized with any technique, and increased pressure (endotension) can be transmitted through clot. Aneurysm pulsatility after EVAR correlates poorly with endoleaks and endotension. An enlarging aneurysm after EVAR mandates surgical or interventional treatment. These and other conclusions will help to resolve controversy and aid in the management of these vexing complications and should also point the way to future research in this field.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
32. Geller SC. Imaging guidelines for abdominal aortic aneurysm repair with endovascular stent grafts. J Vasc Interv Radiol. 2003; 14(9 Pt 2):S263-264.	Review/Other-Dx	N/A	Practice guidelines for AAA repair with endovascular stent grafts.	N/A	4
33. Picel AC, Kansal N. Essentials of endovascular abdominal aortic aneurysm repair imaging: preprocedural assessment. AJR Am J Roentgenol. 2014;203(4):W347-357.	Review/Other-Dx	N/A	To understand the abdominal aortic aneurysm imaging characteristics that must be accurately described for endovascular aortic aneurysm repair treatment planning, including evaluation of the landing zones, aneurysm morphology, and vascular access.	No Results in abstract.	4
34. Picel AC, Kansal N. Essentials of endovascular abdominal aortic aneurysm repair imaging: postprocedure surveillance and complications. AJR Am J Roentgenol. 2014;203(4):W358-372.	Review/Other-Dx	N/A	To review post-EVAR surveillance imaging modalities and complications that must be recognized and appropriately reported by the interpreting physician.	No Results in abstract.	4
35. Tse DM, Tapping CR, Patel R, et al. Surveillance after endovascular abdominal aortic aneurysm repair. Cardiovasc Intervent Radiol. 2014;37(4):875-888.	Review/Other-Dx	N/A	To detect asymptomatic complications, so that early secondary intervention can prevent late aneurysm rupture.	there is wide heterogeneity in surveillance strategies used among EVAR centres.	4
36. American College of Radiology. ACR–NASCI–SIR–SPR Practice Parameter for the Performance and Interpretation of Body Computed Tomography Angiography (CTA). Available at: http://www.acr.org/~/media/ACR/Documents/PGTS/guidelines/Body_CTA.pdf.	Review/Other-Dx	N/A	Guidance document to promote the safe and effective use of diagnostic and therapeutic radiology by describing specific training, skills and techniques.	N/A	4
37. Macari M, Chandarana H, Schmidt B, Lee J, Lamparello P, Babb J. Abdominal aortic aneurysm: can the arterial phase at CT evaluation after endovascular repair be eliminated to reduce radiation dose? Radiology. 2006; 241(3):908-914.	Observational-Dx	85 patients	To retrospectively determine if arterial phase CT imaging is necessary for follow-up imaging of patients who have undergone endovascular stent-graft therapy for AAA.	There was 95% confidence that arterial phase imaging would depict an endoleak missed at venous phase imaging. Arterial phase imaging contributed to a mean of 36.5% of the effective dose delivered. Study results indicate that arterial phase imaging may not be necessary for the routine detection of endoleaks. Radiation exposure can be decreased by eliminating this phase.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
38. Hong C, Heiken JP, Sicard GA, Pilgram TK, Bae KT. Clinical significance of endoleak detected on follow-up CT after endovascular repair of abdominal aortic aneurysm. AJR. 2008; 191(3):808-813.	Observational-Dx	144 patients	To evaluate the clinical significance of endoleaks detected on combined arterial and delayed contrast-enhanced follow-up CT examinations of patients who have undergone EVAR of AAA.	CT showed that three endoleaks were stable (two in the arterial phase only and one in both phases) and that 31 had resolved completely (six in the arterial phase only, eight in the delayed phase only, and 17 in both phases). This finding represents a higher frequency of resolution of endoleaks detected in one phase only than in both phases (Fisher's exact test, P=0.006). Endoleaks detected only in the delayed phase of CT had resolved spontaneously without intervention. Therefore, we can consider eliminating the delayed phase of acquisition to minimize radiation exposure.	4
39. Iezzi R, Cotroneo AR, Filippone A, et al. Multidetector CT in abdominal aortic aneurysm treated with endovascular repair: are unenhanced and delayed phase enhanced images effective for endoleak detection? Radiology. 2006; 241(3):915-921.	Observational-Dx	50 patients	To retrospectively determine the sensitivity and specificity of unenhanced, delayed enhanced phase, and arterial enhanced phase multi-detector row CT for depicting endoleaks during follow-up of EVAR.	At 12 months, sensitivity, specificity, and PPV, respectively, were 80%, 80%, and 50% for session A; 90%, 98%, and 90% for session B; and 100%, 80%, and 56% for session C. Sensitivity did not significantly differ (P>.05) among reading sessions A, B, and C, whereas specificity and PPVs in session B were significantly higher (P<.001). For 6- and 12-month follow-up, no significant differences (P>.05) were found between sessions D and B. The combination of arterial enhanced phase and unenhanced imaging performed at 1-month follow-up offers improved specificity and PPVs compared with arterial enhanced phase alone. Delayed enhanced phase imaging does not significantly increase sensitivity for detection of endoleaks, but it does depict low-flow endoleaks not seen at arterial enhanced phase.	2
40. Stavropoulos SW, Charagundla SR. Imaging techniques for detection and management of endoleaks after endovascular aortic aneurysm repair. Radiology. 2007; 243(3):641-655.	Review/Other-Dx	N/A	A review focusing on the imaging techniques used for endoleak detection and the role imaging surveillance plays in the overall care of the post-EVAR patient.	Lifelong imaging surveillance of patients after EVAR is critical to detect endoleaks for the patient's benefit and to determine the long-term performance of the stent-graft. Although CTA is the most commonly used examination for imaging surveillance, MRA, US, and DSA all have a role in endoleak detection and management.	4

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
41. Buffa V, Solazzo A, D'Auria V, et al. Dual-source dual-energy CT: dose reduction after endovascular abdominal aortic aneurysm repair. Radiol Med. 2014;119(12):934-941.	Observational-Dx	148 Patients	To evaluate the possibility of reducing the dose of ionising radiation by using dual-source dual-energy computed tomography (CT) in patients undergoing CT angiography of the aorta to search for endoleaks after endovascular aneurysm repair (EVAR). Intravenous contrast was administered in this study.	We detected 34 endoleaks (19.8%), with 100% agreement between the triple-phase and dual-energy acquisitions. The effective dose of dual-energy acquisition performed during the delayed phase was 61.7% lower than that of the triple-phase acquisition.	3
42. Stolzmann P, Frauenfelder T, Pfammatter T, et al. Endoleaks after endovascular abdominal aortic aneurysm repair: detection with dual-energy dual-source CT. Radiology. 2008; 249(2):682-691.	Observational-Dx	118 patients	To assess the diagnostic performance of dual-energy, dual-source CT in the detection of endoleaks after endovascular AAA repair.	Reading session A revealed that 52 (44%) of 118 patients had endoleaks. Overall sensitivity, specificity, NPV, and PPV for CT endoleak detection during sessions B and C were identical: 100%, 97%, 100%, and 96%, respectively. The accuracy of the session B and session C readings was not significantly different from that of the session A reading (P=.50). The effective radiation dose in the image acquisition protocol involving one dual-energy scan was significantly (P<.001) lower than the effective doses in the protocols involving standard triple-phase scanning (mean difference, 61%) and standard nonenhanced and delayed phase scanning (mean difference, 41%). Compared with standard protocols, one dual-energy dual-source CT scan performed during the delayed phase with reconstruction of virtual nonenhanced images enables detection of endoleaks after endovascular AAA repair with high accuracy and a considerably lower radiation dose.	2
43. Stavropoulos SW, Clark TW, Carpenter JP, et al. Use of CT angiography to classify endoleaks after endovascular repair of abdominal aortic aneurysms. J Vasc Interv Radiol. 2005; 16(5):663-667.	Observational-Dx	36 patients	To determine the accuracy of CTA in the classification of endoleaks in patients who have undergone EVAR.	There was agreement regarding endoleak classification between CTA and DSA on 86% of the patients (31/36 patients). Correlation between the CTA reading of the two readers was 94% (34/36 patients), yielding a kappa statistic of 0.8. Endoleak classification based on CTA correlates fairly well with DSA findings. However, optimal endoleak management requires performance of selective angiograms with DSA to classify endoleaks that are detected on CTA.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Huang SG, Woo K, Moos JM, et al. A prospective study of carbon dioxide digital subtraction versus standard contrast arteriography in the detection of endoleaks in endovascular abdominal aortic aneurysm repairs. Ann Vasc Surg. 2013;27(1):38-44.	Observational-Dx	76 Patients	To compare intraoperative endoleak detection by carbon dioxide digital subtraction angiography (CO2-DSA) during endovascular aortic aneurysm repair (EVAR) with standard iodinated contrast angiography (ICA).	Of the 76 patients undergoing EVAR, 66 were men with average age of 76 years, a mean aneurysm size of 5.8 cm (range, 4–10 cm), and creatinine of 1 (standard deviation, 0.33). ICA identified 35 type I and 15 type II endoleaks, respectively, while CO2-DSA identified 40 type I and 10 type II endoleaks. Overall, CO2-DSA had a sensitivity of 0.84, specificity of 0.72, positive predictive value of 0.86, and negative predictive value of 0.69 of intraoperative endoleak detection, with respect to ICA as the criterion standard. The interobserver κ between surgeons for ICA was 0.56, for detection of any endoleak or type I endoleak with CO2-DSA was 0.58, and for detection of type II endoleak with CO2-DSA was 0.29.	2
45. Sueyoshi E, Nagayama H, Sakamoto I, Uetani M. Carbon dioxide digital subtraction angiography as an option for detection of endoleaks in endovascular abdominal aortic aneurysm repair procedure. J Vasc Surg. 2015;61(2):298-303.	Observational-Dx	40 Patients	To evaluate carbon dioxide digital subtraction angiography (CO2-DSA) as an option for the detection of endoleaks (ELs) in the endovascular abdominal aortic aneurysm repair (EVAR) procedure.	C-DSA showed that 27 of the 40 patients (68%) had 28 ELs (type I, four; type II, 20; type III, three; type IV, one). CO2-DSA showed that 16 of the 40 patients (40%) had 17 ELs (type I, four; type II, 10; type III, three; type IV, none). For the prediction of direct ELs (type I and type III) with use of C-DSA as the criterion standard, CO2-DSA has a sensitivity of 1.0 and a specificity of 1.0. For the detection of persistent type II ELs (n = 11) with use of computed tomography findings 6 months from EVAR as the criterion standard, CO2-DSA has a sensitivity of 0.87 and a specificity of 0.97. C-DSA has a sensitivity of 0.82 and a specificity of 0.64.	2
46. American College of Radiology. Manual on Contrast Media. Available at: http://www.acr.org/Quality-Safety/Resources/Contrast-Manual.	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
47. Nguyen VL, Leiner T, Hellenthal FA, et al. Abdominal aortic aneurysms with high thrombus signal intensity on magnetic resonance imaging are associated with high growth rate. Eur J Vasc Endovasc Surg. 2014;48(6):676-684.	Observational-Dx	35 Patients	To investigate whether AAAs with high thrombus signal intensity (SI) at T1-weighted (T1w) magnetic resonance imaging (MRI) exhibit a faster aneurysm growth rate.	A total of 35 patients (m/f: 26/9; age 72 7 years; AAA maximal diameter 4.9 0.5 cm) were included. Mean aneurysm growth rate for patients in group A (n ¼ 11, 1.87 cm2/0.5 year) was two-fold higher than group B (n ¼ 17, 0.78 cm2/0.5 year, p ¼ .005) and eight-fold higher than group C (n ¼ 7, 0.23 cm2/0.5 years, p ¼ .004) at 6 months' follow-up. At 12 months' follow-up, the mean aneurysm growth rate remained significantly higher in group A (n ¼ 7, 3.03 cm2/year) than groups B (n ¼ 10, 1.63 cm2/year, p ¼ .03) and C (n ¼ 7, 0.73 cm2/year, p ¼ .004). The reproducibility for thrombus SI measurements was found to be high with a coefficient of variation of 6.2%. Aneurysm maximal cross-sectional area at baseline was not significantly different for the three groups.	2
48. Hoffmann B, Bessman ES, Um P, Ding R, McCarthy ML. Successful sonographic visualisation of the abdominal aorta differs significantly among a diverse group of credentialed emergency department providers. Emerg Med J. 2011; 28(6):472-476.	Observational-Dx	278 consecutive patients	To examine the association between emergency department (ED) providers' experience with bedside ultrasound after achieving credentialing for abdominal aortic aneurysm (AAA) sonography, and their successful visualisation rate of the abdominal aorta among consecutive patients who presented asymptomatically but with risk factors for AAA.	After controlling for bowel gas and BMI, providers with < 1 year of experience (OR 6.7, 95% CI 2.0 to 22.2) and with 1-3 years experience post credentialing for AAA (OR 9.6, 95% CI 2.2 to 43.2) were significantly less likely to visualise and accurately measure the aorta compared to providers with >3 years experience. AAA sonography performance varied markedly among a diverse group of already credential ED sonographers. The most experienced providers demonstrated best performance. The present results suggest that some providers might require > 25 proctored scans to ensure competency and training, and training on technically difficult patients should be part of the credentialing process.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
49. Millen A, Canavati R, Harrison G, et al. Defining a role for contrast-enhanced ultrasound in endovascular aneurysm repair surveillance. J Vasc Surg. 2013;58(1):18-23.	Observational-Dx	539 Patients	To identify a role for CEUS within the EVAR surveillance program.	During the study period, 539 patients underwent EVAR surveillance, of whom 33 (6%) had CEUS for unresolved issues (median age, 79; range, 66-90; 28 male). Median follow-up after EVAR was 23 months (range, 0-132). In all cases, CEUS was able to resolve the clinical issue, resulting in secondary intervention in 10 patients (30%). The remaining patients were returned to surveillance. Within the cohort of 33 patients, the clinical issues were categorized into three groups. Group 1: Endoleak of uncertain classification (n = 27: 21 type II, four type I, two had endoleak excluded). Group 2: Significant aneurysm expansion (>/= 5 mm) without apparent endoleak (n = 4: one type II, three had endoleak excluded). Group 3: Target vessel patency following fenestrated EVAR (n = 2: patency confirmed in both).	3
50. Bredahl K, Taudorf M, Long A, et al. Three-dimensional ultrasound improves the accuracy of diameter measurement of the residual sac in EVAR patients. Eur J Vasc Endovasc Surg. 2013;46(5):525-532.	Observational-Dx	124 Patients	To determine the accuracy of 3D ultrasound and 2D ultrasound using 3D CTA as the gold standard, and, secondly, to determine the reproducibility of 3D ultrasound.	Replacing 2D with 3D ultrasound, the mean difference was improved from 6.0 mm to 1.3 mm (p < .001), and the range of variability was reduced from 9.4 mm to 6.6 mm (p ¼ .009) using 3D CT as the gold standard. The mean difference between 3D ultrasound and 3D CT maximum diameter of the residual sac was 1.3 mm with upper and lower limits of agreement of 5.2 mm and 7.9 mm, respectively. Reproducibility measures of 3D ultrasound were 4 mm.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. AbuRahma AF, Welch CA, Mullins BB, Dyer B. Computed tomography versus color duplex ultrasound for surveillance of abdominal aortic stent-grafts. J Endovasc Ther. 2005; 12(5):568-573.	Observational-Dx	178 patients	To compare the ability of CT and color duplex US to detect endoleak and accurately measure aortic aneurysm diameters after endovascular repair.	Follow-up ranged from 1 to 53 months (mean 16), during which 367 paired CT and color duplex US studies were acquired. The mean diameter of the AAA sac after repair was 5.15 cm by CT vs 4.99 cm by color duplex US (P=0.07); 93% of paired studies were somewhat similar (≤5 mm). Mean preoperative to postoperative AAA size changes throughout follow-up were: 0.60 mm for CT vs -0.58 mm for color duplex US (P=0.78). 34 (19%) endoleaks were detected (26 early and 8 late). Versus CT, the sensitivity, specificity, PPV, and NPV of color duplex US for detecting endoleaks were 68%, 99%, 85%, and 97%, respectively (kappa=0.73). Color duplex US was more accurate in detecting type I endoleak than type II (88% vs 50%, P=0.046). Although color duplex US has good correlation to CT in measuring the size of AAA, it has a lower sensitivity in detecting endoleak, particularly type II. Therefore, CT scans should remain the primary imaging modality for the diagnosis of endoleak.	3
52. Bargellini I, Cioni R, Napoli V, et al. Ultrasonographic surveillance with selective CTA after endovascular repair of abdominal aortic aneurysm. J Endovasc Ther. 2009; 16(1):93-104.	Observational-Dx	196 patients	To evaluate the agreement between color-coded duplex US and CTA in monitoring aneurysm diameter and detecting endoleaks after EVAR.	The 5-year cumulative endoleak incidence was 43.8% (72 patients). At first diagnosis, US detected 55/72 (76.4%) endoleaks; of the remaining 17, only 3 (4.3%) were clinically significant in terms of aneurysm enlargement. Pairing 709 annual CTA and US examinations from 184 patients showed a high agreement (k = 0.96) between examinations in measuring maximum transverse diameter, with a mean difference between US and CTA of -2.5 mm. After the first year of follow-up, EVAR surveillance costs can be reduced by performing annual US examinations only. Keeping in mind that US underestimates diameter measurements; CTA can be reserved for patients with increasing or persistently stable aneurysm diameters.	3

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Abbas A, Hansrani V, Sedgwick N, Ghosh J, McCollum CN. 3D contrast enhanced ultrasound for detecting endoleak following endovascular aneurysm repair (EVAR). Eur J Vasc Endovasc Surg. 2014;47(5):487-492.	Observational-Dx	23 Patients	To assess the clinical utility and accuracy of 3D CEUS compared with standard 2D CEUS and CTA in post EVAR-surveillance, and its influence on patient management.	30 paired 3D CEUS and CTA images were analysed from 23 patients. Endoleaks were detected in 17 images with CTA, 18 on 2D CEUS, and 18 on 3D CEUS. The sensitivity, specificity, positive, and negative predictive values of 3D CEUS to detect endoleak were 100%, 92%, 94%, and 100%, respectively. There was excellent correlation (r ¼ 0.935; p .0001) between CTA and 3D CEUS for AAA sac diameter. Only 3D CEUS detected the inflow and outflow arteries in all 18 scans with endoleak. 2D CEUS detected the inflow in 16 (88.8%) and CTA on 12 (66.6%) of the images.	3
54. Thurnher S, Cejna M. Imaging of aortic stent-grafts and endoleaks. Radiol Clin North Am. 2002;40(4):799-833.	Review/Other-Dx	N/A	To provide a review of imaging of aortic stent-grafts and endoleaks.	No results stated in abstract.	4
55. Corriere MA, Islam A, Craven TE, Conlee TD, Hurie JB, Edwards MS. Influence of computed tomography angiography reconstruction software on anatomic measurements and endograft component selection for endovascular abdominal aortic aneurysm repair. J Vasc Surg. 2014;59(5):1224-1231 e1221-1223.	Observational-Dx	92 CTA Studies	To evaluate influences of reconstruction software on anatomic measurements and endograft component selection for EVAR, and to directly compare length and diameter measurements obtained from 3D CTA reconstructions created from pre-EVAR axial CTA images of patients treated at a single institution using three different software programs.	Diameter measurements were generally similar between programs. Mean diameters at all locations were within </= 1 mm of one another, and mean length measurements were within </= 10 mm of one another for all pairwise comparisons. Intraclass correlations coefficients between programs for diameter measurements were comparable between programs (>/= 0.82 for all diameter comparisons and >/= 0.88 for all length comparisons) and indicated good correlation. Pair-wise comparisons indicated similar rates of identical and adjacent size endograft component selection without an obvious trend toward superior agreement for any two programs. Rates of identical proximal endograft diameter selection ranged from 46% to 59%, whereas 89% to 100% of proximal endograft diameters selected between programs were within one adjacent (smaller or larger) size of each other. For iliac endograft selection, rates of identical component diameter selection between programs ranged from 36% to 69%, and 58% to 99% of selected iliac endograft diameters were within one adjacent size.	3

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56. Sobocinski J, Chenorhokian H, Maurel B, et al. The benefits of EVAR planning using a 3D workstation. Eur J Vasc Endovasc Surg. 2013;46(4):418-423.	Observational-Dx	295 Patients	To evaluate the influence of planning endovascular aneurysm repair (EVAR) with a three-dimensional (3D) workstation on early and midterm outcomes. Contrast was administered during this study.	A total of 295 patients (149 patients in group 1 and 146 patients in group 2) were included. All patients had completed a minimum of 2 years of follow-up. During this 2-year period following EVAR, the type 1 endoleak rate was 8.7% in group 1 and 1.4% in group 2 (p ¼ .004) respectively. Secondary intervention rates related to type 1 endoleak was 5.4% in group 1 and 0 in group 2 ($p < .001$). No difference was observed regarding all-cause mortality, aneurysm-related death, and freedom from secondary intervention rates during follow-up.	3
57. Tatli S, Lipton MJ, Davison BD, Skorstad RB, Yucel EK. From the RSNA refresher courses: MR imaging of aortic and peripheral vascular disease. Radiographics. 2003; 23 Spec No:S59-78.	Review/Other-Dx	N/A	To review various methods and protocols for studying the aorta and lower limb vasculature.	Understanding the principles of the main MRA techniques is essential for consistent acquisition of diagnostic images. In addition, tailoring the acquisition parameters and the imaging protocol to the vessel being imaged and the clinical question is mandatory for optimal results. Future technical developments that will lead to faster image acquisition and better contrast agents promise to further improve image quality.	4
58. Ludman CN, Yusuf SW, Whitaker SC, Gregson RH, Walker S, Hopkinson BR. Feasibility of using dynamic contrast-enhanced magnetic resonance angiography as the sole imaging modality prior to endovascular repair of abdominal aortic aneurysms. Eur J Vasc Endovasc Surg. 2000; 19(5):524-530.	Observational-Dx	16 patients	To establish the feasibility of using MRI with dynamic contrast-enhanced MRA as the sole imaging modality in the assessment of patients prior to endovascular repair of AAAs.	High-quality MRA/MRI and CT images were obtained in 16 patients. Six patients were considered suitable for an endovascular approach, one was considered borderline and 9 patients were judged unsuitable. In all cases, the overall management determined by the two methods concurred. Comparison of the two imaging modalities resulted in agreement as to suitability for an endovascular approach. We therefore conclude that in our group the use of MRI and dynamic contrast-enhanced MRA proved effective as a sole imaging modality for the assessment of these patients.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Goshima S, Kanematsu M, Kondo H, et al. Preoperative planning for endovascular aortic repair of abdominal aortic aneurysms: feasibility of nonenhanced MR angiography versus contrast-enhanced CT angiography. Radiology. 2013;267(3):948-955.	Observational-Dx	50 Patients	To compare vascular measurements to determine stent types and configurations for abdominal endovascular aneurysm repair (EVAR) by comparing results of contrast material-enhanced computed tomographic (CT) angiography and nonenhanced magnetic resonance (MR) angiography.	No significant difference was found in aortic neck diameter (observer 1: CT, 18.5 mm; MR, 19.0 mm; P = .43) (observer 2: CT, 19.6 mm; MR, 19.3 mm; P = .59), aortic neck diameter 15 mm distal to the lowest renal artery (observer 1: CT, 19.2 mm; MR, 19.2 mm; P = .38) (observer 2: CT, 19.6 mm; MR, 19.6 mm; P = .91), aortic neck length (observer 1: CT, 43.6 mm; MR, 43.6 mm; P = .85) (observer 2: CT, 44.4 mm; MR, 44.0 mm; P = .93), or other key vascular measurements (P = .23-.99) for preoperative planning. These included aneurysm diameter, lowest renal artery to aortic bifurcation length, aortic bifurcation diameter, common iliac artery diameters, external iliac artery diameters, length between orifices of lower renal and internal iliac arteries, and iliac artery sealing length. CT and MR angiography measurements showed very strong correlation (r = 0.92-0.99). Intraclass correlation coefficients between observers ranged from 0.90 to 0.98. Stent types and configurations determined with CT measurements remained unaltered when reassessed with MR measurements.	1

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
60. Shreibati JB, Baker LC, Hlatky MA, Mell MW. Impact of the Screening Abdominal Aortic Aneurysms Very Efficiently (SAAAVE) Act on abdominal ultrasonography use among Medicare beneficiaries. Arch Intern Med. 2012;172(19):1456-1462.	Review/Other-Dx	781, 264 patients	To examine the association between the SAAAVE Act and abdominal ultrasonography for AAA screening, elective AAA repair, hospitalization for AAA rupture, and all-cause mortality among male beneficiaries newly enrolled in Medicare.	Fewer than 3% of abdominal ultrasonography claims after 2007 were for SAAAVE-specific AAA screening. There was a significantly greater increase in abdominal ultrasonography use among SAAAVE-eligible beneficiaries (2.0 percentage points among 65-year-old men, from 7.6% in 2004 to 9.6% in 2008; 0.7 points [8.9% to 9.6%] among 70-year-old men; 0.7 points [10.8% to 11.5%] among 76-year-old men; and 0.9 points [7.5% to 8.4%] among 65-year-old women) ($P < .001$ for all comparisons with 65-year-old men). The SAAAVE Act was associated with increased use of abdominal ultrasonography in 65-year-old men compared with 70-year-old men (adjusted odds ratio [AOR], 1.15; 95% CI, 1.11-1.19) ($P < .001$), and this increased use remained even when SAAAVE-specific AAA screening was excluded (AOR, 1.12; 95% CI, 1.08-1.16) ($P < .001$). Implementation of the SAAAVE Act was not associated with changes in rates of AAA repair, AAA rupture, or all-cause mortality.	4

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
61. Garg T, Baker LC, Mell MW. Adherence to postoperative surveillance guidelines after endovascular aortic aneurysm repair among Medicare beneficiaries. J Vasc Surg. 2015;61(1):23-27.	Review/Other-Dx	9695 Patients	To describe long-term adherence to surveillance guidelines among United States Medicare beneficiaries and determine patient and hospital factors associated with incomplete surveillance.	Our cohort comprised 9695 patients. Median follow-up duration was 6.1 years. A CT scan #30 days of EVAR was performed in 3085 (31.8%) patients and #60 days in 60.8%. The median time to the postoperative CT was 38 days (interquartile range, 25-98 days). Complete surveillance was observed in 4169 patients (43.0%). For this group, the mean follow-up time was shorter than for those with incomplete surveillance (3.4 6 2.74 vs 6.5 6 2.1 years; P < .001). Among those with incomplete surveillance, follow-up became incomplete at 3.3 6 1.9 years, with 57.6% lost to follow-up, 64.1% with gaps in follow-up (mean gap length, 760 6 325 days), and 37.6% with both. A multivariable analysis showed incomplete surveillance was independently associated with Medicaid eligibility (hazard ratio [HR], 1.42; 95% confidence interval [CI], 1.29-1.55; P < .001), low-volume hospitals (HR, 1.12; 95% CI, 1.05-1.20; P < .001), and ruptured abdominal aortic aneurysm (HR, 1.51; 95% CI, 1.24-1.84; P < .001).	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
62. Gill HL, Ladowski S, Sudarshan M, et al. Predictive value of negative initial postoperative imaging after endovascular aortic aneurysm repair. J Vasc Surg. 2014;60(2):325-329.	Observational-Dx	134 Patients	To determine if a negative result of first postoperative imaging by computed tomography (CT) scan was predictive of decreased need for reintervention. We hypothesized that initial negative postoperative imaging could identify a low-risk cohort of patients who could be observed less frequently.	A total of 134 patients were included in the analysis. A total of 107 patients (80%) had negative initial postoperative imaging, whereas 27 patients (20%) had evidence of an endoleak. There were no significant differences between the two groups in terms of comorbidities or anticoagulation status. Kaplan-Meier survival curves showed that there was a significant difference between those patients who had a negative initial CT scan and those who had a positive scan for endoleak in terms of both overall reintervention rates and leak-related reintervention rates. Endoleak on the first postoperative CT scan was associated with a hazard ratio of 6.37 (confidence interval, 2.02-20.10; P = .002) for leak-related reintervention and a hazard ratio of 6.01 (confidence interval, 2.24-16.17; P < .001) for all-cause reintervention.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Patel MS, Carpenter JP. The value of the initial post-EVAR computed tomography angiography scan in predicting future secondary procedures using the Powerlink stent graft. J Vasc Surg. 2010; 52(5):1135-1139.	Observational-Dx	345 patients 1,519 post-EVAR CT scans	To determine if surveillance CT angiography (CTA) can be safely reduced after endovascular abdominal aortic aneurysm repair (EVAR)	Of the 58 core laboratory identified findings, the inciting abnormality was present on the initial postoperative scan in 49 (84%). Of the remaining nine CT-driven procedures, three (5.2%) were due to late sac expansion attributed to type II endoleak (n=2) or endotension (n=1); two (3.4%) were for prophylactic reasons in the absence of endoleak; and four (6.8%) were in patients with type II endoleak not observed by the core laboratory and without sac expansion. The negative predictive value of the initial postoperative CTA for the need for a secondary procedure is therefore 96.4%, which can be improved to 97.6% with duplex ultrasound surveillance to detect sac expansion. Thus, a negative initial postoperative CTA is highly predictive of long-term freedom from secondary intervention. Among enrolled patients with suitable anatomy for EVAR, most abnormalities that result in a secondary procedure are detected on the initial postoperative CTA or present with clinical symptoms. Long-term surveillance CTA may therefore be replaced by duplex ultrasound imaging if the initial postoperative CTA shows no abnormalities.	3

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
64. Sternbergh WC, 3rd, Greenberg RK, Chuter TA, Tonnessen BH. Redefining postoperative surveillance after endovascular aneurysm repair: recommendations based on 5-year follow-up in the US Zenith multicenter trial. J Vasc Surg. 2008; 48(2):278-284; discussion 284-275.	Observational-Tx	739 patients	To examine the correlation of early endoleaks with the long-term outcome in patients treated in the Zenith (Cook Inc, Bloomington, Ind) United States (US) multicenter trial, assessing possible correlation with early endoleak.	EVAR was done in 739 patients (mean follow-up, 29.9 +/- 17.1 months). Freedom from endoleak at 1 month was highly predictive (P < .001) of reduced ARM: freedom from ARM was 92.3%, 89.8%, 85.2%, 83.1% and 83.1 % at 1, 2, 3, 4, and 5 years, respectively, in patients without endoleak (83.1%) and 75%, 67.1%, 61.5%, 55.9%, and 55.9% in patients with endoleak (16.9%). Cumulative absence of endoleak at 1 year (77.6%) was associated with 94%, 91.5%, 88.1%, 85.8%, and 85.8% 1- to 5-year freedom from ARM vs 73.3%, 66.7%, 56.6%, 52.5%, and 52.5% in patients with endoleak </=1 year (22.4%), P < .001. In patients without endoleak at 12 months, the subsequent risk of any ARM was 8.2% (5-year risk, 14.2%; 1-year risk, 6.0%). In patients with significant sac shrinkage (>/=5 mm) and cumulative absence of endoleak at 12 months, the subsequent risk of an ARM was 5.3% (5-year risk, 11.1%; 1-year risk, 5.8%).	2
65. Farner MC, Carpenter JP, Baum RA, Fairman RM. Early changes in abdominal aortic aneurysm diameter after endovascular repair. J Vasc Interv Radiol. 2003; 14(2 Pt 1):205-210.	Observational-Dx	63 patients	To determine the rate of diameter change in AAA treated by endovascular repair.	The mean and median follow-up interval was 12 months. There was a significant decrease in maximum diameter at follow-up (6.0 cm vs 5.1 cm; P<.001). The mean annual decrease of AAA diameter was 8.4 mm. There is a significant difference in mean annual diameter change between patients with treated endoleak and those with persistent endoleak (P<.05). There was no difference in mean annual rate of change between patients with no endoleak and those with treated endoleak (8.4 mm/y vs 11 mm/y; P=NS). Patients with resolved endoleak exhibit a similar shrinkage rate to patients who never had endoleak during imaging follow-up. There remains a group of patients without significant sac shrinkage after EVAR yet have no endoleak on follow-up imaging (ie, endotension). It is still unclear whether these patients have received protection from AAA rupture from EVAR.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
66. Cayne NS, Veith FJ, Lipsitz EC, et al. Variability of maximal aortic aneurysm diameter measurements on CT scan: significance and methods to minimize. J Vasc Surg. 2004; 39(4):811-815.	Observational-Dx	23 AAA's	To evaluate the variability and methods to minimize substantial differences when measuring repeatedly the same AAA on the same CT scan.	Routine CT maximal diameter measurement of AAAs can have substantial interobserver variability. Standardized measurement protocols can decrease, but not eliminate, this measurement variability. Thus apparent size changes based on CT measurements may represent measurement artifact rather than actual aneurysm growth or shrinkage, particularly when a standardized system is not used.	3
67. Bargellini I, Cioni R, Petruzzi P, et al. Endovascular repair of abdominal aortic aneurysms: analysis of aneurysm volumetric changes at mid-term follow-up. Cardiovasc Intervent Radiol. 2005; 28(4):426-433.	Observational-Dx	63 consecutive patients	To evaluate the volumetric changes in AAA after EVAR in 24 months of follow-up.	Mean volume reduction rates were 6.5%, 8%, and 9.6% at 6, 12, and 24 months follow-up, respectively. Mean Dmax reduction rates were 4.2%, 6.7%, and 12%; correlation with volumes was poor (r=0.73-0.81). The accuracies of volume changes in predicting endoleaks ranged between 74.6% and 84.1% and were higher than those of Dmax modifications. The strongest independent predictor of endoleak was a volume change at 6 months ≤0.3% (P=0.005), although 6/19 (32%) patients with endoleak showed no significant AAA enlargement, whereas in 6 of 44 (14%) patients without endoleak the aneurysm enlarged. The lack of volume decrease in the aneurysm of at least 0.3% at 6 months follow-up indicates the need for closer surveillance, and has a higher predictive accuracy for an endoleak than Dmax.	3
68. Demehri S, Signorelli J, Kumamaru KK, et al. Volumetric quantification of type II endoleaks: an indicator for aneurysm sac growth following endovascular abdominal aortic aneurysm repair. Radiology. 2014;271(1):282-290.	Observational-Dx	72 Patients	To test the hypothesis that type II endoleak cavity volume (ECV) and endoleak cavity diameter (ECD) measurements are accurate indicators of aneurysm sac volume (ASV) enlargement in patients who undergo endovascular aneurysm repair (EVAR) in the abdominal aorta. Intravenous contrast was administered.	In 56 (49.5%) of 113 CT studies in type II endoleaks, there was an interval increase in ASV. The accuracies of ECVDEP (area under the ROC curve [AUC], 0.85) and normalized ECVDEP (AUC, 0.86) were superior to the accuracies of ECDM (AUC, 0.73), ECDT (AUC, 0.73), and ECVAEP (AUC, 0.66). At ROC curve analysis, the sensitivity, specificity, and positive and negative predictive values for type II endoleak cavities with an ECVDEP of less than 0.5 mL for showing no future sac volume enlargement were 33% (19 of 57), 100% (56 of 56), 100% (19 of 19), and 60% (56 of 94), respectively.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
69. Prinssen M, Verhoeven EL, Verhagen HJ, Blankensteijn JD. Decision-making in follow-up after endovascular aneurysm repair based on diameter and volume measurements: a blinded comparison. Eur J Vasc Endovasc Surg. 2003; 26(2):184-187.	Observational-Dx	82 patients	To assess whether volume, in addition to diameter, measurements facilitate decision-making after EVAR.	The intra-observer agreement was 0.93 for both diameter and volume. Volume data resulted in significantly more “good/wait” decisions out to 36 months. Diameter data resulted in more “not good/Dx or Rx”– decisions out to 36 months (all P<50.005). Post-EVAR aneurysm sac volume data appears to provide earlier reassurance, reduce unnecessary interventions and to be more sensitive to secondary problems than diameter data alone.	1
70. Bley TA, Chase PJ, Reeder SB, et al. Endovascular abdominal aortic aneurysm repair: nonenhanced volumetric CT for follow-up. Radiology. 2009;253(1):253-262.	Observational-Dx	70 patients	To retrospectively evaluate the clinical usefulness of volumetric analysis at nonenhanced CT as the sole method with which to follow-up EVAR and to identify endoleaks causing more than 2% volumetric increase from the previous volume determination.	Types I and III high-pressure endoleaks (n=10) showed a 10.0% (95% CI: 5.0%, 18.2%) interval volumetric increase. Type II low-pressure endoleaks (n=37) showed a 5.4% (95% CI: 4.6%, 6.2%) interval volumetric increase. Endoleaks associated with minimal aortic volume increase of less than 2% did not require any intervention. This protocol reduced radiation exposure by approximately 57%-82% in an average-sized patient. Serial volumetric analysis of aortic aneurysm with nonenhanced CT serves as an adequate screening test for endoleak, causing volumetric increase of more than 2% from the volume seen at the previous examination.	3

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
71. Bobadilla JL, Suwanabol PA, Reeder SB, Pozniak MA, Bley TA, Tefera G. Clinical implications of non-contrast-enhanced computed tomography for follow-up after endovascular abdominal aortic aneurysm repair. Ann Vasc Surg. 2013;27(8):1042-1048.	Observational-Dx	126 Patients	To evaluate the use of nonecontrast-enhanced CT as the primary method of follow-up after EVAR of AAAs.	Over a 7-year period, 126 patients were followed. Serial CTA was performed in 59 patients, while 67 patients were followed with the NCT protocol. The mean follow-up was 2.07 years. There were no differences in age, sex, or initial aneurysm volume or size. There were 35 total endoleaks identified. Twenty of these were early endoleaks (<30 days post-EVAR). The remaining 15 leaks were late in nature (10 in the contrast group and 5 in the noncontrast group; P=0.17). NCT aneurysm sac volume changes prompted contrasted studies in all 5 late leaks. The mean volume change was 11.2 cm3, an average change of 5.88%. These findings were not significantly different than the late leaks found by routine contrast studies (8.9 cm3; 4.98% [P=0.58]). There were no delayed ruptures or emergent reinterventions in the NCT group.	3
72. Cani A, Cotta E, Recaldini C, et al. Volumetric analysis of the aneurysmal sac with computed tomography in the follow-up of abdominal aortic aneurysms after endovascular treatment. Radiol Med. 2012;117(1):72-84.	Observational-Dx	33 Patients	To assess the usefulness of volumetric analysis for the follow-up of abdominal aortic aneurysms after endovascular repair (EVAR) and operator independence of the method. Intravenous contrast was administered in this study.	One patient was excluded. Twenty-one patients showed no endoleak: 12/21 showed a volume reduction at both follow-up scans (9.7% and 19.5%, respectively); 8/21 showed an early volume increase (9.8%) with a late reduction (10.5%); 1/21 patient showed a volume increase at both follow-up scans (endotension). Eleven patients had an endoleak (one type I, nine type II and one type III); 4/9 type II endoleaks showed a volume reduction at both post-EVAR scans (8.5% and 19.5%). All other cases showed a volume increase after EVAR (type II 15.4%/16.8%, type I 24.1%/9.1%, type III 8%/10.7%). The Friedman statistical test assessed operator independence with $p < 0.001$. Mean difference between the two operators was 0.9% (0–4.3%).	2

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
73. Nambi P, Sengupta R, Krajcer Z, Muthupillai R, Strickman N, Cheong BY. Non-contrast computed tomography is comparable to contrast-enhanced computed tomography for aortic volume analysis after endovascular abdominal aortic aneurysm repair. Eur J Vasc Endovasc Surg. 2011; 41(4):460-466.	Observational-Dx	316 consecutive patients	To evaluate whether non-contrast computed tomography (NCCT) images are as reliable as contrast-enhanced computed tomography (CECT) images for the measurement of aortic volume (AV).	Both NCCT and CECT yielded similar AVs that were highly correlated (r(2) = 0.99; P < 0.0001). Bland and Altman analysis revealed a small bias (mean +/- 2 standard deviations: -0.9 +/- 8 ml). The intraclass correlation coefficients (all >0.99; P < 0.0001) and low repeatability coefficients indicated that the AVs were reproducible with both methods. The AVs measured from NCCT images were accurate and highly reproducible compared with those from CECT images. Therefore, NCCT can be a reasonable alternative to CECT for AV assessment after EVAR. This is particularly important for patients with renal insufficiency (potentially sparing them from nephrotoxic contrast agents and unnecessary radiation) or allergy to contrast agents.	2
74. Caldwell DP, Pulfer KA, Jaggi GR, Knuteson HL, Fine JP, Pozniak MA. Aortic aneurysm volume calculation: effect of operator experience. Abdom Imaging. 2005; 30(3):259-262.	Observational-Dx	10 patients	To compare the effect of variable operator experience on volumetric calculation accuracy.	Mean aneurysm volume and volume difference between two measurements were calculated for four operators. The average (standard deviation) percent volume differences were 1.2% (0.2%) for the experienced reader, 3.2% (0.3%) for the moderately experienced reader, and 6.0% (1.0%) and 5.8% (1.1%) for the two readers with light experience. Differences between averages were statistically significant (P<0.005). This defines a percent margin of error for aortic aneurysm volume measurement and has shown a direct correlate to level of experience. Diagnosis of endoleak based on aneurysm volume enlargement on serial scans needs to account for the level of operator experience.	4

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Czermak BV, Fraedrich G, Schocke MF, et al. Serial CT volume measurements after endovascular aortic aneurysm repair. J Endovasc Ther. 2001; 8(4):380-389.	Observational-Dx	53 patients	To evaluate the efficacy of transluminal stent-graft placement in aortic aneurysms using postoperative enhanced spiral CT volumetric measurements of the aneurysm sac, the intra-aneurysmal vascular channel, the thrombus, and the stent-graft.	Mean follow-up was 16 months. Total aneurysm volumes and thrombus volumes decreased, whereas intra-aneurysmal vascular channel and stent-graft volumes increased over time. Between the postoperative and 12-month imaging studies, reductions in total aneurysm ($P=0.011$) and thrombus ($P<0.001$) volumes were significant. No statistically significant difference in volume changes for the aneurysm sac ($P=0.555$) or the thrombus ($P=0.920$) was found when comparing the 24 patients without primary leak to the 12 with primary type-II leak. Postoperative CT volumetric analysis is an effective tool for evaluating the outcome of endovascular aortic aneurysm repair. Thrombus volume measurements are more accurate than total aneurysm volumes. In patients in whom contrast agents are contraindicated, volume measurements can also be obtained without the use of contrast.	3
76. Merkle EM, Klein S, Kramer SC, Wisianowsky C. MR angiographic findings in patients with aortic endoprostheses. AJR. 2002; 178(3):641-648.	Review/Other-Dx	N/A	A pictorial essay of MRA findings in various patients with aortic endoprostheses.	Currently, multislice CT represents the imaging gold standard after endovascular repair of aortic aneurysms. MRA may become an alternative imaging modality because the development of improved hardware and software and the bolus-triggered application of contrast medium now permit satisfactory visualization of both the arterial and venous vascular systems. An important advantage of MRI relates to the low toxicity of its contrast agents; hence, MRA can be used instead of CT, particularly in patients with renal insufficiency. Finally, the amount of radiation exposure associated with an imaging modality must be considered, particularly in young patients, when selecting an imaging modality for a patient who has undergone endovascular repair of traumatic aortic rupture.	4

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77. Klemm T, Duda S, Machann J, et al. MR imaging in the presence of vascular stents: A systematic assessment of artifacts for various stent orientations, sequence types, and field strengths. J Magn Reson Imaging. 2000; 12(4):606-615.	Review/Other-Dx	8 different stent types	A systematic evaluation of the potential quality of MRI recorded in the presence of metallic stents.	The optimal strategy for visualization of vascular and perivascular regions outside the stents was fast spin-echo imaging with the stent axis and read direction parallel to the static field. Susceptibility-induced signal void in gradient-echo images was minimal using the three-dimensional approach. Increased transmitter amplitudes above usual values provided clearly improved insight in the lumen using gradient-echo sequences.	4
78. Ayuso JR, de Caralt TM, Pages M, et al. MRA is useful as a follow-up technique after endovascular repair of aortic aneurysms with nitinol endoprostheses. J Magn Reson Imaging. 2004; 20(5):803-810.	Observational-Dx	28 patients	To evaluate whether MRA is a useful tool for the follow-up of aortic aneurysms treated with nitinol endoluminal grafts.	Three type III leaks were correctly assessed at both examinations; however, CTA was less sensitive (50%) than MRA in depicting type II or unclassified leaks. No differences in aneurismal size were observed between the two examinations or between arterial signal-to-noise ratios observed in or out of the devices. MRA can provide all relevant information necessary for the follow-up of patients treated with nitinol endoprostheses, and performs better than CTA in detecting endoleaks.	3
79. Habets J, Zandvoort HJ, Reitsma JB, et al. Magnetic resonance imaging is more sensitive than computed tomography angiography for the detection of endoleaks after endovascular abdominal aortic aneurysm repair: a systematic review. Eur J Vasc Endovasc Surg. 2013;45(4):340-350.	Review/Other-Dx	11 Articles; 369 Patients	The purpose of this systematic review was to examine whether magnetic resonance imaging (MRI) or computed tomography angiography (CTA) is more sensitive for the detection of endoleaks in patients with abdominal aortic aneurysm (AAA) after EVAR.	Eleven articles were included. The overall methodological quality of the articles was good. In total, 369 patients with 562 MRI and 562 CTA examinations were included. A total of 146 endoleaks were detected by CTA; MRI detected all but two of these endoleaks. With MRI 132 additional endoleaks were found.	4

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
80. Pitton MB, Schweitzer H, Herber S, et al. MRI versus helical CT for endoleak detection after endovascular aneurysm repair. AJR. 2005; 185(5):1275-1281.	Observational-Dx	52 patients	To investigate the diagnostic accuracy of MRI and helical CT for endoleak detection.	The incidence of types I, II, and III endoleaks and complex endoleaks was 3.2%, 40.1%, 8.7%, and 4.0%, respectively. The sensitivity for endoleak detection was 92.9%, 44.0%, 34.8%, and 38.3% for MRI, biphasic CT, uniphasic arterial CT, and uniphasic late CT, respectively. The corresponding NPV were 91.7%, 58.4%, 54.7%, and 56.1%, respectively. The overall accuracy of endoleak detection and correct sizing was 95.2%, 58.3%, 55.6%, and 57.1% for MRI, biphasic CT, uniphasic arterial CT, and uniphasic late CT, respectively. MRI is significantly superior to biphasic CT for endoleak detection and rating of endoleak size, followed by uniphasic late and uniphasic arterial CT scans. MRI shows a significant number of endoleaks in cases with negative CT findings and may help illuminate the phenomenon of endotension. Endoleak rates reported after EVAR substantially depend on the imaging techniques used.	3
81. Lookstein RA, Goldman J, Pukin L, Marin ML. Time-resolved magnetic resonance angiography as a noninvasive method to characterize endoleaks: initial results compared with conventional angiography. J Vasc Surg. 2004; 39(1):27-33.	Observational-Dx	12 patients	To compare the findings of time-resolved MRA with conventional angiography for the characterization of endoleaks.	Time-resolved MRA identified 7 patients with type I leaks, including four proximal and three distal. Four patients had type II leaks, including two arising from the inferior mesenteric artery and two from an iliolumbar artery. One patient had a type III leak. Conventional angiography confirmed the type of endoleak in all 12 patients. These initial results demonstrate time-resolved MRA to be an effective noninvasive method for classifying endoleaks. This technique may allow for screening of patients with endoleaks to identify those requiring urgent repair.	2
82. Ersoy H, Jacobs P, Kent CK, Prince MR. Blood pool MR angiography of aortic stent-graft endoleak. AJR Am J Roentgenol. 2004;182(5):1181-1186.	Observational-Dx	7 patients	To investigate the value of a blood pool contrast agent in detecting endoleaks on MR angiography after endoluminal stent-graft repair of infrarenal aortic aneurysms.	No results stated in abstract.	2

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83. Ichihashi S, Marugami N, Tanaka T, et al. Preliminary experience with superparamagnetic iron oxide-enhanced dynamic magnetic resonance imaging and comparison with contrast-enhanced computed tomography in endoleak detection after endovascular aneurysm repair. J Vasc Surg. 2013;58(1):66-72.	Observational-Dx	23 patients	To examine superparamagnetic iron oxide (SPIO)-enhanced dynamic MRI as a potential alternative to contrast-enhanced computed tomogrpahy (CE-CT) for detection of endoleaks after EVAR.	A total of 11 type II endoleaks originating from either the lumbar or inferior mesenteric artery were detected. Eight were able to be detected by CE-CT (8/11:73%) and 10 (10/11:91%) by SPIO-enhanced MRI. Interobserver (kappa = 0.91; 95% CI, 0.74-1.00) and intraobserver agreement for MRI (kappa = 1.00) were excellent. Intermodality agreement for endoleak detection was moderate (kappa = 0.63; 95% CI, 0.32-0.94; and kappa = 0.62; 95% CI, 0.29-0.95 for observers A and B, respectively).	1
84. Resta EC, Secchi F, Giardino A, et al. Non-contrast MR imaging for detecting endoleak after abdominal endovascular aortic repair. Int J Cardiovasc Imaging. 2013;29(1):229-235.	Observational-Dx	23 Patients	To investigate the possibility of ruling out endoleak after endovascular aortic repair (EVAR) of abdominal aortic aneurysm (AAA) using non-contrast MRI.	Out of 23 patients, 13 (57%) were negative for endoleak at final assessment, while the remaining 10 (43%) were positive, with the following type distribution: Ia (n = 4), Ib (n = 2), II (n = 3), and III (n = 1). Sensitivity was 10/10 (100%; CI 95% 69-100%), specificity 7/13 (54%; 25-81%), accuracy 17/23 (74%; 52-90%), PPV 10/16 (63%; 35-85%) and NPV 7/7 (100%; 59-100%) for R1; 9/10 (90%; 56-100%), 8/13 (62%; 32-86%), 17/23 (74%; 52-90%), 9/14 (64%; 35-8%), and 8/9 (89%; 52-100%) for R2, respectively. Inter-reader Cohen kappa was 0.810.	3

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85. Ashoke R, Brown LC, Rodway A, et al. Color duplex ultrasonography is insensitive for the detection of endoleak after aortic endografting: a systematic review. J Endovasc Ther. 2005; 12(3):297-305.	Meta-analysis	N/A	A systematic search to synthesize the available evidence regarding the diagnostic accuracy of color duplex US vs the accepted gold-standard of contrast-enhanced CT for the detection and classification of endoleaks after aortic endografting.	From meta-analyses, the pooled sensitivity of color duplex US (vs CT as the gold standard) was 69% (95% CI 52%-87%) and the specificity of color duplex US was 91% (95% CI 87%-95%). These parameters did not appear to vary over time when a smaller dataset of 117 patients with 239 paired scans was used to compare CT and color duplex US specifically at 3, 12, and 24 months after endografting. Endoleak classification data, which was derived from only 5 small studies, indicated that color duplex US appeared to have better diagnostic accuracy in detecting type I or type III endoleaks compared with type II endoleaks; however, the data were insufficient for statistical analysis. Color duplex US currently does not have sufficient diagnostic accuracy for the detection of all endoleaks in routine clinical practice. The diagnostic accuracy of color duplex US may improve if type II endoleaks are ignored.	M

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
86. Sun Z. Diagnostic value of color duplex ultrasonography in the follow-up of endovascular repair of abdominal aortic aneurysm. J Vasc Interv Radiol. 2006; 17(5):759-764.	Meta-analysis	21 studies	To systematically review the findings of diagnostic value of color duplex US in the follow-up of endovascular repair of AAAs.	Pooled estimates of sensitivity, specificity, PPV, NPV, and accuracy of color duplex US compared with CTA (with 95% CI) were 66% (52%-81%), 93% (89%-97%), 76% (65%-87%), 90% (86%-95%), and 91% (86%-97%), respectively, for unenhanced color duplex US; and 81% (52%-100%), 82% (68%-97%), 58% (26%-90%), 95% (87%-100%), and 98% (91%-100%), respectively, for enhanced color duplex US. The sensitivity in the detection of endoleak was significantly improved with contrast material-enhanced color duplex US compared with unenhanced color duplex US (P<.05); however, no significant difference was found regarding the specificity, PPV, NPV, and accuracy between unenhanced and enhanced color duplex US (P>.05). Color duplex US was insensitive in measurement of aneurysm diameter compared with CTA in most situations. Color duplex US is not as accurate as CTA and cannot replace CTA in the follow-up of endovascular aortic repair of AAAs. However, the use of contrast material-enhanced color duplex US resulted in improvement of diagnostic accuracy in the detection of endoleak and warrants further study.	M

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
87. Gargiulo M, Gallitto E, Serra C, et al. Could four-dimensional contrast-enhanced ultrasound replace computed tomography angiography during follow up of fenestrated endografts? Results of a preliminary experience. Eur J Vasc Endovasc Surg. 2014;48(5):536-542.	Observational-Dx	22 Patients	To evaluate four-dimensional contrast-enhanced ultrasound (4D-CEUS) as an alternative imaging method to computed tomography angiography (CTA) during follow up of fenestrated endovascular aneurysm repair (FEVAR) for juxta- and para-renal abdominal aortic aneurysms (AAA).	Twenty-two patients (96% male, 4% female; mean age 74 +/- 7 years; American Society of Anesthesiologists grade III/IV 82%/18%) were enrolled. Seventy-eight RVV (fenestrations: 60; scallops: 17; branches: 1) were analyzed. The mean AAA diameter evaluated by 4D-CEUS and CTA was 45 +/- 10 mm (range 30-69 mm) and 48 +/- 9 mm (range 32-70 mm), respectively. The mean difference was 3 +/- 3 mm. The mean AAA volume evaluated by 4D-CEUS and CTA was 150 +/- 7 cc (range 88-300 cc) and 159 +/- 68 cc (range 80-310 cc), respectively. The mean difference was 7 +/- 4 cc; a Bland-Altman plot revealed agreement in AAA diameter and volume evaluation ($p < .01$) between 4D-CEUS and CTA. The observed agreement for the detection of endoleaks was 95%. McNemar's Chi-square test confirmed that 4D-CEUS and CTA were equivalent ($p > .05$) at detecting endoleaks. The first segment of six (8%) RVVs (four renal and two superior mesenteric arteries) was not directly visualized by 4D-CEUS owing to obesity, but the contrast enhancement into the distal part of vessel or into the relative parenchyma gave indirect information about their patency. McNemar's Chi-square test demonstrated the superiority of CTA ($p = .031$) in visualizing RVVs. The patency of 77/78 RVVs was confirmed with both techniques. McNemar's Chi-square test confirmed that 4D-CEUS and CTA were equivalent in their ability to detect visceral vessel patency.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
88. Gurtler VM, Sommer WH, Meimarakis G, et al. A comparison between contrast-enhanced ultrasound imaging and multislice computed tomography in detecting and classifying endoleaks in the follow-up after endovascular aneurysm repair. J Vasc Surg. 2013;58(2):340-345.	Observational-Dx	171 Patients	To compare contrast-enhanced ultrasound (CEUS) imaging and multislice computed tomography (MS-CT) angiography in detecting and classifying endoleaks in the follow-up of patients after endovascular aneurysm repair (EVAR).	From the 132 patients in our cohort, we obtained 200 contemporary imaging examination pairs. MS-CT was used as the preferred examination in determining the presence of an endoleak. The true-positive rate for the detection of endoleaks with CEUS imaging was 42% (84 of 200), the false-positive rate was 4% (8 of 200), the true-negative rate was 52% (105 of 200), and the false-negative rate was 2% (3 of 200). The sensitivity of CEUS imaging was therefore 97%, and the specificity was 93%. The McNemar test value was 0.227, and the k coefficient was 0.889.	3
89. Perini P, Sediri I, Midulla M, Delsart P, Gautier C, Haulon S. Contrast-enhanced ultrasound vs. CT angiography in fenestrated EVAR surveillance: a single-center comparison. J Endovasc Ther. 2012;19(5):648-655.	Observational-Dx	62 Patients	To evaluate contrast-enhanced ultrasound (CEUS) as an effective alternative to computed tomographic angiography (CTA) during follow-up after fenestrated endovascular aneurysm repair (EVAR) of juxtarenal aortic aneurysms.	The mean diameters of the aneurysm sac were 56.58+/-8.56 mm with CEUS and 57.70+/-8.59 mm with CTA. The mean difference in aneurysm sac diameter was -1.13+/-3.19 mm (95% CI -0.34 to -1.92), with CTA measurements tending to be slightly larger. Bland-Altman plots showed good agreement between the imaging modalities with respect to aneurysm sac diameter (Spearman correlation coefficient r(s)=0.921, p<0.01). Endoleaks were detected by CTA in 7 (11.3%) of 62 patients and by CEUS in 6 (9.7%). In 59 (95.16%) cases, the tests agreed, and their equivalence was confirmed by binomial distribution testing. There was complete agreement between CEUS and CTA in the assessment of target vessels (144/146 patent target arteries; 1 had a significant stenosis and another was thrombosed).	2

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
90. Gray C, Goodman P, Herron CC, et al. Use of colour duplex ultrasound as a first line surveillance tool following EVAR is associated with a reduction in cost without compromising accuracy. Eur J Vasc Endovasc Surg. 2012;44(2):145-150.	Observational-Dx	145 Patients	To evaluate the potential cost savings obtained by using CDUS rather than CT as the first line imaging method for post-EVAR surveillance and compare the efficacy of the two modalities to ensure that any cost saving would not compromise accuracy of follow up.	Adopting a protocol where CDUS was employed as the first line surveillance tool following EVAR would result in a reduction in the number of postoperative CTs required in 2010 from 235 to 36. Based on 2010 costings, this would equate to an estimated reduction in expenditure from euro117,500 to euro34,915 a saving of euro82,585. CDUS had a sensitivity of 100% and a specificity of 85% in the detection of endoleaks compared to CT. The positive predictive value was 28% and negative predictive value 100%. The Pearson Coefficient correlation of 0.96 indicates a large degree of correlation between CDUS and CT when measuring residual aneurysm size following EVAR.	3
91. AbuRahma AF. Fate of endoleaks detected by CT angiography and missed by color duplex ultrasound in endovascular grafts for abdominal aortic aneurysms. J Endovasc Ther. 2006; 13(4):490-495.	Observational-Dx	232 patients	To analyze the clinical implications of endoleaks documented by CTA and missed by color duplex US.	39 endoleaks were documented in 35 (15%) of 232 patients using CTA. The mean follow-up was 25 months (range 1-64). Color duplex US was more helpful in detecting type I endoleaks than type II endoleaks (89% vs 58%, P<0.05). 19 (49%) type II endoleaks (16 early, 3 late) were diagnosed using CTA, 11 (58%) of which were detected by color duplex US (6 early and 2 late missed). Overall, color duplex US failed to identify endoleak in 11 (28%) of 39 endoleaks [2 late type I, 8 type II (6 early, 2 late), and 1 early type IV]. Consequences to treatment occurred in 2 (20%): one type I endoleak required treatment and one type II endoleak would have missed treatment. Color duplex US has a lower sensitivity in detecting endoleak, particularly type II; therefore, EVAR surveillance should not be based solely on color duplex US. Although a significant number of type II endoleaks resolved spontaneously, intervention can be offered for type II endoleaks if associated with an increasing sac size.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
92. Collins JT, Boros MJ, Combs K. Ultrasound surveillance of endovascular aneurysm repair: a safe modality versus computed tomography. Ann Vasc Surg. 2007; 21(6):671-675.	Observational-Dx	160 patients	To evaluate US surveillance as being adequate and safe for monitoring EVAR.	CT discovered three endoleaks that were not seen with US. However, these particular US exams were inadequate due to additional factors (bowel gas, body habitus, hernia), which prompted CT investigation and, hence, endoleak discovery. Of the 41 endoleaks found on US, only 14 were seen on CT. Specifically, 26 type II endoleaks were seen with US vs only nine during CT. Additional factors addressed included comparison between US and CT of residual aneurysm sac measurements and conditions limiting US examination. Although criticized in the past, color flow US is a safe and effective modality for surveillance of aortic endografts. Utilizing US to analyze AAA sac dimensions and endoleak detection is statistically sound for screening AAA status post-EVAR.	3
93. Manning BJ, O'Neill SM, Haider SN, Colgan MP, Madhavan P, Moore DJ. Duplex ultrasound in aneurysm surveillance following endovascular aneurysm repair: a comparison with computed tomography aortography. J Vasc Surg. 2009; 49(1):60-65.	Observational-Dx	132 EVAR patients, 117 attended follow-up	To compare CTA as the gold standard with duplex US during EVAR follow-up to determine whether duplex US may be used as an alternative.	There was one type I and four type III endoleaks. Two of these (both type III) had an increased sac size. PPV for duplex US was 45% and NPV 94%. Specificity of duplex US for endoleak detection was 67% when compared with CTA, because of the large number of false positive duplex US results. Sensitivity for duplex US was 86%, with all clinically significant endoleaks demonstrated on CTA also detected on duplex US. Despite its low PPV, we found duplex US to be a sensitive test for the detection of clinically significant endoleaks. Given concerns about cumulative radiation exposure and cost, and the surprisingly low sensitivity of CTA for endoleak detection in this series, selective CTA based on duplex US surveillance may be a more appropriate long-term strategy.	2

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
94. Parent FN, Meier GH, Godziachvili V, et al. The incidence and natural history of type I and II endoleak: a 5-year follow-up assessment with color duplex ultrasound scan. J Vasc Surg. 2002; 35(3):474-481.	Observational-Dx	83 patients	To demonstrate the value of color duplex US scanning in the detection of type I endoleak and type II endoleak, and determine the correlation of Doppler scan waveform pattern to endoleak persistence or seal, and describe the natural history of endoleak.	Color duplex US scan is effective in the identification of the type of endoleak, the delineation of the vessel involved, and the hemodynamic information not available with any other testing method. Endoleaks have a dynamic natural history characterized by a variable onset with changing branch vessel involvement and spectral flow patterns. Periodic long-term endograft surveillance with color duplex US scanning is necessary for following existing endoleaks and for detecting new ones. Corroboration of these findings in larger multicenter prospective trials will be needed to determine whether color duplex US scan analysis of endoleaks would be predictive of long-term success in endovascular AAA repair.	4
95. Arko FR, Filis KA, Siedel SA, et al. Intrasac flow velocities predict sealing of type II endoleaks after endovascular abdominal aortic aneurysm repair. J Vasc Surg. 2003; 37(1):8-15.	Observational-Dx	265 patients	To determine whether intrasac spectral Doppler flow velocities can predict whether or not a type II endoleak will spontaneously seal and to relate intrasac flow to preoperative branch vessel anatomy.	Spectral Doppler velocities were significantly lower in patients with sealed endoleaks compared with persistent endoleaks (75.5 +/- 78.8 cm/s vs 138.2 +/- 36.2 cm/s; P<.01). Patients with sealed endoleaks and low (<100 cm/s) intrasac Doppler velocities had significantly fewer patent inferior mesenteric arteries (43% vs 81%; P<.01), a smaller inferior mesenteric artery (5.6 +/- 1.8 mm vs 7.2 +/- 1.3 mm; P<.01), and fewer paired lumbar arteries (1.3 +/- 0.8 vs 2.4 +/- 0.6; P<.0001) compared with those with persistent endoleaks and high (>100 cm/s) intrasac flow velocities. Aneurysm diameter (-4.6 +/- 5.6 mm) and volume (-0.9 +/- 45.2 mL) decreased in patients with sealed endoleaks. Aneurysm diameter (1.8 +/- 4.9 mm) and volume (18.5 +/- 33.9 mL) increased slightly in patients with persistent endoleaks (P<.05). Intrasac Doppler velocities can be used to predict whether a type II endoleak will spontaneously seal. High-velocity type II endoleaks are related to preoperative large branch vessel diameter and number and are resistant to endovascular treatment.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
96. Karthikesalingam A, Al-Jundi W, Jackson D, et al. Systematic review and meta-analysis of duplex ultrasonography, contrast-enhanced ultrasonography or computed tomography for surveillance after endovascular aneurysm repair. Br J Surg. 2012;99(11):1514-1523.	Meta-analysis	25 Studies	To review the role of surveillance is to enable the treatment of endograft-related complications that would otherwise lead to aneurysm-related death, there is a need for reappraisal of the diagnostic accuracy of CEUS and DUS, focusing on detection of clinically relevant types 1 and 3 endoleak.	Twenty-five studies (3975 paired scans) compared DUS with CT for all endoleaks. The pooled sensitivity was 0.74 (95 per cent confidence interval 0.62 to 0.83) and the pooled specificity was 0.94 (0.90 to 0.97). Thirteen studies (2650 paired scans) reported detection of types 1 and 3 endoleak by DUS; the pooled sensitivity of DUS was 0.83 (0.40 to 0.97) and the pooled specificity was 1.00 (0.97 to 1.00). Eleven studies (961 paired scans) compared CEUS with CT for all endoleaks. The pooled sensitivity of CEUS was 0.96 (0.85 to 0.99) and the pooled specificity was 0.85 (0.76 to 0.92). Eight studies (887 paired scans) reported detection of types 1 and 3 endoleak by CEUS. The pooled sensitivity of CEUS was 0.99 (0.25 to 1.00) and the pooled specificity was 1.00 (0.98 to 1.00).	M
97. Causey MW, Jayaraj A, Leotta DF, et al. Three-dimensional ultrasonography measurements after endovascular aneurysm repair. Ann Vasc Surg. 2013;27(2):146-153.	Observational-Dx	7 Patients	To compare the variability in diameter, cross-sectional area (CSA), and volume measurements of abdominal aortic aneurysms obtained using a three-dimensional (3D) US imaging system with those obtained using computed tomographic (CT) angiography, and to determine the reliability of these measures.Intravenous contrast was administered in this study	The average aneurysm measured 57.2 mm on CT and 56.2 mm on US ($P = 0.14$). Correlation coefficients for diameter, CSA, and volume were 0.88, 0.90, and 0.93, respectively (all P values < 0.001). A Bland–Altman analysis demonstrated a strong agreement between 92% of the diameter, 96.4% of the CSA, and 100% of the volume measurements. The interrater reliability was remarkably high comparing the modalities (CT vs. US), and ranged from 0.934 to 0.997 for single measurements and 0.965 to 0.998 for all measurements together; moreover, there was a strong reliability when the tests were reviewed 6 to 8 weeks later, with a reliability of 0.962 to 0.998 for single measurements and 0.992 to 0.999 for all tests (all P values < 0.001).	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
98. Chaikof EL, Brewster DC, Dalman RL, et al. SVS practice guidelines for the care of patients with an abdominal aortic aneurysm: executive summary. J Vasc Surg. 2009;50(4):880-896.	Review/Other-Dx	N/A	To provide recommendations for evaluating the patient, including risk of aneurysm rupture and associated medical co-morbidities, guidelines for selecting surgical or endovascular intervention, intraoperative strategies, perioperative care, long-term follow-up, and treatment of late complications.	No results stated in abstract.	4
99. Murphy M, Hodgson R, Harris PL, McWilliams RG, Hartley DE, Lawrence-Brown MM. Plain radiographic surveillance of abdominal aortic stent-grafts: the Liverpool/Perth protocol. J Endovasc Ther. 2003; 10(5):911-912.	Review/Other-Dx	N/A	To present a protocol for radiographic surveillance of abdominal aortic stent-grafts that addresses the main variables in need of standardization: (1) patient position, (2) radiographic centering point, and (3) focus-to-film distance.	Evaluation of the radiographs depends on the design of the stent-graft, so it is important to understand graft construction and the position of the radiopaque markers to best assess changes on follow-up films.	4
100. 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