



Society for  
Vascular Surgery

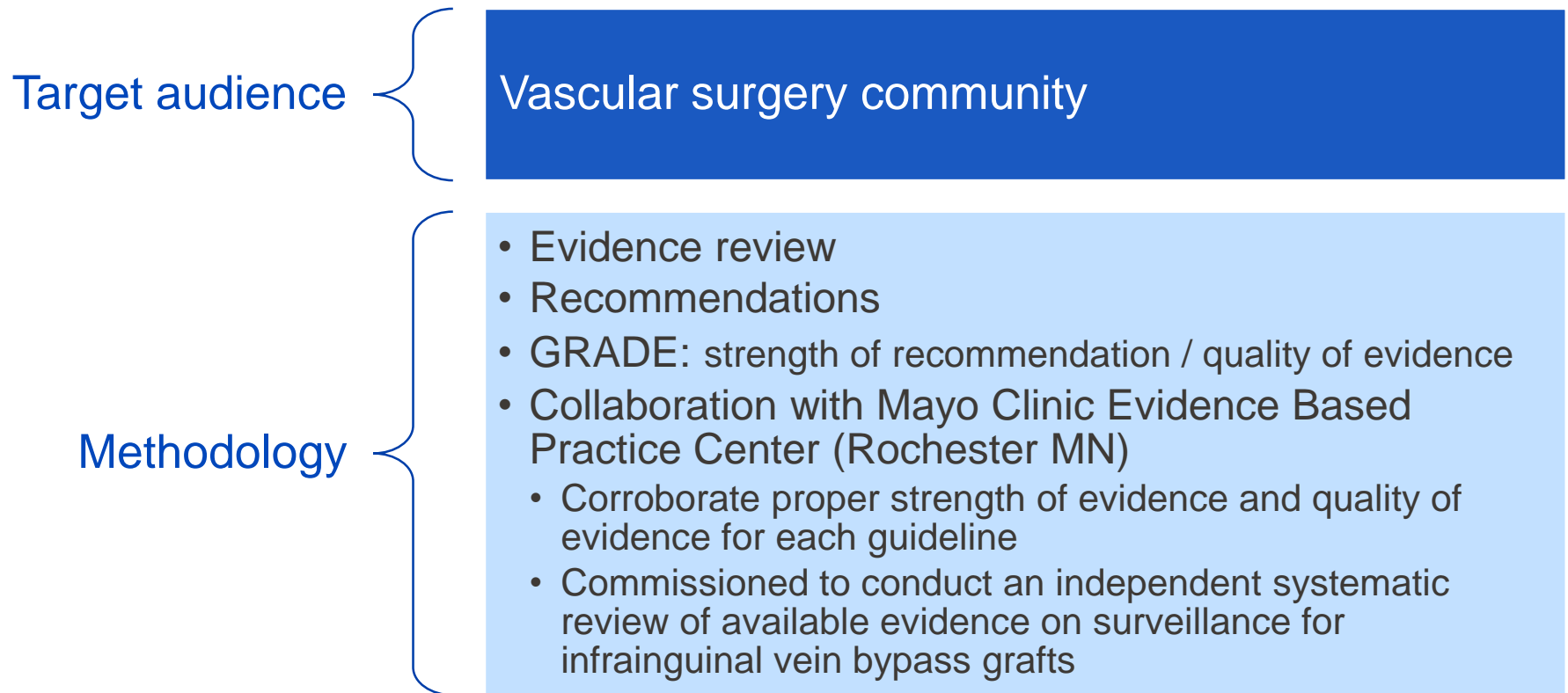
# Recommendations for Follow-up After Vascular Surgery Arterial Procedures

2018 SVS Practice Guidelines

[vsweb.org/SVSGuidelines](http://vsweb.org/SVSGuidelines)

# About the guidelines

Published in the **July 2018** issue of *Journal of Vascular Surgery*, these are the first guidelines devoted solely to imaging following vascular surgery arterial procedures (open and endovascular).



# Goals for follow-up and surveillance

The **primary goal** of follow-up is to detect clinically significant problems at an early stage when they can be managed most safely and effectively, even before clinical signs and symptoms are evident.

- Surveillance is planned serial testing in patients with no current evidence of a problem related to their procedure
- Surveillance is justified **only if** the consequences of failure are severe and early reintervention can improve the outcome.
- Accurate testing methods with **clinically relevant threshold criteria** and **appropriate follow-up or testing intervals** are required.
- Follow-up plan for the individual patient will ideally **minimize**:
  - ✓ risks
  - ✓ costs
  - ✓ disruption of the patient's lifestyle

# Follow-up and surveillance methods

## From simple options

- Vascular history and physical examination (incl. ABI for lower extremities)
- Non-invasive laboratory tests such as duplex ultrasound (DUS)

## To more sophisticated imaging

- CTA or MRA
- Catheter angiography

- ✓ **safe**
- ✓ relatively **low in cost**
- ✓ provide **objective** anatomic and physiologic information that can be used to **assess the durability of an intervention over time**

# GRADE

Strength of Recommendation	
<b>1</b> – Strong <i>“We recommend”</i>	Benefits of an intervention outweigh its risks or, alternatively, risks outweigh benefits.
<b>2</b> – Weak <i>“We suggest”</i>	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	
<b>A</b> – High	Additional research is considered <b>very unlikely to change confidence</b> in the estimate of effect.
<b>B</b> – Moderate	Further research is <b>likely</b> to have an <b>important impact</b> on the estimate of effect.
<b>C</b> – Low	Further research is <b>very likely to change</b> the estimate of the effect.
<p>[Good Practice Statement]            Ungraded recommendations advising about performing certain actions considered by surgeons to be <b>essential for patient care</b> and supported only by <b>indirect evidence</b>.</p>	

# Evidence gaps

- Some **strong recommendations** for surveillance were made despite **low-quality evidence**, when:
  - ✓ costs and risks of surveillance were considered to be relatively low, and
  - ✓ early detection of complications was deemed critical from a patient's perspective
- Due to limited evidence, **no 1A recommendations** were made in these guidelines
- There is a **pressing need for better clinical evidence** on all aspects of follow-up after vascular surgery procedures, including routine surveillance, modes of failure, indications for reintervention, and resulting outcomes

# Systematic Review and Meta-Analysis of Duplex Ultrasound Surveillance for Infrainguinal Vein Bypass Grafts

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## **Objective:**

Duplex ultrasound (DUS) surveillance of infrainguinal vein bypass grafts is widely practiced, but the evidence of its effectiveness compared with other methods of surveillance remains unclear.

## **Methods:**

Following an a priori protocol developed by the guidelines committee from the Society for Vascular Surgery, this systematic review and meta-analysis included randomized and nonrandomized comparative studies that enrolled patients who underwent infrainguinal arterial reconstruction and received DUS surveillance for follow-up compared with any other method of surveillance. The search included MEDLINE, Embase, Cochrane Central Register of Controlled Trials and Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health Literature, and Scopus through November 2016. Outcomes of interest included all-cause mortality, limb viability, and graft patency reports. Meta-analysis was performed using the random-effects model.

## **Results:**

We included 15 studies. Compared with ankle-brachial index and clinical examination, DUS surveillance was not associated with a significant change in primary, secondary, or assisted primary patency or mortality. DUS surveillance was associated with a non-statistically significant reduction in amputation rate (odds ratio, 0.70 [95% confidence interval, 0.23-2.13]). The quality of evidence was low because of imprecision (small number of events and wide confidence intervals) and high risk of bias in the primary literature.

## **Conclusions:**

A recommendation for routine DUS surveillance of infrainguinal vein grafts remains dependent on low quality evidence. Considering that DUS offers the opportunity of early intervention and because of its noninvasive nature and low cost, vascular surgeons may incorporate DUS as they individualize the follow-up of lower extremity vein grafts.

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# Recommendations for open surgical and endovascular procedures in 6 areas

Extracranial carotid artery

Thoracic and abdominal aorta

Mesenteric arteries

Renal arteries

Open lower extremity arterial revascularization

Endovascular lower extremity arterial revascularization



RECOMMENDATIONS

# Extracranial Carotid Artery

# Extracranial carotid artery

Recommendation	Strength of recommendation	Quality of evidence
1. After CEA or CAS, we recommend surveillance with DUS at baseline and every 6 months for 2 years and annually thereafter until stable (i.e., until no restenosis or ISR is observed in 2 consecutive annual scans). The first or baseline DUS should occur soon after the procedure, preferably within 3 months, with the goal of establishing a post-treatment baseline. Considering the small risk of delayed restenosis or ISR, some interval of regular surveillance (e.g. every 2 years) should be maintained for the life of the patient.	1 (Strong)	B (Moderate)
2. For patients undergoing CAS with diabetes, aggressive patterns of ISR (Type IV), prior treatment for ISR, prior cervical radiation, or heavy calcification, in addition to the baseline DUS we recommend surveillance with DUS every 6 months until a stable clinical pattern is established and annually thereafter.	1 (Strong)	B (Moderate)

# Extracranial carotid artery

Recommendation	Strength of recommendation	Quality of evidence
<p>3. We recommend that DUS after CAS include at least the following assessments:</p> <p>A. Doppler measurement of PSV and EDV in the native CCA, in the proximal, mid, and distal stent, and in the distal native ICA. Modified threshold velocity criteria should be used to interpret the significance of these velocity measurements after CAS.</p> <p>B. B-mode imaging should be used to supplement and to enhance the accuracy of velocity criteria to estimate the severity of luminal narrowing.</p>	1 (Strong)	C (Low)

RECOMMENDATIONS

# Thoracic and Abdominal Aorta

# Thoracic and abdominal aorta

Recommendation	Strength of recommendation	Quality of evidence
1. We recommend contrast-enhanced CT scanning at 1 month and 12 months and then annually after TEVAR for thoracic aortic aneurysm. If the 1-month CT scan detects an abnormality, a repeated CT scan at 6 months should be considered.	1 (Strong)	B (Moderate)
2. We recommend contrast-enhanced CT scanning at 1 month, 6 months, and 12 months and then annually after TEVAR for thoracic aortic dissection.	1 (Strong)	B (Moderate)
3. We recommend contrast-enhanced CT scanning at 1 month and 12 months and then annually after TEVAR for blunt thoracic aortic injury. If the 1-month CT scan detects an abnormality, a repeated CT scan at 6 months should be considered. Future studies may provide data to support longer surveillance intervals after TEVAR for traumatic injury once a stable clinical pattern is established.	1 (Strong)	B (Moderate)

# Thoracic and abdominal aorta

Recommendation	Strength of recommendation	Quality of evidence
4. We recommend CT scanning with or without contrast at 5-year intervals after open surgical repair for thoracic aortic disease.	1 (Strong)	C (Low)
5. We recommend contrast-enhanced CT scanning at 1 month and 12 months after EVAR, with consideration of more frequent imaging if an endoleak or other abnormality of concern is detected at 1 month.	1 (Strong)	B (Moderate)
6. We recommend DUS at 12-month intervals as alternative imaging surveillance after EVAR if no endoleak or sac enlargement was detected during the first year.	1 (Strong)	B (Moderate)
7. We recommend DUS and non-contrast CT scanning as alternative imaging surveillance after EVAR in patients with contraindications to iodinated contrast agents.	1 (Strong)	B (Moderate)
8. We recommend total aortic imaging with non-contrast CT scanning at 5-year intervals after open surgical repair or EVAR to detect aneurysmal degeneration of other aortic segments.	1 (Strong)	C (Low)

RECOMMENDATIONS  
**Mesenteric Arteries**

# Mesenteric arteries

Recommendation	Strength of recommendation	Quality of evidence
<p>1. There are no prospective reports documenting the efficacy of a surveillance protocol after mesenteric artery stenting or bypass grafts; however, recurrent mesenteric ischemia is potentially life-threatening. Therefore, after mesenteric artery (celiac, superior mesenteric, and inferior mesenteric) angioplasty with or without stenting, or mesenteric artery bypass grafting, we recommend the following:</p> <ul style="list-style-type: none"><li>A. Clinical follow-up and baseline DUS within 1 month of the procedure;</li><li>B. Clinical follow-up and DUS at 6 months, 12 months, and then annually thereafter.</li></ul>	1 (Strong)	C (Low)



# Mesenteric arteries

Recommendation	Strength of recommendation	Quality of evidence
<p>2. We suggest contrast imaging for patients with symptoms of recurrent mesenteric ischemia after mesenteric artery stents or bypass grafts, or for the following duplex findings:</p> <ul style="list-style-type: none"><li>A. Celiac axis: PSV &gt;370 cm/s or a substantial increase from the post-treatment baseline PSV (what constitutes a substantial increase has not been defined);</li><li>B. Superior mesenteric artery: PSV &gt;420 cm/s, or a substantial increase from the post-treatment baseline PSV (what constitutes a substantial increase has not been defined);</li><li>C. Inferior mesenteric artery: Substantial increase from the post-treatment baseline PSV (what constitutes a substantial increase has not been defined).</li></ul>	2 (Weak)	C (Low)

RECOMMENDATIONS  
**Renal Arteries**

# Renal arteries

Recommendation	Strength of recommendation	Quality of evidence
<p>1. There are no prospective reports documenting the efficacy of a surveillance protocol after renal artery interventions. After renal artery angioplasty with or without stenting, or renal artery bypass or endarterectomy, we suggest the following:</p> <p>A. Clinical follow-up and baseline DUS within 1 month of the procedure;</p> <p>B. Clinical follow-up and DUS at 6 months, 12 months, and then annually thereafter.</p>	2 (Weak)	C (Low)

# Renal arteries

Recommendation	Strength of recommendation	Quality of evidence
<p>2. We suggest contrast imaging for loss of renal parenchyma (a decrease in kidney length of &gt;1 cm) or for the following duplex findings:</p> <p>A. Renal artery - PSV <math>\geq 280</math> cm/s, or a substantial increase from the post-treatment baseline PSV (what constitutes a substantial increase has not been defined);</p> <p>B. RAR of <math>\geq 4.5</math></p>	2 (Weak)	B (Moderate)

RECOMMENDATIONS

# Open Lower Extremity Arterial Revascularization

# Open lower extremity arterial revascularization

Recommendation	Strength of recommendation	Quality of evidence
1. We recommend clinical examination and ABI, with or without the addition of DUS, in the early postoperative period to provide a baseline for further follow-up after aortobifemoral bypass. This evaluation should be repeated at 6 and 12 months and then annually as long as there are no new signs or symptoms.	1 (Strong)	C (Low)
2. We recommend clinical examination and ABI, with or without the addition of DUS, in the early postoperative period to provide a baseline for further follow-up after iliofemoral bypass. This evaluation should be repeated at 6 and 12 months and then annually as long as there are no new signs or symptoms.	1 (Strong)	C (Low)

# Open lower extremity arterial revascularization

Recommendation	Strength of recommendation	Quality of evidence
3. We recommend clinical examination and ABI, with or without the addition of DUS, in the early postoperative period to provide a baseline for further follow-up after femoral-femoral bypass. This evaluation should be repeated at 6 and 12 months and then annually as long as there are no new signs or symptoms.	1 (Strong)	C (Low)
4. We recommend clinical examination and ABI, with or without the addition of DUS, in the early postoperative period to provide a baseline for further follow-up after axillo-bifemoral bypass. This evaluation should be repeated at 6 and 12 months and then annually as long as there are no new signs or symptoms.	1 (Strong)	C (Low)

# Open lower extremity arterial revascularization

Recommendation	Strength of recommendation	Quality of evidence
<p>5. Based on the high prevalence of abnormalities detected by DUS, as well as the relatively low associated cost and risks, we recommend clinical examination, ABI, and DUS for infrainguinal vein graft surveillance. This should include an early postoperative baseline evaluation and follow-up at 3, 6, and 12 months and at least annually thereafter. More frequent surveillance may be considered when uncorrected abnormalities are identified on DUS or when alternative vein conduits (other than great saphenous vein) are used.</p>	1 (Strong)	B (Moderate)
<p>6. After prosthetic infrainguinal bypass grafts we recommend clinical examination and ABI, with or without the addition of DUS, in the early postoperative period to provide a baseline for further follow-up. This evaluation should be repeated at 6 and 12 months and then annually as long as there are no new signs or symptoms.</p>	1 (Strong)	B (Moderate)



RECOMMENDATIONS

# Endovascular Lower Extremity Arterial Revascularization

# Endovascular lower extremity arterial revascularization

Recommendation	Strength of recommendation	Quality of evidence
<p>1. We recommend clinical examination, ABI, and DUS within the first month following aorto-iliac segment EVT to provide a post-treatment baseline and evaluate for residual stenosis. Clinical examination and ABI, with or without the addition of DUS, should be performed at 6 and 12 months and then annually as long as there are no new signs or symptoms.</p>	<p>1 (Strong)</p>	<p>C (Low)</p>
<p>2. We suggest clinical examination, ABI, and DUS within the first month following femoropopliteal artery EVT to provide a post-treatment baseline and evaluate for residual stenosis. Continued surveillance at 3 months and then every 6 months is indicated for the following:</p> <ul style="list-style-type: none"> <li>A. Patients with interventions utilizing stents, due to the potential increased difficulty of treating an occlusive versus stenotic in-stent lesion;</li> <li>B. Patients undergoing angioplasty or atherectomy for critical limb ischemia, due to increased risk of recurrent critical limb ischemia should the intervention fail.</li> </ul>	<p>2 (Weak)</p>	<p>C (Low)</p>

# Endovascular lower extremity arterial revascularization

Recommendation	Strength of recommendation	Quality of evidence
<p>3. We suggest clinical examination, ABI, and DUS within the first month following tibial artery EVT to provide a post-treatment baseline and evaluate for residual stenosis. Continued surveillance at 3 months and then every 6 months should be considered. Those patients with a deteriorating clinical vascular examination, return of rest pain, non-healing wounds, or new tissue loss, should undergo repeat DUS.</p>	2 (Weak)	C (Low)



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