SVS | Society for Vascular Surgery

Care of Patients with an Abdominal Aortic Aneurysm

2018 Practice Guidelines from the Society for Vascular Surgery

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About the guidelines

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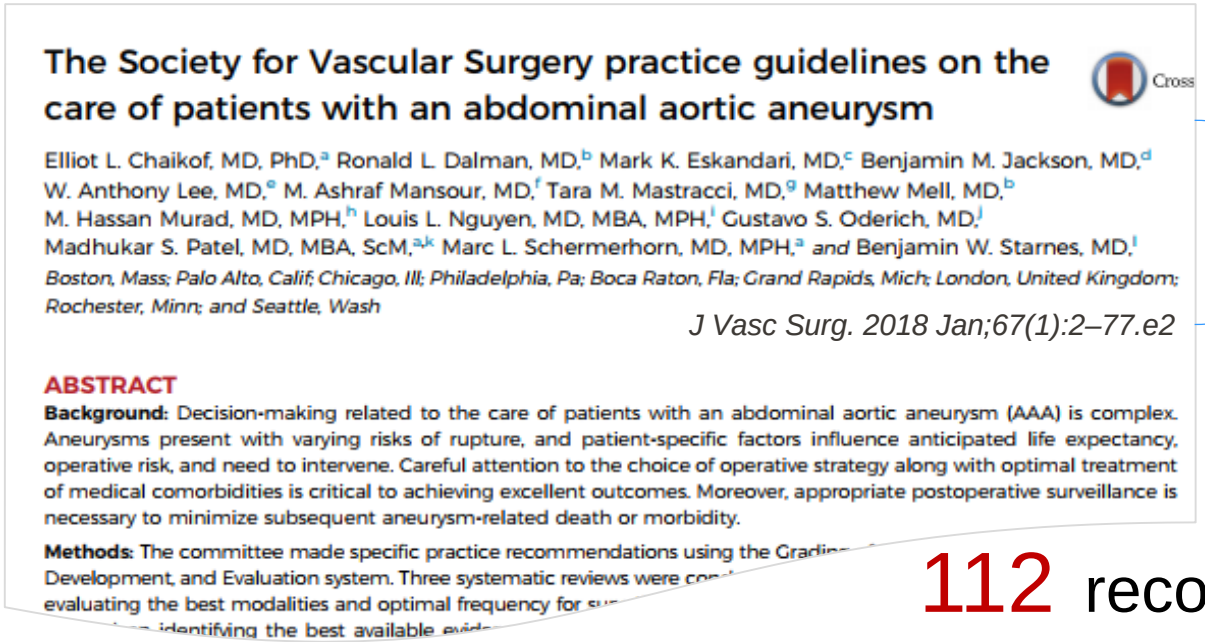

The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm

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ABSTRACT

Background: Decision-making related to the care of patients with an abdominal aortic aneurysm (AAA) is complex. Aneurysms present with varying risks of rupture, and patient-specific factors influence anticipated life expectancy, operative risk, and need to intervene. Careful attention to the choice of operative strategy along with optimal treatment of medical comorbidities is critical to achieving excellent outcomes. Moreover, appropriate postoperative surveillance is necessary to minimize subsequent aneurysm-related death or morbidity.

Methods: The committee made specific practice recommendations using the Grading
Development, and Evaluation system. Three systematic reviews were co
evaluating the best modalities and optimal frequency for su
identifying the best available evid

14 international experts

112 recommendations

\+ 774 supporting references

Methodology

Target audience

Surgeons and physicians involved in the preoperative, operative, and postoperative care of patients with AAAs

Methodology

- Evidence review
- Recommendations
- GRADE: strength of recommendation / quality of evidence
- Collaboration with Knowledge and Evaluation Research Unit at the Mayo Clinic, Rochester MN
  - Corroborate proper strength of evidence and quality of evidence for each guideline
  - Commissioned to conduct three systematic reviews: best modalities and optimal frequency for surveillance after EVAR, and a third umbrella systematic review (overview of reviews) on diagnosis and management

GRADE

Strength of Recommendation	
1 – Strong *"We recommend"*	Benefits of an intervention outweighed its risks or, alternatively, risks outweighed benefits
2 – Weak *"We suggest"*	Benefits and risks are less certain, and more dependent on specific clinical scenarios. There may be primarily low-quality evidence, or high-quality evidence suggesting benefits and risks are closely balanced
Level of Evidence	
A – High	Additional research is considered ***very unlikely to change confidence*** in the estimate of effect
B – Moderate	Further research is ***likely*** to have an ***important impact*** on the estimate of effect
C – Low	Further research is ***very likely to change*** the estimate of the effect
[Good Practice Statement] Ungraded recommendations advising about performing certain actions considered by surgeons to be ***essential for patient care*** and supported only by ***indirect evidence***.	

Highlights

A first for SVS: suggested case volume threshold and outcome targets

NEW

- Elective EVAR to be performed in hospitals
  - with documented mortality and conversion rate to open surgical repair of ≤ 2%, and
  - that perform at least 10 EVAR cases/year.

NEW

- Elective Open AAA to be performed in hospitals
  - with a mortality rate < 5%, and
  - that perform at least 10 open aortic operations of any type/year.

The volume threshold was discussed through a lengthy member and public comment period, and the final recommendation represents a ***balance between the available evidence and the different practice environments*** *in which SVS members work.*

Highlights

NEW

- Surgeons should use the SVS Vascular Quality Initiative (VQI) mortality risk score to assist in making informed decisions and recommendations about aneurysm repair.

NEW

- Endovascular repair is preferred over open repair for treating ruptured aneurysms if anatomically feasible.

Highlights

- A door-to-intervention time of < 90 minutes for emergency repairs.
- A one-time AAA ultrasound screening for men and women ages 65 to 75 who have a history of tobacco use.

  (Several other organizations recommend screenings for male smokers only)
- Recommendations for the treatment of endoleaks.
- Appropriate use of antibiotic prophylaxis in patients with an aortic prosthesis undergoing dental and other invasive procedures

Diagnosis

Areas of focus

- Physical examination
- Aneurysm imaging
- Assessment of medical comorbidities

Physical examination

Recommendation	Level of recommendation	Quality of evidence
In patients with a suspected or known AAA, we recommend performing physical examination that includes an assessment of femoral and popliteal arteries. In patients with a popliteal or femoral artery aneurysm, we recommend evaluation for an AAA.	1	A

Assessment of medical comorbidities

Recommendation	Level of recommendation	Quality of evidence
In patients with active cardiac conditions, including unstable angina, decompensated heart failure, severe vulvular disease, and significant arrythmia, we recommend cardiology consultation before endovascular aneurysm repair (EVAR) or open surgical repair (OSR).	1	B
In patients with significant clinical risk factors, such as coronary artery disease, congestive heart failure, cerebrovascular disease, diabetes mellitus, chronic renal insufficiency, and unknown or poor functional capacity (metabolic equivalent [MET] < 4), who are to undergo OSR or EVAR, we suggest noninvasive stress testing.	2	B
We recommend a preoperative resting 12-lead electrocardiogram (ECG) in all patients undergoing EVAR or OSR within 30 days of planned treatment.	1	B
We recommend echocardiography before planned operative repair in patients with dyspnea of unknown origin or worsening dyspnea	1	A

Assessment of medical comorbidities

Recommendation	Level of recommendation	Quality of evidence
We suggest coronary revascularization before aneurysm repair in patients with acute ST-segment or non-ST segment elevation myocardial infarction (MI), unstable angina, or stable angina with left main coronary artery or three-vessel disease.	2	B
We suggest coronary revascularization before aneurysm repair in patients with stable angina and two-vessel disease that includes the proximal left descending artery and either ischemia on noninvasive stress testing or reduced left ventricular function (ejection fraction < 50%).	2	B
In patients who may need aneurysm repair in the subsequent 12 months and in whom percutaneous coronary intervention is indicated, we suggest a strategy of balloon angioplasty or bare-metal stent placement, followed by 4 to 6 weeks of dual antiplatelet therapy.	2	B
We suggest deferring elective aneurysm repair for 30 days after bare-metal stent placement or coronary artery bypass surgery if clinical circumstances permit. As an alternative, EVAR may be performed with uninterrupted continuation of dual antiplatelet therapy.	2	B
We suggest deferring open aneurysm repair for at least 6 months after drug-eluting coronary stent placement or, alternatively, performing EVAR with continuation of dual antiplatelet therapy.	2	B

Assessment of medical comorbidities

Recommendation	Level of recommendation	Quality of evidence
In patients with a drug-eluting coronary stent requiring open aneurysm repair, we recommend discontinuation of P2Y12 platelet receptor inhibitor therapy 10 days preoperatively with continuation of aspirin. The P2Y12 inhibitor should be restarted as soon as possible after surgery. The relative risks and benefits of perioperative bleeding and stent thrombosis should be discussed with the patient.	1	B
We suggest continuation of beta blocker therapy during the perioperative period if it is part of an established medical regimen.	2	B
If a decision was made to start beta blocker therapy (because of the presence of multiple risk factors, such as coronary artery disease, renal insufficiency, and diabetes), we suggest initiation well in advance of surgery to allow sufficient time to assess safety and tolerability.	2	B
We suggest preoperative pulmonary function studies, including room air arterial blood gas determinations, in patients with a history of symptomatic chronic obstructive pulmonary disease (COPD), long-standing tobacco use, or inability to climb one flight of stairs.	2	C
We recommend smoking cessation for at least 2 weeks before aneurysm repair.	1	C
We suggest administration of pulmonary bronchodilators for at least 2 weeks before aneurysm repair in patients with a history of COPD or abnormal results of pulmonary function testing.	2	C

Assessment of medical comorbidities

Recommendation	Level of recommendation	Quality of evidence
We suggest holding angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor antagonists on the morning of surgery and restarting these agents after the procedure once euvolemia has been achieved.	2	C
We recommend preoperative hydration in non dialysis dependent patients with renal insufficiency before aneurysm repair.	1	A
We recommend preprocedure and postprocedure hydration with normal saline or 5% dextrose/sodium bicarbonate for patients at increased risk of contrast-induced nephropathy (CIN) undergoing EVAR	1	A
We recommend holding metformin at the time of administration of contrast material among patients with an estimated glomerular filtration rate (eGFR) of <60 mL/min or up to 48 hours before administration of contrast material if the eGFR is <45 mL/min.	1	C
We recommend restarting metformin no sooner than 48 hours after administration of contrast material as long as renal function has remained stable (<25% increase in creatinine concentration above baseline).	1	C
We recommend perioperative transfusion of packed red blood cells if the hemoglobin level is <7 g/dL	1	B
We suggest hematologic assessment if the preoperative platelet count is <150,000/μL.	2	C

Aneurysm imaging

Recommendation	Level of recommendation	Quality of evidence
We recommend using ultrasound, when feasible, as the preferred imaging modality for aneurysm screening and surveillance.	1	A
We suggest that the maximum aneurysm diameter derived from computed tomography (CT) imaging should be based on an outer wall to outer wall measurement perpendicular to the path of the aorta.	Ungraded Good Practice Statement	
We recommend a one-time ultrasound screening for AAAs in men or women 65 to 75 years of age with a history of tobacco use.	1	A
We suggest ultrasound screening for AAA in first degree relatives of patients who present with an AAA. Screening should be performed in first-degree relatives who are between 65 and 75 years of age or in those older than 75 years and in good health.	2	C
We suggest a one-time ultrasound screening for AAAs in men or women older than 75 years with a history of tobacco use and in otherwise good health who have not previously received a screening ultrasound examination.	2	C

Aneurysm imaging

Recommendation	Level of recommendation	Quality of evidence
If initial ultrasound screening identified an aortic diameter >2.5 cm but <3 cm, we suggest rescreening after 10 years.	2	C
We suggest surveillance imaging at 3-year intervals for patients with an AAA between 3.0 and 3.9 cm.	2	C
We suggest surveillance imaging at 12-month intervals for patients with an AAA of 4.0 to 4.9 cm in diameter.	2	C
We suggest surveillance imaging at 6-month intervals for patients with an AAA between 5.0 and 5.4 cm in diameter.	2	C
We recommend a CT scan to evaluate patients thought to have AAA presenting with recent-onset abdominal or back pain, particularly in the presence of a pulsatile epigastric mass or significant risk factors for AAA.	1	B

Treatment

Areas of focus

- Decision to treat
- Medical management during the period of AAA surveillance
- Timing for intervention
- Assessment of operative risk and life expectancy
- EVAR, including:
  - Perioperative outcomes of elective EVAR
  - Role of elective EVAR in the high-risk and unfit patient
- Open surgical repair (OSR), including:
  - Perioperative outcomes of an open AAA
- Patient with a ruptured aneurysm

The decision to treat

Recommendation	Level of recommendation	Quality of evidence
We suggest referral to a vascular surgeon at the time of initial diagnosis of an aortic aneurysm.	Ungraded Good Practice Statement	
We recommend repair for the patient who presents with an AAA and abdominal or back pain that is likely to be attributed to the aneurysm.	1	C
We recommend elective repair for the patient at low or acceptable surgical risk with a fusiform AAA that is greater or equal to 5.5 cm.	1	A
We suggest elective repair for the patient who presents with a saccular aneurysm.	2	C
We suggest repair in women with AAA between 5.0 cm and 5.4 cm in maximum diameter.	2	B
In patients with a small aneurysm (4.0-5.4 cm) who will require chemotherapy, radiation therapy, or solid organ transplantation, we suggest a shared decision-making approach to decide about treatment options	2	C

Medical management during the period of AAA surveillance

Recommendation	Level of recommendation	Quality of evidence
We recommend smoking cessation to reduce the risk of AAA growth and rupture.	1	B
We suggest not administering statins, doxycycline, roxithromycin, ACE inhibitors, or angiotensin receptor blockers for the sole purpose of reducing the risk of AAA expansion and rupture.	2	C
We suggest not administering beta blocker therapy for the sole purpose of reducing the risk of AAA expansion and rupture.	1	B

Timing for intervention

Recommendation	Level of recommendation	Quality of evidence
We recommend immediate repair for patients who present with a ruptured aneurysm.	1	A
Should repair of a symptomatic AAA be delayed to optimize coexisting medical conditions, we recommend that the patient be monitored in an intensive care unit (ICU) setting with blood products available.	1	C

Assessment of operative risk and life expectancy

Recommendation	Level of recommendation	Quality of evidence
We suggest informing patients contemplating open repair or EVAR of their Vascular Quality Initiative (VQI) perioperative mortality risk score.	2	C

EVAR

Recommendation	Level of recommendation	Quality of evidence
We recommend preservation of flow to at least one internal iliac artery.	1	A
We recommend using Food and Drug Administration (FDA)-approved branch endograft devices in anatomically suitable patients to maintain perfusion to at least one internal iliac artery.	1	A
We recommend staging bilateral internal iliac artery occlusion by at least 1 to 2 weeks if required for EVAR.	1	A
We suggest renal artery or superior mesenteric artery (SMA) angioplasty and stenting for selected patients with symptomatic disease before EVAR or OSR.	2	C
We suggest prophylactic treatment of an asymptomatic, high-grade stenosis of the SMA in the presence of a meandering mesenteric artery based off of a large inferior mesenteric artery (IMA), which will be sacrificed during the course of treatment.	2	C
We suggest preservation of accessory renal arteries at the time of EVAR or OSR if the artery is 3 mm or larger in diameter or supplies more than one-third of the renal parenchyma.	2	C

Perioperative outcomes of elective EVAR

Recommendation	Level of recommendation	Quality of evidence
We suggest that elective EVAR be performed at centers with a volume of at least 10 EVAR cases each year and a documented perioperative mortality and conversion rate to OSR of 2% or less.	2	C

Role of elective EVAR in the high-risk and unfit patient

Recommendation	Level of recommendation	Quality of evidence
We suggest informing high-risk patients of their VQI perioperative mortality risk score for them to make an informed decision to proceed with aneurysm repair.	2	C

Open surgical repair (OSR)

Recommendation	Level of recommendation	Quality of evidence
We recommend a retroperitoneal approach for patients requiring OSR of an inflammatory aneurysm, a horseshoe kidney, or an aortic aneurysm in the presence of a hostile abdomen.	1	C
We suggest a retroperitoneal exposure or a transperitoneal approach with a transverse abdominal incision for patients with significant pulmonary disease requiring OSR.	2	C
We recommend a thrombin inhibitor, such as bivalirudin or argatroban, as an alternative to heparin for patients with a history of heparin-induced thrombocytopenia.	1	B
We recommend straight tube grafts for OSR of AAA in the absence of significant disease of the iliac arteries	1	A
We recommend performing the proximal aortic anastomosis as close to the renal arteries as possible.	1	A
We recommend that all portions of an aortic graft be excluded from direct contact with the intestinal contents of the peritoneal cavity.	1	A
We recommend reimplantation of a patent IMA under circumstances that suggest an increased risk of colonic ischemia.	1	A
We recommend preserving blood flow to at least one hypogastric artery in the course of OSR.	1	A

Open surgical repair (OSR)

Recommendation	Level of recommendation	Quality of evidence
We suggest concomitant surgical treatment of other visceral arterial disease at the time of OSR in symptomatic patients who are not candidates for catheter-based intervention.	2	B
We suggest concomitant surgical repair of an AAA and coexistent cholecystitis or an intra-abdominal tumor in patients who are not candidates for EVAR or staged intervention.	2	C

Perioperative outcomes of open AAA

Recommendation	Level of recommendation	Quality of evidence
We suggest that elective OSR for AAA be performed at centers with an annual volume of at least 10 open aortic operations of any type and a documented perioperative mortality of 5% or less.	2	C

The patient with a ruptured aneurysm

Recommendation	Level of recommendation	Quality of evidence
We suggest a door-to-intervention time of <90 minutes, based on a framework of 30-30-30 minutes, for the management of the patient with a ruptured aneurysm.	Ungraded Good Practice Statement	
An established protocol for the management of ruptured AAA is essential for optimal outcomes.	Ungraded Good Practice Statement	
We recommend implementing hypotensive hemostasis with restriction of fluid resuscitation in the conscious patient.	1	B
We suggest that patients with ruptured AAA who require transfer for repair be referred to a facility with an established rupture protocol and suitable endovascular resources.	Ungraded Good Practice Statement	
If it is anatomically feasible, we recommend EVAR over open repair for treatment of a ruptured AAA.	1	C

Anesthetic considerations and perioperative management

Areas of focus

- Choice of anesthetic technique and agent
- Antibiotic prophylaxis
- Intraoperative fluid resuscitation and blood conservation
- Cardiovascular monitoring
- Maintenance of body temperature
- Role of the ICU
- Nasogastric decompression and perioperative nutrition
- Prophylaxis for deep venous thrombosis
- Postoperative blood transfusion
- Perioperative pain management

Choice of anesthetic technique and agent

Recommendation	Level of recommendation	Quality of evidence
We recommend general endotracheal anesthesia for patients undergoing open aneurysm repair.	1	A

Antibiotic prophylaxis

Recommendation	Level of recommendation	Quality of evidence
We recommend intravenous administration of a first-generation cephalosporin or, in the event of penicillin allergy, vancomycin within 30 minutes before OSR or EVAR. Prophylactic antibiotics should be continued for no more than 24 hours.	1	A
We recommend that any potential sources of dental sepsis be eliminated at least 2 weeks before implantation of an aortic prosthesis.	Ungraded Good Practice Statement	

Intraoperative fluid resuscitation and blood conservation

Recommendation	Level of recommendation	Quality of evidence
We recommend using cell salvage or an ultrafiltration device if large blood loss is anticipated.	1	B
If the intraoperative hemoglobin level is <10 g/dL and blood loss is ongoing, we recommend transfusion of packed blood cells along with fresh frozen plasma and platelets in a ratio of 1:1:1.	1	B

Cardiovascular monitoring

Recommendation	Level of recommendation	Quality of evidence
We suggest using pulmonary artery catheters only if the likelihood of a major hemodynamic disturbance is high.	1	B
We recommend central venous access and arterial line monitoring in all patients undergoing open aneurysm repair	1	B
We recommend postoperative ST-segment monitoring for all patients undergoing open aneurysm repair and for those patients undergoing EVAR who are at high cardiac risk.	1	B
We recommend postoperative troponin measurement for all patients with electrocardiographic changes or chest pain after aneurysm repair.	1	A

Maintenance of body temperature

Recommendation	Level of recommendation	Quality of evidence
We recommend maintaining core body temperature at or above 36°C during aneurysm repair.	1	A

Role of the ICU

Recommendation	Level of recommendation	Quality of evidence
We recommend postoperative management in an ICU for the patient with significant cardiac, pulmonary, or renal disease as well as for those requiring postoperative mechanical ventilation or who developed a significant arrhythmia or hemodynamic instability during operative treatment.	1	A

Nasogastric decompression and perioperative nutrition

Recommendation	Level of recommendation	Quality of evidence
We recommend optimization of preoperative nutritional status before elective open aneurysm repair if repair will not be unduly delayed.	1	A
We recommend using nasogastric decompression intraoperatively for all patients undergoing open aneurysm repair but postoperatively only for those patients with nausea and abdominal distention.	1	A
We recommend parenteral nutrition if a patient is unable to tolerate enteral support 7 days after aneurysm repair.	1	A

Prophylaxis for deep venous thrombosis

Recommendation	Level of recommendation	Quality of evidence
We recommend thromboprophylaxis that includes intermittent pneumatic compression and early ambulation for all patients undergoing OSR or EVAR.	1	A
We suggest thromboprophylaxis with unfractionated or low-molecular-weight heparin for patients undergoing aneurysm repair at moderate to high risk for venous thromboembolism and low risk for bleeding.	2	C

Postoperative blood transfusion

Recommendation	Level of recommendation	Quality of evidence
In the absence of ongoing blood loss, we suggest a threshold for blood transfusion during or after aneurysm repair at a hemoglobin concentration of 7 g/dL or below.	2	C

Perioperative pain management

Recommendation	Level of recommendation	Quality of evidence
We recommend multimodality treatment, including epidural analgesia, for postoperative pain control after OSR of an AAA.	1	A

Postoperative and long-term management

Areas of focus

- Late outcomes
- Postoperative surveillance

Late outcomes

Recommendation	Level of recommendation	Quality of evidence
We recommend treatment of type I endoleaks.	1	B
We suggest treatment of type II endoleaks associated with aneurysm expansion	2	C
We recommend surveillance of type II endoleaks not associated with aneurysm expansion.	1	B
We recommend treatment of type III endoleaks.	1	B
We suggest no treatment of type IV endoleaks.	2	C
We recommend open repair if endovascular intervention fails to treat a type I or type III endoleak with ongoing aneurysm enlargement.	1	B
We suggest open repair if endovascular intervention fails to treat a type II endoleak with ongoing aneurysm enlargement.	2	C
We suggest treatment for ongoing aneurysm expansion, even in the absence of a visible endoleak.	2	C

Late outcomes

Recommendation	Level of recommendation	Quality of evidence
We recommend that follow-up of patients after aneurysm repair include a thorough lower extremity pulse examination or ankle-brachial index (ABI).	1	B
We recommend a prompt evaluation for possible graft limb occlusion if patients develop new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair.	1	A
We recommend antibiotic prophylaxis to prevent graft infection before any dental procedure involving the manipulation of the gingival or periapical region of teeth or perforation of the oral mucosa, including scaling and root canal procedures, for any patient with an aortic prosthesis, whether placed by OSR or EVAR.	1	B
We suggest antibiotic prophylaxis before respiratory tract procedures, gastrointestinal or genitourinary procedures, and demotologic or musculoskeletal procedures for any patient with an aortic prothesis if the potential for infection exists or the patient is immunocompromised.	2	C
After aneurysm repair, we recommend prompt evaluation for possible graft infection if a patient presents with generalized sepsis, groin drainage, pseudoaneurysm formation, or ill-defined pain.	1	A

Late outcomes

Recommendation	Level of recommendation	Quality of evidence
We recommend prompt evaluation for possible aortoenteric fistula in a patient presenting with gastrointestinal bleeding after aneurysm repair.	1	A
In patients presenting with an infected graft in the presence of extensive contamination with gross purulence, we recommend extra-anatomic reconstruction followed by excision of all graft material along with aortic stump closure covered by an omental flap	1	B
In patients presenting with an infected graft with minimal contamination, we suggest in situ reconstruction with a cryopreserved allograft.	2	B
In a stable patient presenting with an infected graft, we suggest in situ reconstruction with femoral vein after graft excision and debridement.	2	B
In unstable patients with an infected graft, we recommend in situ reconstruction with a silver- or antibiotic-impregnated graft, cryopreserved allograft, or polytetrafluoroethylene (PTFE) graft.	1	B

Postoperative surveillance

Recommendation	Level of recommendation	Quality of evidence
We recommend baseline imaging in the first month after EVAR with contrast-enhanced CT and color duplex ultrasound imaging. In the absence of an endoleak or sac enlargement, imaging should be repeated in 12 months using contrast-enhanced CT or color duplex ultrasound imaging.	1	B
If a type II endoleak is observed 1 month after EVAR, we suggest postoperative surveillance with contrast-enhanced CT and color duplex ultrasound imaging at 6 months.	2	B
If neither endoleak nor AAA enlargement is observed 1 year after EVAR, we suggest color duplex ultrasound when feasible, or CT imaging if ultrasound is not possible, for annual surveillance.	2	C
If a type II endoleak is associated with an aneurysm sac that is shrinking or stable in size, we suggest color duplex ultrasound for continued surveillance at 6-month intervals for 24 months and then annually thereafter.	2	C
If a new endoleak is detected, we suggest evaluation for a type I or type III endoleak.	2	C
We suggest noncontrast-enhanced CT imaging of the entire aorta at 5-year intervals after open repair or EVAR.	2	C

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