

Peripheral Vascular Disease (Screening, Diagnosis and Management)

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Dr. Carter is a graduate of the University of South Carolina School of Medicine in Columbia. He completed his residency at Palmetto Health Richland in Columbia and a fellowship at Georgetown University School of Medicine in Washington, DC. He practices in a residency teaching program and primarily cares for underserved patients. He has interests in diabetes, cardiovascular health, headache disorders, and urologic conditions. He feels family physicians are critical partners to help guide patients through complex evaluations and specialty care.

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Learning Objectives

1. Identify patients at risk for asymptomatic PAD who may benefit from ankle-brachial index (ABI) screening.
2. Formulate a differential diagnosis for patients experiencing signs and symptoms of intermittent claudication.
3. Develop a treatment protocol that provides medical therapy, risk factor modification (i.e. smoking cessation programs, diet/nutrition counseling, exercise prescriptions, etc.) and regular monitoring and follow-up to promote compliance, evaluate treatment efficacy, and provide early endovascular evaluation if needed.
4. Collaborate with appropriate subspecialty providers to provide multidisciplinary management of patients diagnosed with PAD.


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Audience Engagement System

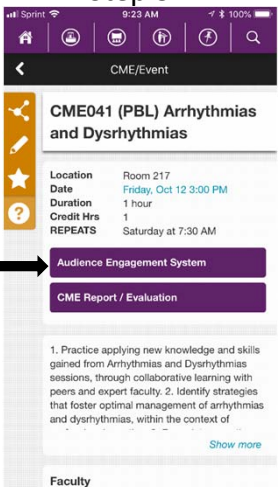
Step 1



Step 2



Step 3



The image illustrates the Audience Engagement System through three steps. Step 1 shows the app's dashboard with a grid of icons for navigation, including My Schedule, CME/Events, Faculty, Exhibit Hall, Maps, Event Pulse, Claim CME, Attendee Profiles, Social Media, and Local Places. Step 2 shows the CME/Events calendar view for the week of October 9th to 13th, listing various CME events such as CME041 (PBL) Arrhythmias and Dysrhythmias, CME063 Cardiovascular Pharmacology, CME134 Hepatitis C Treatment Update, CME137 Sexually Transmitted Infections Update, CME142 Office Immunization Management, CME157 (PBL) Fracture Management, and CME192 Fibromyalgia. Step 3 shows the details for CME041 (PBL) Arrhythmias and Dysrhythmias, including the location (Room 217), date (Friday, Oct 12 3:00 PM), duration (1 hour), credit hours (1), and repeats (Saturday at 7:30 AM). The details page also features buttons for Audience Engagement System and CME Report / Evaluation, and a list of faculty members.

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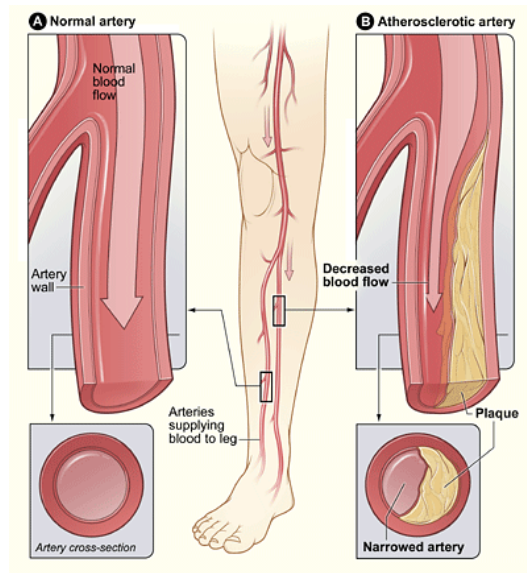


Image: Public domain, National Heart, Lung and Blood Institute, NIH, US Government

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PVD in US

- 5.9% with low ABI
- ≈7.2% (8.5 million) with PVD, 25% of these have severe disease
- Prevalence increases with age
 - 22% of persons \geq 80 years
- More common in non-Hispanic black adults (11.6%)
- Gender prevalence: male (5.9%) and female (5.0%)

Benjamin et al. The American Heart Association Heart Disease and Stroke Statistics–2018 Update: A Report From the American Heart Association Circulation. 2018;137:e67–e492; US Preventive Services Task Force. Screening for Peripheral Artery Disease and Cardiovascular Disease Risk Assessment with Ankle-Brachial Index. JAMA 2018; 320(2): 177-183.

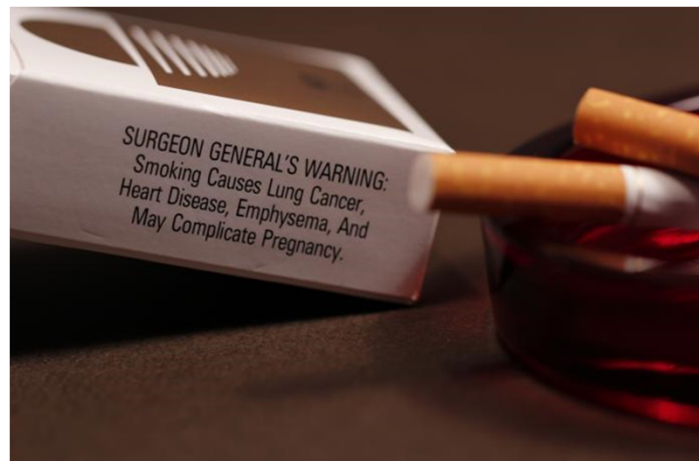
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- Overall mortality 15.5 / 100,000 in 2015
- Annual cost estimate: ≈21 billion
- ABI decline of >0.15 in 10 years
 - Increased mortality (RR of 2.4%)
 - 5 year cumulative CV mortality with low ABI
 - 9% for asymptomatic patients
 - 13% for symptomatic patients
 - vs. 5% for persons with normal ABI

Benjamin et al. The American Heart Association Heart Disease and Stroke Statistics–2017 Update: A Report From the American Heart Association *Circulation* 2017; 135; Kullo IJ, Rooke TW. *N Engl J Med* 2016; 374(9): 861-71; US Preventive Services Task Force. Screening for Peripheral Artery Disease and Cardiovascular Disease Risk Assessment with Ankle-Brachial Index. *JAMA* 2018; 320(2): 177-183.

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Risk Factors



Debora Cartagena, Centers for Disease Control

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Risk Factors

- Similar to ASCVD, but...
- Smoking and Diabetes most significant
 - Odds ratios may be as high as 3-4
 - Meta-analysis
 - Smoking (odds ratio 2.72)
 - Diabetes (odds ratio 1.88)

Benjamin et al. The American Heart Association Heart Disease and Stroke Statistics–2018 Update: A Report From the American Heart Association Circulation. 2018;137:e67–e492.
Kullo IJ, Rooke TW. N Engl J Med 2016; 374(9): 861-71

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Symptoms

- Claudication
 - Cramping, numbness, burning
 - Pallor or rubor
- Trophic symptoms
 - Skin changes – dry, scaly
 - Loss of hair
 - Nail changes - thickening

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Claudication

- Classic PVD symptom
- Described as
 - Pain or cramping in leg, buttocks with exertion
 - May also occur at rest
 - Related to relative ischemia
- Only $\approx 10\%$ will report it
- 40% don't, other 50% with other leg symptoms



A man suffering from cramp in the leg. Coloured aquatint after M. Egerton, 1828. Wellcome Images, Wellcome Trust, UK via wikimedia commons

Benjamin et al. The American Heart Association Heart Disease and Stroke Statistics–2018 Update: A Report From the American Heart Association Circulation. 2018;137:e67–e492.

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Physical Exam

- Cardiovascular
 - Heart
 - Aorta
 - Peripheral pulses
 - Bruits
 - Buerger's Test
 - Patient lying supine
 - Raise feet to 45° for 2 minutes
 - Observe for pallor on soles of the feet
 - Have patient sit up and hand legs over edge of exam table. Observe for reactive hyperemia. This can signal critical limb ischemia.
- General exam – gait, signs of malnutrition, tobacco use
- Skin exam – trophic changes
- Physical exam – low sensitivity in asymptomatic patients for finding mild PAD
- Dorsalis pedis may be congenitally absent in 10-15% of people

Final Recommendation Statement: Peripheral Arterial Disease (PAD) and CVD in Adults: Risk Assessment with Ankle Brachial Index. U.S. Preventive Services Task Force. December 2016.
Screening for Peripheral Arterial Disease. Am Fam Physician. 2006 Feb 1;73(3):497-500.

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Differential Diagnosis

- Vascular disease
 - Arterial
 - Venous
- Neurologic
 - Peripheral neuropathy
 - Central neuropathic (neurogenic claudication– spinal stenosis)
- Inflammatory/Autoimmune
 - Vasculitis
 - Vasospastic phenomenon
- Musculoskeletal
 - Arthritic – Back pain, hip, knee, ankle, foot
 - Functional
 - Inflammatory

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Complications

- Claudication
- Decreased lower extremity function
- Diminished QOL
- Ulceration
- Amputation
- Critical ischemia
- Increased risk of CV events, stroke, death

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Arterial Ulcers



- Discrete
- “Punched out”
- Peripheral surrounding inflammation
- Painful
- Poor healing
- Lack of granulation tissue

Image: via Wikimedia commons
Moore J. The Foot and Ankle Online Journal 1 (9): 2.

https://commons.wikimedia.org/wiki/File:Arterial_ulcer_peripheral_vascular_disease.jpg

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Critical Limb Ischemia

- Resting Pain
- Nocturnal pain
- Tissue damage
 - ulcer
 - gangrene



Rooke TW, et al. 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease (updating the 2005 guideline). J Am Coll Cardiol 2011;58:2020–45;

Image: Author-Drgnu23 via Wikimedia commons

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When should I suspect PAD?

- Exertional lower extremity symptoms
- Age ≥ 65
- Age $\geq 50-64$ with risk factors:
 - Smoking, DM, FH of PAD, HTN, Hyperlipidemia
- Age < 50 with DM and one other ASCVD risk
- Non-healing wound
- Symptomatic Claudication

Gerhard-Herman MD, Gornik HL, Barrett C, et al. 2016 AHA/ACC guideline on the management of patients with lower extremity peripheral artery disease. *J Am Coll Cardiol* 2017;69:1465-508.

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Screening Guidance

- ACC/AHA – No screening guidelines. Recommendations for case finding in patients with suspected PAD
- ADA – Diabetes and ≥ 50 years or any patient with claudication or abnormal pedal pulse
- USPSTF – Insufficient evidence to assess benefits and harms of ABI screening

US Preventive Services Task Force. Screening for Peripheral Artery Disease and Cardiovascular Disease Risk Assessment with Ankle-Brachial Index. *JAMA* 2018; 320(2): 177-183.
American Diabetes Association. Standards of Medical Care in Diabetes 2017. *Diabetes Care* 2017;40(Suppl.1):S1–S142

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AES Question #1

Which one of the following is the threshold value for resting ankle-brachial index for diagnosing PAD?

- A. ≤ 0.99
- B. ≤ 0.9
- C. ≤ 0.5

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Ankle-Brachial Index

- Ratio of systolic pressures
 - ankle segment divided by brachial segment in a supine patient
- PVD = Resting ABI ≤ 0.9
- Normal = 1.00 – 1.30
- 0.91-0.99 borderline
- Evidence regarding accuracy is lacking
- Low sensitivity (7-34%), high specificity (96-100%) in screening populations

Kullo IJ, Rooke TW. N Engl J Med 2016; 374(9): 861-71

Crawford F, Welch K, Andras A, Chappell FM. Ankle brachial index for the diagnosis of lower limb peripheral arterial disease. Cochrane Database of Systematic Reviews 2016, Issue 9. Art. No.: CD010680.

US Preventive Services Task Force. Screening for Peripheral Artery Disease and Cardiovascular Disease Risk Assessment with Ankle-Brachial Index. JAMA 2018; 320(2): 177-183.

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- Normal ABI
 - 1.00-1.40
- Borderline
 - 0.91-0.99
- Mild PAD
 - ABI \leq 0.90 at rest or after exertion
- Moderate PAD
 - \leq 0.70 at rest, \leq 0.50 after exertion
- Severe PAD
 - \leq 0.50 at rest, \leq 0.15 after exertion

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Testing

- ABI
 - Resting
 - Exertional
- Ultrasound vascular studies
- Contrast vascular studies
- Transcutaneous tissue oxygen measurement (TCOM)

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Treatment Overview

- ASCVD Framework
 - If you have PVD, you have ASCVD
- Therefore:
 - Secondary prevention for ASCVD
 - Statins
 - Hypertension and Diabetes treatment
 - AHA Simple Seven – Lifestyle optimization
 - AHRQ Heart ABCS – Aspirin, BP, Cholesterol, Sugar
 - Evaluate for other end organ ASCVD

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Lifestyle Treatment

- Smoking Cessation
- Diet and exercise relevant to ASCVD and DM (as applicable)
- Walking program

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Supplemental Treatment

- Exercise therapy
- Walk 30-60 min 3x per week for 12 weeks
- Supervised programs (usually through cardiac rehab programs)
 - Statistically significant improvements in walk time and distance (? clinical)
 - ? covered by insurance

Kullo IJ, Rooke TW. *N Engl J Med* 2016; 374(9): 861-71

Fokkenrood HJP, Bendermacher BLW, Lauret GJ, Willigendael EM, Prins MH, Tejjink JAW. Supervised exercise therapy versus non-supervised exercise therapy for intermittent claudication. *Cochrane Database of Systematic Reviews* 2013, Issue 8. Art. No.: CD005263.

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Walking

- Can improve time and distance to claudication symptoms
- Recommended for patients with symptomatic claudication
- Evidence of efficacy in screen detected patients uncertain

Parmenter BJ, Raymond J, Dinnen P, Singh MA. *Atherosclerosis*. 2011;218:1–12.
Gerhard-Herman MD, Gornik HL, Barrett C, et al. *J Am Coll Cardiol* 2017;69:1465-508.
Guirguis-Blake JM, et al. *JAMA* 2018; 320(2): 184-196.



Becky Rentz, Centers for Disease Control

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Smoking Cessation

- Improves PAD outcomes
 - Decreased mortality,
 - Less disease progression
 - Fewer critical ischemic events
 - Less amputation
 - Fewer bypass graft failures
- Decreases ASCVD events (MI, stroke)
- Use counseling, cessation programs, and medications (bupropion, nicotine, varenicline)



Image: public domain, Wikimedia commons

Kullo IJ, Rooke TW. N Engl J Med 2016; 374(9): 861-71
Rooke TW, et al. J Am Coll Cardiol 2011; 58: 2020-45

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Varenicline and CV events?

- Conflicting evidence from studies as to whether this increases CV events
- There is FDA labeling regarding considering this risk
- Large Canadian study did show increased risk
- 2016 Systematic review and meta-analysis did not find a relationship
- Have to consider the overall balance for patients

Sterling LH, Windle SB, Filion KB, Touma L, Eisenberg MJ. J Am Heart Assoc 2016
Gershon AS, et al. Am J Resp and Crit Care Med 2018; 197 (7): 913-922.

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AES Question #2

Antiplatelet agents in patients with PAD are shown to improve which one of the following outcomes?

- A. Amputation rate
- B. Bleeding
- C. Claudication severity
- D. All-cause mortality

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Medical Treatment

- Antiplatelet
 - aspirin
 - clopidogrel (Plavix)
 - ticagrelor (Brilinta)
 - vorapaxar (Zontivity)
- PDE inhibitor
 - cilostazol (Pletal)
- Note: pentoxifylline (Trental) not effective for PAD

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Antiplatelet agents

- Improve all-cause and CV mortality
- One study supporting improved walking distance
- No clear impact on CV events
- Evidence base is lacking

Wong PF, Chong LY, Mikhailidis DP, Robless P, Stansby G. Antiplatelet agents for intermittent claudication. Cochrane Database of Systematic Reviews 2011, Issue 11. Art. No.: CD001272.

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- aspirin
 - General first line for ASCVD
- clopidogrel (Plavix)
 - Alternative to aspirin or with dual antiplatelet
- ticagrelor (Brilinta)
 - Alternative to clopidogrel and/or may be considered to address comorbidity (ex. MI)
- vorapaxar (Zontivity)
 - Newer agent – thrombin protease-activated receptor 1
 - Approved as add-on with ASA or clopidogrel
 - Reduced acute limb ischemia and revascularization
 - Increased risk of bleeding, intracranial
 - Don't use in pts. with stroke, TIA, intracranial bleeding hx

Kullo IJ, Rooke TW. N Engl J Med 2016; 374(9): 861-71
<https://www.fda.gov/drugs/informationondrugs/ucm423935.htm>
Hess CN, Hiatt WR. JAMA 2018;319(22):2329-2330

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EUCLID

- Double-blind RCT – clopidogrel vs. ticagrelor
- 2.5 year median follow-up
- Primary end point – composite CV death, MI, stroke
- Limb events included in secondary outcomes
- No difference in outcomes or bleeding risk

Hiatt WR, et al. N Engl J Med 2017; 376(1): 32-40.

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Interventional Treatment

- Percutaneous
- Surgical
 - Regional vessel
 - Major vessel

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- Increased endovascular treatment of critical limb ischemia
- 5.1% (2003) to 11.0% (2011)
- Lower rates of in-hospital mortality and major amputation
- Still needing more data on outcomes
- Know your local resources and/or regional high volume centers to increase patient options

Benjamin et al. The American Heart Association Heart Disease and Stroke Statistics–2018 Update: A Report From the American Heart Association *Circulation*. 2018;137:e67–e492.

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AAA



Image: James Hellman, MD, via Wikimedia commons

- Abdominal Aorta 3 cm or greater
- 12.5% of men and 5.2% of women 74 to 84 years
- Mortality for ruptured AAA nears 90%

Keisler B, Carter C. Abdominal Aortic Aneurysm. *Am Fam Physician* 2015; 91(8): 538-543

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AAA Screening

- USPSTF
 - Screen “ever smoking” men one time between ages 65-75
 - Ever smoking is 100 lifetime cigarettes
 - Selective screening in men 65-75 with other risk factors
 - Uncertain benefit in women

U.S. Preventive Services Task Force. Screening for abdominal aortic aneurysm: recommendation statement. *Ann Intern Med.* 2014;161(4):281–290.

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AES Question #3

You follow a 72 year-old man who has a 3.7 cm AAA. How often should you perform an ultrasound to reassess growth?

- A. Every 5 years
- B. Every 2 years
- C. Every year
- D. Every 6 months
- E. Every 3 months

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Risk of Rupture

Aneurysm size	Annual rate of growth
3.0-3.9 cm	1-4 mm
4.0-6.0 cm	3-5 mm
6.0 or greater	7-8 mm
Aneurysm size	Absolute risk of rupture
5 cm	20%
6 cm	40%
7 cm	50%



Image: public domain, Wikimedia commons

Hirsch AT, Haskal ZJ, Hertzler NR, et al. *Circulation*. 2006;113(11):e463–e654.
 Roger VL, Go AS, Lloyd-Jones DM, et al. *Circulation*. 2012;125(1):e2–e220.
 Keisler B, Carter C. Abdominal Aortic Aneurysm. *Am Fam Physician* 2015; 91(8): 538-543

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AAA Surveillance



Aortic Diameter	Surveillance Interval
< 3.0 cm	No surveillance*
3.0 cm to 3.9 cm	Q 2-3 Years - Ultrasound
4.0 cm to 5.4 cm	Q 6-12 months – Ultrasound or CT Consider surgical consultation if: <ul style="list-style-type: none"> • 5.0 cm • expanding more rapidly than expected
> 5.4 cm	Surgical consultation for elective repair

* Consider risk factors

Hirsch AT, Haskal ZJ, Hertzler NR, et al. *Circulation*. 2006;113(11):e463–e654.
 Keisler B, Carter C. Abdominal Aortic Aneurysm. *Am Fam Physician* 2015; 91(8): 538-543

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Best Practice Recommendations

- Have elevated index of suspicion in patients with extremity symptoms and risk factors
- Don't rely on claudication to identify PAD
- Approach PAD using the ASCVD framework
- Lifestyle interventions improve outcomes
- Screen men age 65-75 who've smoked for AAA

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Questions



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