

PRACTICE EXAM 10: VASCULAR TECHNOLOGY SIMULATION (170 QUESTIONS)

This practice examination contains 170 questions. Allow approximately three hours, matching the current ARDMS Vascular Technology examination. Select the single best answer for each item. The official examination uses a scaled score from 300 to 700, with 555 required to pass; this practice score is for study purposes only.

1. Which vessel normally lies anterior to the vertebral transverse processes and supplies the posterior cerebral circulation?

- A. External carotid artery
- B. Facial artery
- C. Vertebral artery
- D. Superior thyroid artery

2. Which duplex finding most strongly supports acute lower-extremity deep vein thrombosis?

- A. A fully compressible vein with phasic flow
- B. A noncompressible vein containing hypoechoic material
- C. A small echogenic vein with collaterals
- D. Spontaneous flow augmented by compression

3. Which dialysis access finding most strongly suggests a stenosis at the venous anastomosis?

- A. Uniform low-resistance flow throughout
- B. Focal velocity acceleration with post-stenotic turbulence
- C. Normal access thrill without velocity change
- D. Respiratory phasicity in the outflow vein

4. A brachial pressure is 140 mmHg and an ankle pressure is 98 mmHg. What is the ankle-brachial index?

- A. 0.50
- B. 0.85
- C. 1.43
- D. 0.70

5. Before ultrasound-guided thrombin injection of a pseudoaneurysm, which feature is especially important to document?

- A. The sac, neck, and adjacent native artery
- B. Only the contralateral carotid artery
- C. Only the patient's ankle pressure
- D. The portal vein direction alone

6. What Doppler angle practice best supports reproducible velocity measurement?

- A. Use a 90-degree correction angle for every sampled vessel
- B. Align the angle cursor perpendicular to the observed flow stream
- C. Keep the correction angle at or below 60 degrees and parallel to flow
- D. Change the correction angle randomly between consecutive spectral samples

7. Before beginning a vascular examination, what is the best first step for patient identification?

- A. Ask only the room number
- B. Rely solely on facial recognition
- C. Use two approved patient identifiers
- D. Use the diagnosis as the identifier

8. A normal common carotid artery spectral waveform should demonstrate which pattern?

[Figure PQ-1: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. No diastolic flow throughout
- B. Continuous forward flow with moderate diastolic flow
- C. Persistent flow reversal in diastole
- D. Markedly pulsatile venous flow

9. Which finding is most characteristic of chronic post-thrombotic venous change?

[Figure PQ-2: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. An enlarged vein with soft thrombus
- B. A normal vein with complete compression
- C. A cystic mass without venous continuity
- D. A contracted irregular vein with echogenic synechiae

10. Which waveform is expected in the feeding artery of a functioning arteriovenous fistula?

- A. High-flow low-resistance arterial waveform
- B. High-resistance triphasic waveform
- C. Absent diastolic arterial flow
- D. Purely venous respiratory waveform

11. Which resting ankle-brachial index is most suggestive of noncompressible calcified arteries?

- A. Between 1.00 and 1.20
- B. Greater than 1.40
- C. Between 0.91 and 0.99
- D. Less than 0.50

12. During thrombin injection, where should the needle tip generally be visualized?

- A. Inside the native artery lumen
- B. Within the adjacent vein
- C. Within the pseudoaneurysm sac away from the neck
- D. Outside the sac in subcutaneous tissue

13. Color aliasing occurs when the Doppler shift exceeds what?

[Figure PQ-3: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. The acoustic impedance
- B. The transducer bandwidth only
- C. The grayscale dynamic range
- D. The Nyquist limit

14. How should a sonographer handle a critical duplex finding?

- A. Follow the laboratory's urgent notification protocol and document communication
- B. Wait for the routine final report only
- C. Tell the patient a definitive diagnosis independently
- D. Delete technically limited images

15. Which feature most reliably distinguishes the internal carotid artery from the external carotid artery at the bifurcation?

- A. The internal carotid usually has no cervical branches
- B. The internal carotid is always smaller
- C. The internal carotid shows temporal tapping oscillations
- D. The internal carotid has multiple neck branches

16. Reflux lasting more than the accepted laboratory threshold after distal augmentation most directly indicates what?

- A. Acute arterial occlusion
- B. Normal respiratory phasicity
- C. Venous valvular incompetence
- D. Increased arterial resistance

17. During EVAR surveillance, persistent flow within the aneurysm sac should raise concern for what?

- A. Normal graft porosity after all follow-up
- B. Renal vein reflux
- C. Carotid restenosis
- D. An endoleak

18. A pressure drop of 25 mmHg between adjacent segmental cuffs most strongly suggests what?

- A. Normal pressure variation
- B. Hemodynamically significant disease between those levels
- C. Isolated deep venous thrombosis
- D. A technical need to increase Doppler gain

19. What should be assessed immediately after pseudoaneurysm thrombin injection?

- A. Only carotid artery velocity
- B. Only respiratory venous phasicity
- C. Sac thrombosis and patency of the distal artery
- D. Portal flow after a meal

20. Which adjustment is most appropriate when color aliasing obscures a high-velocity jet?

- A. Lower the wall filter to zero only
- B. Increase the color scale or pulse repetition frequency
- C. Increase color persistence maximally
- D. Reduce the color scale further

21. What should be documented when a complete prescribed protocol cannot be performed?

- A. The technical limitation and portions not completed
- B. Nothing if some images were obtained
- C. A guessed result for missing segments
- D. Only the machine serial number

22. Normal respiratory phasicity in the common femoral vein primarily reflects pressure changes transmitted from where?

[Figure PQ-4: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. The left ventricle only
- B. The distal calf muscles
- C. The carotid sinus
- D. The thorax and abdomen

23. A tardus-parvus waveform distal to an arterial lesion suggests which hemodynamic condition?

[Figure PQ-5: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. Normal high-resistance flow
- B. Distal venous reflux
- C. A significant proximal stenosis
- D. An arteriovenous fistula at the sample

24. A bypass graft with markedly low velocities throughout is at increased risk for what?

- A. Portal hypertension
- B. Thrombosis from inadequate flow
- C. Acute venous reflux only
- D. Carotid body tumor

25. What is the principal purpose of postexercise ankle pressures?

- A. To diagnose acute DVT
- B. To measure carotid stenosis
- C. To confirm portal hypertension
- D. To reveal flow-limiting disease masked at rest

26. During endovenous thermal ablation, why is tumescent anesthesia placed around the target vein?

- A. To compress the vein and protect surrounding tissue from heat
- B. To increase resistance in the adjacent native artery
- C. To create sustained hypertension in the portal circulation
- D. To reverse flow in the ipsilateral carotid artery

27. What is the principal effect of increasing the Doppler sample volume length?

[Figure PQ-6: Grayscale vascular duplex panel with a clearly labeled vessel segment, orientation marker, color-flow box, and spectral waveform corresponding to the findings described in the stem; include velocity scale, baseline, sample gate, angle cursor, and units, using neutral textbook styling without annotations that reveal the answer.]

- A. It improves axial resolution automatically
- B. It includes velocities from a larger region
- C. It eliminates all spectral broadening
- D. It lowers transmitted frequency

28. Which preparation is commonly appropriate before a mesenteric duplex examination?

- A. A large meal immediately before scanning
- B. Continuous leg exercise during imaging
- C. Fasting according to laboratory protocol
- D. Mandatory contrast injection

29. Which lower-extremity artery is normally found with the paired posterior tibial veins behind the medial malleolus?

- A. Anterior tibial artery
- B. Peroneal artery
- C. Dorsalis pedis artery
- D. Posterior tibial artery

30. Which spectral change is expected at a hemodynamically significant arterial stenosis?

- A. Focal velocity acceleration with spectral broadening
- B. Uniform velocity reduction without turbulence
- C. Loss of all systolic flow proximally

D. Only increased venous phasicity

31. Which TIPS Doppler assessment is most important during surveillance?

- A. Carotid plaque morphology only
- B. Ankle pressure after exercise
- C. Patency and velocity patterns throughout the shunt
- D. Upper-extremity venous reflux

32. Which photoplethysmography finding supports venous reflux?

- A. Abnormally shortened refill time
- B. Prolonged normal refill after exercise
- C. A triphasic arterial waveform
- D. A normal toe pressure

33. Which postablation finding requires careful evaluation for extension into the deep system?

- A. Expected echogenic treated segment
- B. Normal compressibility of remote veins
- C. Normal arterial triphasicity
- D. Thrombus near the treated vein's deep venous junction

34. Mirror-image artifact across a strong reflector commonly produces what appearance?

- A. Complete loss of all echoes
- B. A duplicated vessel or waveform on the opposite side
- C. A true second vessel with independent anatomy
- D. Only increased temporal resolution

35. When prior imaging is available, why should it be reviewed before scanning?

- A. To replace the current examination
- B. To avoid obtaining patient history
- C. To target known abnormalities and assess interval change
- D. To guarantee identical velocities

36. The celiac artery normally divides into which three principal branches?

- A. Common hepatic, splenic, and left gastric arteries
- B. SMA, IMA, and renal arteries
- C. Right gastric, renal, and splenic arteries
- D. Hepatic, iliac, and mesenteric arteries

37. Flow in a true aneurysm sac involves which arterial wall layers?

- A. Only the adventitia
- B. All three wall layers
- C. No arterial wall layers
- D. Only an implanted graft

38. During a morning vascular laboratory examination, which dialysis access finding most strongly suggests a stenosis at the venous anastomosis?

- A. Uniform low-resistance flow throughout
- B. Normal access thrill without velocity change
- C. Respiratory phasicity in the outflow vein
- D. Focal velocity acceleration with post-stenotic turbulence

39. Why must the pressure cuff width be appropriate for limb circumference?

- A. A small cuff always lowers pressure
- B. Cuff size affects only venous color flow
- C. Cuff width has no hemodynamic effect
- D. An undersized cuff can falsely elevate the pressure

40. During a morning vascular laboratory examination, before ultrasound-guided thrombin injection of a pseudoaneurysm, which feature is especially important to document?

- A. Only the contralateral carotid artery
- B. The sac, neck, and adjacent native artery
- C. Only the patient's ankle pressure
- D. The portal vein direction alone

41. Which action follows the ALARA principle?

- A. Use the lowest output and shortest exposure that obtain diagnostic information
- B. Maximize power for every examination
- C. Ignore dwell time during spectral Doppler
- D. Use output power to compensate for poor positioning first

42. Which communication approach best supports informed cooperation during a vascular examination?

- A. Use unexplained technical jargon
- B. Promise a normal result before scanning
- C. Explain the procedure in clear language and invite questions
- D. Avoid discussing positioning or pressure

43. Which normal renal artery waveform characteristic reflects the kidney's low-resistance vascular bed?

- A. Persistent forward diastolic flow
- B. Early diastolic flow reversal
- C. Absent end-diastolic flow
- D. Triphasic flow at the hilum

44. The classic spectral waveform in the neck of a pseudoaneurysm is described as what?

- A. Continuous hepatopetal flow
- B. Monophasic low-velocity venous flow
- C. To-and-fro flow
- D. Triphasic flow without reversal

45. While reviewing a technically adequate duplex study, which waveform is expected in the feeding artery of a functioning arteriovenous fistula?

- A. High-resistance triphasic waveform
- B. High-flow low-resistance arterial waveform
- C. Absent diastolic arterial flow
- D. Purely venous respiratory waveform

46. Which test is preferred when ankle arteries are noncompressible?

- A. Carotid bruit auscultation
- B. Portal vein diameter
- C. Venous reflux time only
- D. Toe-brachial index

47. While reviewing a technically adequate duplex study, during thrombin injection, where should the needle tip generally be visualized?

- A. Inside the native artery lumen

- B. Within the adjacent vein
- C. Within the pseudoaneurysm sac away from the neck
- D. Outside the sac in subcutaneous tissue

48. If a spectral waveform is cut off at the top of the display, which adjustment is appropriate?

- A. Raise the velocity scale or shift the baseline
- B. Increase wall filter until flow disappears
- C. Lower pulse repetition frequency
- D. Increase persistence only

49. While reviewing a technically adequate duplex study, before beginning a vascular examination, what is the best first step for patient identification?

- A. Ask only the room number
- B. Use two approved patient identifiers
- C. Rely solely on facial recognition
- D. Use the diagnosis as the identifier

50. In the normal portal vein, blood flows in which direction?

- A. Away from the liver
- B. Bidirectionally with each heartbeat
- C. Toward the spleen only
- D. Toward the liver

51. Which finding suggests carotid subclavian steal physiology?

- A. Reversed or alternating ipsilateral vertebral flow
- B. Elevated portal venous velocity
- C. Continuous forward vertebral flow bilaterally

D. Absent femoral venous phasicity alone

52. In a patient referred for a focused vascular assessment, during EVAR surveillance, persistent flow within the aneurysm sac should raise concern for what?

- A. Normal graft porosity after all follow-up
- B. Renal vein reflux
- C. Carotid restenosis
- D. An endoleak

53. In a patient referred for a focused vascular assessment, a brachial pressure is 140 mmHg and an ankle pressure is 98 mmHg. What is the ankle-brachial index?

- A. 0.50
- B. 0.70
- C. 0.85
- D. 1.43

54. In a patient referred for a focused vascular assessment, what should be assessed immediately after pseudoaneurysm thrombin injection?

- A. Only carotid artery velocity
- B. Only respiratory venous phasicity
- C. Sac thrombosis and patency of the distal artery
- D. Portal flow after a meal

55. What does the resistive index calculate?

- A. End-diastolic velocity divided by mean velocity
- B. Peak systolic velocity multiplied by vessel diameter
- C. Mean velocity divided by heart rate

D. (Peak systolic velocity minus end-diastolic velocity) divided by peak systolic velocity

56. In a patient referred for a focused vascular assessment, how should a sonographer handle a critical duplex finding?

- A. Wait for the routine final report only
- B. Follow the laboratory's urgent notification protocol and document communication
- C. Tell the patient a definitive diagnosis independently
- D. Delete technically limited images

57. Which vein joins the splenic vein to form the main portal vein?

- A. Superior mesenteric vein
- B. Inferior vena cava
- C. Left renal vein
- D. Hepatic vein

58. A patient with celiac artery compression by the median arcuate ligament often shows what respiratory behavior?

- A. Higher velocity only after eating
- B. Complete celiac occlusion during inspiration
- C. Higher celiac velocity during expiration
- D. No respiratory velocity variation

59. During comparison with a prior vascular study, a bypass graft with markedly low velocities throughout is at increased risk for what?

- A. Portal hypertension
- B. Thrombosis from inadequate flow
- C. Acute venous reflux only

D. Carotid body tumor

60. During comparison with a prior vascular study, which resting ankle-brachial index is most suggestive of noncompressible calcified arteries?

- A. Greater than 1.40
- B. Between 1.00 and 1.20
- C. Between 0.91 and 0.99
- D. Less than 0.50

61. During comparison with a prior vascular study, during endovenous thermal ablation, why is tumescent anesthesia placed around the target vein?

- A. To increase resistance in the adjacent native artery
- B. To create sustained hypertension in the portal circulation
- C. To compress the vein and protect surrounding tissue from heat
- D. To reverse flow in the ipsilateral carotid artery

62. A renal waveform has PSV 100 cm/s and EDV 30 cm/s. What is its resistive index?

- A. 0.30
- B. 0.43
- C. 1.30
- D. 0.70

63. During comparison with a prior vascular study, what should be documented when a complete prescribed protocol cannot be performed?

- A. The technical limitation and portions not completed
- B. Nothing if some images were obtained
- C. A guessed result for missing segments

D. Only the machine serial number

64. Which transcranial window is commonly used to insonate the middle cerebral artery?

- A. Suboccipital window
- B. Transorbital window
- C. Submandibular window
- D. Transtemporal window

65. Which renal artery abnormality is classically associated with a string-of-beads angiographic appearance?

- A. Atherosclerosis at the ostium
- B. Renal vein thrombosis
- C. Fibromuscular dysplasia
- D. Acute cortical necrosis

66. While optimizing a complete diagnostic protocol, which TIPS Doppler assessment is most important during surveillance?

- A. Carotid plaque morphology only
- B. Patency and velocity patterns throughout the shunt
- C. Ankle pressure after exercise
- D. Upper-extremity venous reflux

67. While optimizing a complete diagnostic protocol, a pressure drop of 25 mmHg between adjacent segmental cuffs most strongly suggests what?

- A. Hemodynamically significant disease between those levels
- B. Normal pressure variation
- C. Isolated deep venous thrombosis

D. A technical need to increase Doppler gain

68. While optimizing a complete diagnostic protocol, which postablation finding requires careful evaluation for extension into the deep system?

- A. Expected echogenic treated segment
- B. Thrombus near the treated vein's deep venous junction
- C. Normal compressibility of remote veins
- D. Normal arterial triphasicity

69. Which transducer generally provides the best penetration for a deep abdominal vessel?

- A. A very high-frequency linear transducer
- B. A continuous-wave pencil probe only
- C. A superficial standoff pad without a probe
- D. A lower-frequency curvilinear transducer

70. While optimizing a complete diagnostic protocol, which preparation is commonly appropriate before a mesenteric duplex examination?

- A. A large meal immediately before scanning
- B. Continuous leg exercise during imaging
- C. Fasting according to laboratory protocol
- D. Mandatory contrast injection

71. Which vessel is the direct continuation of the anterior tibial artery at the ankle?

- A. Posterior tibial artery
- B. Dorsalis pedis artery
- C. Peroneal artery
- D. Deep femoral artery

72. Which portal Doppler finding indicates abnormal flow direction related to portal hypertension?

- A. Hepatofugal portal flow
- B. Hepatopetal portal flow
- C. Low-resistance hepatic arterial flow
- D. Respiratory phasicity in the IVC

73. In a patient with relevant vascular symptoms, what is the principal purpose of postexercise ankle pressures?

- A. To diagnose acute DVT
- B. To measure carotid stenosis
- C. To reveal flow-limiting disease masked at rest
- D. To confirm portal hypertension

74. During a morning vascular laboratory examination, before ultrasound-guided thrombin injection of a pseudoaneurysm, which feature is especially important to document?

- A. Only the contralateral carotid artery
- B. Only the patient's ankle pressure
- C. The portal vein direction alone
- D. The sac, neck, and adjacent native artery

75. Which quality-control observation warrants investigation?

- A. Stable measurements matching baseline
- B. A new persistent dropout region on phantom images
- C. Uniform targets at expected depths
- D. Consistent sensitivity across repeated tests

76. In a patient with relevant vascular symptoms, when prior imaging is available, why should it be reviewed before scanning?

- A. To replace the current examination
- B. To avoid obtaining patient history
- C. To target known abnormalities and assess interval change
- D. To guarantee identical velocities

77. The normal inferior vena cava typically changes caliber how during quiet inspiration?

- A. It becomes completely rigid
- B. It doubles in caliber
- C. It develops sustained reversal
- D. It decreases in caliber

78. Which symptom pattern is most typical of chronic mesenteric ischemia?

- A. Postprandial abdominal pain with weight loss
- B. Painless ankle edema only
- C. Transient arm numbness with elevation
- D. Isolated nocturnal calf cramping

79. During a morning vascular laboratory examination, which photoplethysmography finding supports venous reflux?

- A. Abnormally shortened refill time
- B. Prolonged normal refill after exercise
- C. A triphasic arterial waveform
- D. A normal toe pressure

80. While reviewing a technically adequate duplex study, during thrombin injection, where should the needle tip generally be visualized?

- A. Inside the native artery lumen
- B. Within the pseudoaneurysm sac away from the neck
- C. Within the adjacent vein
- D. Outside the sac in subcutaneous tissue

81. During a morning vascular laboratory examination, what Doppler angle practice best supports reproducible velocity measurement?

- A. Use a 90-degree correction angle for every sampled vessel
- B. Align the angle cursor perpendicular to the observed flow stream
- C. Keep the correction angle at or below 60 degrees and parallel to flow
- D. Change the correction angle randomly between consecutive spectral samples

82. During a morning vascular laboratory examination, which communication approach best supports informed cooperation during a vascular examination?

- A. Use unexplained technical jargon
- B. Promise a normal result before scanning
- C. Avoid discussing positioning or pressure
- D. Explain the procedure in clear language and invite questions

83. While reviewing a technically adequate duplex study, which vessel normally lies anterior to the vertebral transverse processes and supplies the posterior cerebral circulation?

- A. External carotid artery
- B. Facial artery
- C. Superior thyroid artery
- D. Vertebral artery

84. A Baker cyst is most commonly identified in which location during a venous duplex examination?

- A. The medial popliteal fossa
- B. The carotid bifurcation
- C. The renal hilum
- D. The anterior ankle

85. While reviewing a technically adequate duplex study, why must the pressure cuff width be appropriate for limb circumference?

- A. A small cuff always lowers pressure
- B. Cuff size affects only venous color flow
- C. An undersized cuff can falsely elevate the pressure
- D. Cuff width has no hemodynamic effect

86. While reviewing a technically adequate duplex study, color aliasing occurs when the Doppler shift exceeds what?

- A. The acoustic impedance
- B. The Nyquist limit
- C. The transducer bandwidth only
- D. The grayscale dynamic range

87. In a patient referred for a focused vascular assessment, before beginning a vascular examination, what is the best first step for patient identification?

- A. Ask only the room number
- B. Rely solely on facial recognition
- C. Use the diagnosis as the identifier
- D. Use two approved patient identifiers

88. In a patient referred for a focused vascular assessment, a normal common carotid artery spectral waveform should demonstrate which pattern?

- A. Continuous forward flow with moderate diastolic flow
- B. No diastolic flow throughout
- C. Persistent flow reversal in diastole
- D. Markedly pulsatile venous flow

89. Which carotid lesion can splay the internal and external carotid arteries?

- A. Thyroid cyst
- B. Carotid body tumor
- C. Jugular valve
- D. Vertebral artery loop

90. In a patient referred for a focused vascular assessment, which test is preferred when ankle arteries are noncompressible?

- A. Carotid bruit auscultation
- B. Portal vein diameter
- C. Toe-brachial index
- D. Venous reflux time only

91. In a patient referred for a focused vascular assessment, which adjustment is most appropriate when color aliasing obscures a high-velocity jet?

- A. Lower the wall filter to zero only
- B. Increase the color scale or pulse repetition frequency
- C. Increase color persistence maximally
- D. Reduce the color scale further

92. During comparison with a prior vascular study, how should a sonographer handle a critical duplex finding?

- A. Wait for the routine final report only
- B. Tell the patient a definitive diagnosis independently
- C. Delete technically limited images
- D. Follow the laboratory's urgent notification protocol and document communication

93. During comparison with a prior vascular study, which feature most reliably distinguishes the internal carotid artery from the external carotid artery at the bifurcation?

- A. The internal carotid is always smaller
- B. The internal carotid shows temporal tapping oscillations
- C. The internal carotid usually has no cervical branches
- D. The internal carotid has multiple neck branches

94. A monophasic arterial waveform throughout one leg most strongly suggests what?

- A. Significant inflow disease
- B. Normal resting physiology
- C. Isolated superficial venous reflux
- D. Normal collateral reserve

95. While optimizing a complete diagnostic protocol, a brachial pressure is 140 mmHg and an ankle pressure is 98 mmHg. What is the ankle-brachial index?

- A. 0.50
- B. 0.70
- C. 0.85
- D. 1.43

96. During comparison with a prior vascular study, what is the principal effect of increasing the Doppler sample volume length?

- A. It improves axial resolution automatically
- B. It eliminates all spectral broadening
- C. It includes velocities from a larger region
- D. It lowers transmitted frequency

97. While optimizing a complete diagnostic protocol, normal respiratory phasicity in the common femoral vein primarily reflects pressure changes transmitted from where?

- A. The left ventricle only
- B. The distal calf muscles
- C. The carotid sinus
- D. The thorax and abdomen

98. Which finding supports May-Thurner anatomy in a patient with left-leg swelling?

- A. Compression of the left common iliac vein by the right common iliac artery
- B. Compression of the right renal artery by the SMA
- C. Occlusion of the left vertebral artery
- D. Dilation of the right portal vein

99. In a patient with relevant vascular symptoms, which resting ankle-brachial index is most suggestive of noncompressible calcified arteries?

- A. Between 1.00 and 1.20
- B. Between 0.91 and 0.99
- C. Less than 0.50
- D. Greater than 1.40

100. While optimizing a complete diagnostic protocol, mirror-image artifact across a strong reflector commonly produces what appearance?

- A. Complete loss of all echoes
- B. A true second vessel with independent anatomy
- C. A duplicated vessel or waveform on the opposite side
- D. Only increased temporal resolution

101. In a patient with relevant vascular symptoms, which lower-extremity artery is normally found with the paired posterior tibial veins behind the medial malleolus?

- A. Anterior tibial artery
- B. Posterior tibial artery
- C. Peroneal artery
- D. Dorsalis pedis artery

102. In suspected popliteal artery entrapment, which maneuver may provoke arterial compression?

- A. Active plantar flexion against resistance
- B. Quiet expiration only
- C. Distal venous augmentation
- D. Passive wrist extension

103. During a morning vascular laboratory examination, a pressure drop of 25 mmHg between adjacent segmental cuffs most strongly suggests what?

- A. Normal pressure variation
- B. Isolated deep venous thrombosis
- C. Hemodynamically significant disease between those levels
- D. A technical need to increase Doppler gain

104. In a patient with relevant vascular symptoms, which action follows the ALARA principle?

- A. Maximize power for every examination
- B. Use the lowest output and shortest exposure that obtain diagnostic information
- C. Ignore dwell time during spectral Doppler
- D. Use output power to compensate for poor positioning first

105. During a morning vascular laboratory examination, the celiac artery normally divides into which three principal branches?

- A. SMA, IMA, and renal arteries
- B. Right gastric, renal, and splenic arteries
- C. Hepatic, iliac, and mesenteric arteries
- D. Common hepatic, splenic, and left gastric arteries

106. Which ultrasound feature helps distinguish arterial dissection from simple atherosclerotic plaque?

- A. A mobile or fixed intimal flap separating flow channels
- B. Posterior acoustic enhancement only
- C. Uniform wall thickness everywhere
- D. Normal color filling without a defect

107. While reviewing a technically adequate duplex study, what is the principal purpose of postexercise ankle pressures?

- A. To diagnose acute DVT
- B. To measure carotid stenosis
- C. To reveal flow-limiting disease masked at rest
- D. To confirm portal hypertension

108. During a morning vascular laboratory examination, if a spectral waveform is cut off at the top of the display, which adjustment is appropriate?

- A. Raise the velocity scale or shift the baseline
- B. Increase wall filter until flow disappears
- C. Lower pulse repetition frequency
- D. Increase persistence only

109. While reviewing a technically adequate duplex study, which normal renal artery waveform characteristic reflects the kidney's low-resistance vascular bed?

- A. Early diastolic flow reversal
- B. Absent end-diastolic flow
- C. Triphasic flow at the hilum
- D. Persistent forward diastolic flow

110. While reviewing a technically adequate duplex study, which duplex finding most strongly supports acute lower-extremity deep vein thrombosis?

- A. A fully compressible vein with phasic flow
- B. A noncompressible vein containing hypoechoic material
- C. A small echogenic vein with collaterals
- D. Spontaneous flow augmented by compression

111. In a patient referred for a focused vascular assessment, which photoplethysmography finding supports venous reflux?

- A. Prolonged normal refill after exercise
- B. Abnormally shortened refill time
- C. A triphasic arterial waveform
- D. A normal toe pressure

112. While reviewing a technically adequate duplex study, what does the resistive index calculate?

- A. (Peak systolic velocity minus end-diastolic velocity) divided by peak systolic velocity
- B. End-diastolic velocity divided by mean velocity
- C. Peak systolic velocity multiplied by vessel diameter
- D. Mean velocity divided by heart rate

113. In a patient referred for a focused vascular assessment, in the normal portal vein, blood flows in which direction?

- A. Away from the liver
- B. Bidirectionally with each heartbeat
- C. Toward the liver
- D. Toward the spleen only

114. In a patient referred for a focused vascular assessment, which finding is most characteristic of chronic post-thrombotic venous change?

- A. An enlarged vein with soft thrombus
- B. A normal vein with complete compression
- C. A cystic mass without venous continuity
- D. A contracted irregular vein with echogenic synechiae

115. During comparison with a prior vascular study, why must the pressure cuff width be appropriate for limb circumference?

- A. A small cuff always lowers pressure
- B. An undersized cuff can falsely elevate the pressure
- C. Cuff size affects only venous color flow
- D. Cuff width has no hemodynamic effect

116. In a patient referred for a focused vascular assessment, a renal waveform has PSV 100 cm/s and EDV 30 cm/s. What is its resistive index?

- A. 0.70
- B. 0.30
- C. 0.43
- D. 1.30

117. During comparison with a prior vascular study, which vein joins the splenic vein to form the main portal vein?

- A. Inferior vena cava
- B. Left renal vein
- C. Hepatic vein
- D. Superior mesenteric vein

118. During comparison with a prior vascular study, reflux lasting more than the accepted laboratory threshold after distal augmentation most directly indicates what?

- A. Acute arterial occlusion
- B. Normal respiratory phasicity
- C. Venous valvular incompetence
- D. Increased arterial resistance

119. During comparison with a prior vascular study, which transducer generally provides the best penetration for a deep abdominal vessel?

- A. A very high-frequency linear transducer
- B. A lower-frequency curvilinear transducer
- C. A continuous-wave pencil probe only
- D. A superficial standoff pad without a probe

120. While optimizing a complete diagnostic protocol, which transcranial window is commonly used to insonate the middle cerebral artery?

- A. Transtemporal window
- B. Suboccipital window
- C. Transorbital window
- D. Submandibular window

121. While optimizing a complete diagnostic protocol, a tardus-parvus waveform distal to an arterial lesion suggests which hemodynamic condition?

- A. Normal high-resistance flow
- B. Distal venous reflux
- C. An arteriovenous fistula at the sample
- D. A significant proximal stenosis

122. While optimizing a complete diagnostic protocol, which quality-control observation warrants investigation?

- A. Stable measurements matching baseline
- B. A new persistent dropout region on phantom images
- C. Uniform targets at expected depths
- D. Consistent sensitivity across repeated tests

123. In a patient with relevant vascular symptoms, which vessel is the direct continuation of the anterior tibial artery at the ankle?

- A. Posterior tibial artery
- B. Peroneal artery
- C. Dorsalis pedis artery
- D. Deep femoral artery

124. In a patient with relevant vascular symptoms, which spectral change is expected at a hemodynamically significant arterial stenosis?

- A. Focal velocity acceleration with spectral broadening
- B. Uniform velocity reduction without turbulence
- C. Loss of all systolic flow proximally
- D. Only increased venous phasicity

125. During a morning vascular laboratory examination, what Doppler angle practice best supports reproducible velocity measurement?

- A. Use a 90-degree correction angle for every sampled vessel
- B. Align the angle cursor perpendicular to the observed flow stream
- C. Change the correction angle randomly between consecutive spectral samples
- D. Keep the correction angle at or below 60 degrees and parallel to flow

126. During a morning vascular laboratory examination, the normal inferior vena cava typically changes caliber how during quiet inspiration?

- A. It becomes completely rigid
- B. It doubles in caliber
- C. It decreases in caliber
- D. It develops sustained reversal

127. During a morning vascular laboratory examination, flow in a true aneurysm sac involves which arterial wall layers?

- A. All three wall layers
- B. Only the adventitia
- C. No arterial wall layers
- D. Only an implanted graft

128. While reviewing a technically adequate duplex study, color aliasing occurs when the Doppler shift exceeds what?

- A. The acoustic impedance
- B. The transducer bandwidth only
- C. The Nyquist limit
- D. The grayscale dynamic range

129. In a patient referred for a focused vascular assessment, which vessel normally lies anterior to the vertebral transverse processes and supplies the posterior cerebral circulation?

- A. External carotid artery
- B. Facial artery
- C. Superior thyroid artery
- D. Vertebral artery

130. While reviewing a technically adequate duplex study, the classic spectral waveform in the neck of a pseudoaneurysm is described as what?

- A. Continuous hepatopetal flow
- B. To-and-fro flow
- C. Monophasic low-velocity venous flow
- D. Triphasic flow without reversal

131. During comparison with a prior vascular study, a normal common carotid artery spectral waveform should demonstrate which pattern?

- A. No diastolic flow throughout
- B. Persistent flow reversal in diastole
- C. Markedly pulsatile venous flow
- D. Continuous forward flow with moderate diastolic flow

132. In a patient referred for a focused vascular assessment, which finding suggests carotid subclavian steal physiology?

- A. Reversed or alternating ipsilateral vertebral flow
- B. Elevated portal venous velocity
- C. Continuous forward vertebral flow bilaterally
- D. Absent femoral venous phasicity alone

133. While optimizing a complete diagnostic protocol, which feature most reliably distinguishes the internal carotid artery from the external carotid artery at the bifurcation?

- A. The internal carotid is always smaller
- B. The internal carotid shows temporal tapping oscillations
- C. The internal carotid usually has no cervical branches
- D. The internal carotid has multiple neck branches

134. During comparison with a prior vascular study, a patient with celiac artery compression by the median arcuate ligament often shows what respiratory behavior?

- A. Higher velocity only after eating
- B. Higher celiac velocity during expiration
- C. Complete celiac occlusion during inspiration
- D. No respiratory velocity variation

135. In a patient with relevant vascular symptoms, normal respiratory phasicity in the common femoral vein primarily reflects pressure changes transmitted from where?

- A. The left ventricle only
- B. The distal calf muscles
- C. The thorax and abdomen
- D. The carotid sinus

136. While optimizing a complete diagnostic protocol, which renal artery abnormality is classically associated with a string-of-beads angiographic appearance?

- A. Atherosclerosis at the ostium
- B. Renal vein thrombosis
- C. Acute cortical necrosis
- D. Fibromuscular dysplasia

137. During a morning vascular laboratory examination, which lower-extremity artery is normally found with the paired posterior tibial veins behind the medial malleolus?

- A. Posterior tibial artery
- B. Anterior tibial artery
- C. Peroneal artery
- D. Dorsalis pedis artery

138. In a patient with relevant vascular symptoms, which portal Doppler finding indicates abnormal flow direction related to portal hypertension?

- A. Hepatopetal portal flow
- B. Hepatofugal portal flow
- C. Low-resistance hepatic arterial flow
- D. Respiratory phasicity in the IVC

139. While reviewing a technically adequate duplex study, the celiac artery normally divides into which three principal branches?

- A. Common hepatic, splenic, and left gastric arteries
- B. SMA, IMA, and renal arteries
- C. Right gastric, renal, and splenic arteries
- D. Hepatic, iliac, and mesenteric arteries

140. During a morning vascular laboratory examination, which symptom pattern is most typical of chronic mesenteric ischemia?

- A. Painless ankle edema only
- B. Transient arm numbness with elevation
- C. Isolated nocturnal calf cramping
- D. Postprandial abdominal pain with weight loss

141. In a patient referred for a focused vascular assessment, which normal renal artery waveform characteristic reflects the kidney's low-resistance vascular bed?

- A. Early diastolic flow reversal
- B. Persistent forward diastolic flow
- C. Absent end-diastolic flow
- D. Triphasic flow at the hilum

142. While reviewing a technically adequate duplex study, a Baker cyst is most commonly identified in which location during a venous duplex examination?

- A. The carotid bifurcation
- B. The renal hilum
- C. The medial popliteal fossa
- D. The anterior ankle

143. During comparison with a prior vascular study, in the normal portal vein, blood flows in which direction?

- A. Away from the liver
- B. Bidirectionally with each heartbeat
- C. Toward the liver
- D. Toward the spleen only

144. In a patient referred for a focused vascular assessment, which carotid lesion can splay the internal and external carotid arteries?

- A. Carotid body tumor
- B. Thyroid cyst
- C. Jugular valve
- D. Vertebral artery loop

145. While optimizing a complete diagnostic protocol, which vein joins the splenic vein to form the main portal vein?

- A. Inferior vena cava
- B. Superior mesenteric vein
- C. Left renal vein
- D. Hepatic vein

146. During comparison with a prior vascular study, a monophasic arterial waveform throughout one leg most strongly suggests what?

- A. Normal resting physiology
- B. Isolated superficial venous reflux
- C. Normal collateral reserve
- D. Significant inflow disease

147. In a patient with relevant vascular symptoms, which transcranial window is commonly used to insonate the middle cerebral artery?

- A. Suboccipital window
- B. Transorbital window
- C. Submandibular window
- D. Transtemporal window

148. While optimizing a complete diagnostic protocol, which finding supports May-Thurner anatomy in a patient with left-leg swelling?

- A. Compression of the right renal artery by the SMA
- B. Compression of the left common iliac vein by the right common iliac artery
- C. Occlusion of the left vertebral artery
- D. Dilation of the right portal vein

149. During a morning vascular laboratory examination, which vessel is the direct continuation of the anterior tibial artery at the ankle?

- A. Dorsalis pedis artery
- B. Posterior tibial artery
- C. Peroneal artery
- D. Deep femoral artery

150. In a patient with relevant vascular symptoms, in suspected popliteal artery entrapment, which maneuver may provoke arterial compression?

- A. Quiet expiration only
- B. Distal venous augmentation
- C. Active plantar flexion against resistance
- D. Passive wrist extension

151. While reviewing a technically adequate duplex study, the normal inferior vena cava typically changes caliber how during quiet inspiration?

- A. It decreases in caliber
- B. It becomes completely rigid
- C. It doubles in caliber
- D. It develops sustained reversal

152. During a morning vascular laboratory examination, which ultrasound feature helps distinguish arterial dissection from simple atherosclerotic plaque?

- A. Posterior acoustic enhancement only
- B. Uniform wall thickness everywhere
- C. A mobile or fixed intimal flap separating flow channels
- D. Normal color filling without a defect

153. In a patient referred for a focused vascular assessment, which duplex finding most strongly supports acute lower-extremity deep vein thrombosis?

- A. A fully compressible vein with phasic flow
- B. A small echogenic vein with collaterals
- C. Spontaneous flow augmented by compression
- D. A noncompressible vein containing hypoechoic material

154. During comparison with a prior vascular study, which finding is most characteristic of chronic post-thrombotic venous change?

- A. An enlarged vein with soft thrombus
- B. A contracted irregular vein with echogenic synechiae
- C. A normal vein with complete compression
- D. A cystic mass without venous continuity

155. While optimizing a complete diagnostic protocol, reflux lasting more than the accepted laboratory threshold after distal augmentation most directly indicates what?

- A. Acute arterial occlusion
- B. Normal respiratory phasicity
- C. Increased arterial resistance
- D. Venous valvular incompetence

156. In a patient with relevant vascular symptoms, a tardus-parvus waveform distal to an arterial lesion suggests which hemodynamic condition?

- A. Normal high-resistance flow
- B. Distal venous reflux
- C. A significant proximal stenosis
- D. An arteriovenous fistula at the sample

157. During a morning vascular laboratory examination, which spectral change is expected at a hemodynamically significant arterial stenosis?

- A. Uniform velocity reduction without turbulence
- B. Focal velocity acceleration with spectral broadening
- C. Loss of all systolic flow proximally
- D. Only increased venous phasicity

158. While reviewing a technically adequate duplex study, flow in a true aneurysm sac involves which arterial wall layers?

- A. All three wall layers
- B. Only the adventitia
- C. No arterial wall layers
- D. Only an implanted graft

159. In a patient referred for a focused vascular assessment, the classic spectral waveform in the neck of a pseudoaneurysm is described as what?

- A. To-and-fro flow
- B. Continuous hepatopetal flow
- C. Monophasic low-velocity venous flow
- D. Triphasic flow without reversal

160. During comparison with a prior vascular study, which finding suggests carotid subclavian steal physiology?

- A. Elevated portal venous velocity
- B. Continuous forward vertebral flow bilaterally
- C. Absent femoral venous phasicity alone
- D. Reversed or alternating ipsilateral vertebral flow

161. While optimizing a complete diagnostic protocol, a patient with celiac artery compression by the median arcuate ligament often shows what respiratory behavior?

- A. Higher velocity only after eating
- B. Complete celiac occlusion during inspiration
- C. Higher celiac velocity during expiration
- D. No respiratory velocity variation

162. In a patient with relevant vascular symptoms, which renal artery abnormality is classically associated with a string-of-beads angiographic appearance?

- A. Atherosclerosis at the ostium
- B. Fibromuscular dysplasia
- C. Renal vein thrombosis
- D. Acute cortical necrosis

163. During a morning vascular laboratory examination, which portal Doppler finding indicates abnormal flow direction related to portal hypertension?

- A. Hepatopetal portal flow
- B. Low-resistance hepatic arterial flow
- C. Hepatofugal portal flow
- D. Respiratory phasicity in the IVC

164. While reviewing a technically adequate duplex study, which symptom pattern is most typical of chronic mesenteric ischemia?

- A. Painless ankle edema only
- B. Transient arm numbness with elevation
- C. Isolated nocturnal calf cramping
- D. Postprandial abdominal pain with weight loss

165. In a patient referred for a focused vascular assessment, a Baker cyst is most commonly identified in which location during a venous duplex examination?

- A. The medial popliteal fossa
- B. The carotid bifurcation
- C. The renal hilum
- D. The anterior ankle

166. During comparison with a prior vascular study, which carotid lesion can splay the internal and external carotid arteries?

- A. Thyroid cyst
- B. Carotid body tumor
- C. Jugular valve
- D. Vertebral artery loop

167. While optimizing a complete diagnostic protocol, a monophasic arterial waveform throughout one leg most strongly suggests what?

- A. Normal resting physiology
- B. Significant inflow disease
- C. Isolated superficial venous reflux
- D. Normal collateral reserve

168. In a patient with relevant vascular symptoms, which finding supports May-Thurner anatomy in a patient with left-leg swelling?

- A. Compression of the right renal artery by the SMA
- B. Occlusion of the left vertebral artery
- C. Dilation of the right portal vein
- D. Compression of the left common iliac vein by the right common iliac artery

169. During a morning vascular laboratory examination, in suspected popliteal artery entrapment, which maneuver may provoke arterial compression?

- A. Active plantar flexion against resistance
- B. Quiet expiration only
- C. Distal venous augmentation
- D. Passive wrist extension

170. While reviewing a technically adequate duplex study, which ultrasound feature helps distinguish arterial dissection from simple atherosclerotic plaque?

- A. Posterior acoustic enhancement only
- B. Uniform wall thickness everywhere
- C. A mobile or fixed intimal flap separating flow channels
- D. Normal color filling without a defect

Practice Exam 10: Answer Key and Explanations

1. C — The vertebral artery ascends through the cervical transverse foramina and joins its counterpart to form the basilar artery. The external carotid and its facial and superior thyroid branches supply extracranial structures rather than the posterior intracranial circulation. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

- 2. B** — Failure of the vein walls to coapt under adequate transducer pressure is the primary sonographic sign of acute deep vein thrombosis. Hypoechoic thrombus and venous enlargement support acuity. A small echogenic vein with collaterals is more typical of chronic post-thrombotic change. Grayscale, color, and spectral findings should agree before disease is assigned.
- 3. B** — A focal rise in velocity with color aliasing and downstream turbulence identifies a localized narrowing in dialysis access outflow. Access circuits normally have high volume, low resistance flow, but a uniform pattern does not localize stenosis. Clinical thrill alone cannot exclude a significant lesion. The reconstructed circuit should be followed from inflow through outflow.
- 4. D** — The ankle-brachial index equals ankle systolic pressure divided by the higher brachial systolic pressure. Dividing 98 by 140 gives 0.70, an abnormal value consistent with peripheral arterial disease. The other choices result from using the wrong operation or incorrectly reversing the pressure ratio. Waveforms, pressures, symptoms, and test technique should be interpreted together.
- 5. A** — Preprocedural imaging must define pseudoaneurysm sac dimensions, neck length and width, flow pattern, thrombus, and relationship to the native artery and nearby structures. This information guides safe needle placement and helps assess embolic risk. Unrelated vascular measurements cannot substitute for local mapping. Continuous visualization and immediate patency assessment remain essential procedural safeguards.
- 6. C** — Velocity error increases rapidly at high insonation angles because the Doppler equation depends on the cosine of the angle. Keeping the angle at or below 60 degrees and aligning it with the flow direction improves reproducibility. A 90-degree angle produces essentially no Doppler shift. The selected control should correct the problem without introducing another artifact.
- 7. C** — Two approved identifiers, such as full name and date of birth, reduce wrong-patient errors before imaging or intervention. Room number, appearance, and diagnosis are not unique identifiers. Identification should follow facility policy and be completed before the examination proceeds. Clear documentation gives the interpreting clinician the necessary examination context. Facility policy should guide escalation, patient communication, and record completion.
- 8. B** — The common carotid artery supplies both the low-resistance internal carotid and higher-resistance external carotid beds, producing an intermediate-resistance waveform with forward diastolic flow. Absent or reversed diastolic flow suggests abnormal resistance, while pulsatile venous flow describes a venous rather than arterial tracing. Normal anatomy and expected hemodynamics should support the final interpretation.
- 9. D** — Chronic thrombotic change commonly produces a smaller, irregular lumen with echogenic wall thickening, fibrous bands, recanalized channels, and collateral flow. Acute thrombosis more often enlarges the vein and appears relatively hypoechoic. Complete compression argues against residual thrombus. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

10. A — A patent arteriovenous fistula provides a low-resistance outflow pathway, increasing feeding-artery volume flow and forward diastolic flow. A high-resistance triphasic pattern or absent diastolic flow suggests inadequate access flow or a problem. Respiratory phasicity describes veins. The reconstructed circuit should be followed from inflow through outflow. Comparison with prior postoperative studies helps identify meaningful interval change.

11. B — An ABI above about 1.40 suggests the ankle arteries could not be compressed reliably, often because of medial arterial calcification. Toe pressures or other testing may be more informative. Lower values indicate borderline or varying degrees of occlusive disease rather than noncompressibility. Waveforms, pressures, symptoms, and test technique should be interpreted together.

12. C — Continuous ultrasound visualization confirms that the needle tip remains inside the pseudoaneurysm sac and away from the neck, reducing the chance of thrombin entering the native artery. Placement in the artery, vein, or surrounding tissue creates avoidable complications. Continuous visualization and immediate patency assessment remain essential procedural safeguards. The laboratory protocol should guide sterile technique and postprocedure documentation.

13. D — Pulsed Doppler samples at a finite pulse repetition frequency, and the Nyquist limit equals one-half that frequency. Shifts beyond this limit wrap to the opposite side of the display. Acoustic impedance, bandwidth, and grayscale dynamic range describe different imaging properties. The selected control should correct the problem without introducing another artifact.

14. A — Critical findings require prompt communication through the laboratory's established escalation pathway, with documentation of whom was contacted, when, and what was conveyed. Sonographers should not independently render a final diagnosis to the patient or suppress images that show technical limitations. Clear documentation gives the interpreting clinician the necessary examination context.

15. A — The internal carotid normally gives off no branches in the neck, whereas the external carotid has multiple cervical branches. Size and position can vary, and temporal tapping commonly produces oscillations in the external carotid waveform, so those features are supportive rather than absolute. Normal anatomy and expected hemodynamics should support the final interpretation.

16. C — Sustained retrograde venous flow after a provocative maneuver reflects failure of venous valves to close effectively. The exact threshold depends on vessel segment and laboratory protocol. The finding concerns venous competence, not arterial obstruction, respiratory variation, or arterial resistance. Grayscale, color, and spectral findings should agree before disease is assigned.

17. D — An endoleak is persistent blood flow outside the endograft lumen but within the excluded aneurysm sac. Duplex surveillance evaluates sac size and searches for flow. Renal venous and carotid findings are unrelated, and persistent sac perfusion is not assumed to be normal. The reconstructed circuit should be followed from inflow through outflow.

18. B — A substantial pressure gradient between adjacent limb levels localizes arterial obstruction to the intervening segment, provided cuff size and technique are appropriate. Small differences can be normal.

Venous thrombosis and Doppler gain do not explain a reproducible segmental systolic pressure drop. Waveforms, pressures, symptoms, and test technique should be interpreted together.

19. C — Postprocedural duplex should confirm cessation of flow in the pseudoaneurysm while demonstrating preserved flow in the native artery and distal circulation. This detects incomplete treatment or embolic complication promptly. Carotid, respiratory, and portal assessments do not address the treated region. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

20. B — Raising the color velocity scale or pulse repetition frequency increases the Nyquist limit and can reduce aliasing. Baseline shift may also help display direction. Lowering the scale worsens aliasing, while persistence and wall filter adjustments do not directly increase the aliasing threshold. The selected control should correct the problem without introducing another artifact.

21. A — Clear documentation of technical limitations, omitted segments, and relevant reasons allows the interpreting clinician to judge study completeness and decide whether additional testing is needed. Guessing findings or omitting limitations can mislead interpretation. Equipment identifiers alone do not describe the examination's diagnostic constraints. Clear documentation gives the interpreting clinician the necessary examination context.

22. D — Respiration changes intrathoracic and intra-abdominal pressure, modulating venous return and creating phasic flow in proximal lower-extremity veins. Cardiac pulsatility may be superimposed, but normal respiratory variation is not generated by calf motion or carotid baroreceptor activity. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

23. C — A tardus-parvus waveform has delayed systolic acceleration and reduced amplitude caused by damping beyond a hemodynamically important proximal obstruction. Normal peripheral arteries are brisk and often multiphasic. Venous reflux and a local fistula create different spectral patterns. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

24. B — Very low graft velocities can indicate poor inflow, poor outflow, diffuse graft disease, or an oversized conduit, all of which promote thrombosis. Surveillance must assess the entire circuit and compare prior studies. The alternative conditions are unrelated to bypass graft hemodynamics. The reconstructed circuit should be followed from inflow through outflow.

25. D — Exercise increases muscle demand and can unmask arterial insufficiency when resting pressures appear normal or borderline. A significant pressure decline with delayed recovery supports flow-limiting disease. The test is not designed for venous thrombosis, carotid stenosis, or portal hypertension. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

26. A — Tumescence fluid surrounds and compresses the vein, improves contact between the vein wall and treatment catheter, provides local anesthesia, and creates a thermal buffer protecting adjacent

tissues. It is not intended to alter distant arterial, portal, or carotid hemodynamics. Continuous visualization and immediate patency assessment remain essential procedural safeguards. The laboratory protocol should guide sterile technique and postprocedure documentation.

27. B — A larger sample volume collects Doppler shifts from more red blood cells across a wider region, potentially increasing spectral broadening and mixing flow components. It does not inherently improve axial resolution, eliminate broadening, or change the transmitted ultrasound frequency. The selected control should correct the problem without introducing another artifact.

28. C — Fasting reduces bowel gas and limits postprandial changes in mesenteric blood flow, improving visualization and standardizing velocity interpretation. The exact duration follows laboratory protocol. A large meal changes hemodynamics, leg exercise is unrelated, and routine duplex does not require injected contrast. Clear documentation gives the interpreting clinician the necessary examination context.

29. D — The posterior tibial artery travels behind the medial malleolus with paired venae comitantes. The anterior tibial artery crosses the interosseous membrane and continues as dorsalis pedis, while the peroneal artery remains deeper and more lateral in the calf. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

30. A — Narrowing conserves volume flow by increasing velocity through the stenotic jet, commonly accompanied by aliasing and spectral broadening. Distal damping may follow. Uniform slowing, proximal absence of systolic flow, or isolated venous changes do not characterize the stenotic segment itself. Grayscale, color, and spectral findings should agree before disease is assigned.

31. C — Transjugular intrahepatic portosystemic shunt surveillance evaluates flow direction and velocities within the portal system and along the entire shunt for stenosis or occlusion. Carotid plaque, ankle pressures, and arm reflux do not evaluate TIPS function. The reconstructed circuit should be followed from inflow through outflow. Comparison with prior postoperative studies helps identify meaningful interval change.

32. A — Venous photoplethysmography assesses calf pump emptying and the time required for venous volume to refill. Incompetent valves permit rapid retrograde filling, shortening refill time. Arterial waveform morphology and toe systolic pressure evaluate different aspects of circulation. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

33. D — After superficial venous ablation, the treated vein is expected to become noncompressible and echogenic. The critical assessment is whether thrombus extends toward or into the adjacent deep vein at the junction. Normal remote venous and arterial findings do not answer that safety question. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

34. B — A strong specular reflector can redirect sound so the system assigns returning echoes to a false mirrored location, duplicating anatomy or Doppler signals. Recognizing the symmetry and reflector

prevents misdiagnosis. The duplicate is artifactual, not an independently perfused vessel. The selected control should correct the problem without introducing another artifact.

35. C — Prior studies help the sonographer identify previous lesions, interventions, anatomic variants, and technical challenges, allowing focused comparison for interval change. They do not replace current imaging or history, and physiologic measurements will not be identical across examinations even with proper technique. Clear documentation gives the interpreting clinician the necessary examination context.

36. A — The classic celiac trunk trifurcation gives rise to the common hepatic, splenic, and left gastric arteries. The superior and inferior mesenteric and renal arteries arise separately from the aorta, and the iliac arteries originate at the aortic bifurcation. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

37. B — A true aneurysm is dilation involving the intima, media, and adventitia. A pseudoaneurysm is contained outside the normal arterial wall and communicates through a neck. Graft dilation is a separate postoperative process and does not define a native true aneurysm. Grayscale, color, and spectral findings should agree before disease is assigned.

38. D — A focal rise in velocity with color aliasing and downstream turbulence identifies a localized narrowing in dialysis access outflow. Access circuits normally have high volume, low resistance flow, but a uniform pattern does not localize stenosis. Clinical thrill alone cannot exclude a significant lesion. The reconstructed circuit should be followed from inflow through outflow.

39. D — A cuff that is too narrow requires greater pressure to occlude the artery and can yield falsely high systolic measurements. An excessively wide cuff can bias results in the opposite direction. Proper sizing is therefore essential for reliable segmental pressures and indices. Waveforms, pressures, symptoms, and test technique should be interpreted together.

40. B — Preprocedural imaging must define pseudoaneurysm sac dimensions, neck length and width, flow pattern, thrombus, and relationship to the native artery and nearby structures. This information guides safe needle placement and helps assess embolic risk. Unrelated vascular measurements cannot substitute for local mapping. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

41. A — ALARA means keeping acoustic exposure as low as reasonably achievable while obtaining necessary diagnostic information. Operators should optimize positioning, frequency, gain, and time before increasing output. Routine maximum power and prolonged dwell time create avoidable exposure without guaranteed diagnostic benefit. The selected control should correct the problem without introducing another artifact.

42. C — A concise explanation of the examination, expected positioning, transducer pressure, and patient role builds rapport and improves cooperation. Questions should be welcomed within the sonographer's scope. Technical jargon, premature diagnostic promises, and withholding practical

information undermine understanding and trust. Clear documentation gives the interpreting clinician the necessary examination context. Facility policy should guide escalation, patient communication, and record completion.

43. A — Renal parenchymal perfusion requires continuous flow, so normal renal arterial waveforms show substantial forward flow throughout diastole. Reversal, absent end-diastolic flow, or a triphasic pattern indicates elevated downstream resistance or sampling of a different vascular bed. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

44. C — Blood enters the pseudoaneurysm during systole and exits during diastole, producing the characteristic to-and-fro spectral pattern in its neck. Swirling bidirectional color may appear in the sac. Hepatopetal flow describes portal circulation, while the other choices lack the neck's directional reversal. Grayscale, color, and spectral findings should agree before disease is assigned.

45. B — A patent arteriovenous fistula provides a low-resistance outflow pathway, increasing feeding-artery volume flow and forward diastolic flow. A high-resistance triphasic pattern or absent diastolic flow suggests inadequate access flow or a problem. Respiratory phasicity describes veins. The reconstructed circuit should be followed from inflow through outflow. Comparison with prior postoperative studies helps identify meaningful interval change.

46. D — Digital arteries are less commonly affected by medial calcification than tibial arteries, so toe pressures and the toe-brachial index can assess perfusion when ABI values are noncompressible. The other choices do not quantify distal lower-extremity arterial perfusion in this setting. Waveforms, pressures, symptoms, and test technique should be interpreted together.

47. C — Continuous ultrasound visualization confirms that the needle tip remains inside the pseudoaneurysm sac and away from the neck, reducing the chance of thrombin entering the native artery. Placement in the artery, vein, or surrounding tissue creates avoidable complications. Continuous visualization and immediate patency assessment remain essential procedural safeguards. The laboratory protocol should guide sterile technique and postprocedure documentation.

48. A — Waveform truncation at the display boundary usually reflects an insufficient velocity range or baseline position. Raising the scale or shifting the baseline brings the trace into view. Lowering pulse repetition frequency worsens aliasing, while persistence and excessive filtering do not correct display range. The selected control should correct the problem without introducing another artifact.

49. B — Two approved identifiers, such as full name and date of birth, reduce wrong-patient errors before imaging or intervention. Room number, appearance, and diagnosis are not unique identifiers. Identification should follow facility policy and be completed before the examination proceeds. Clear documentation gives the interpreting clinician the necessary examination context. Facility policy should guide escalation, patient communication, and record completion.

50. D — Normal portal venous flow is hepatopetal, meaning it travels toward the liver. Hepatofugal flow is abnormal and may accompany portal hypertension. Mild respiratory variation can occur, but

normal portal flow does not alternate direction with each cardiac cycle. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

51. A — A proximal subclavian stenosis can lower pressure beyond the lesion and draw blood retrograde through the ipsilateral vertebral artery. Early steal may alternate direction; complete steal is retrograde. Portal and femoral venous findings are unrelated, and continuous antegrade vertebral flow argues against steal. Grayscale, color, and spectral findings should agree before disease is assigned.

52. D — An endoleak is persistent blood flow outside the endograft lumen but within the excluded aneurysm sac. Duplex surveillance evaluates sac size and searches for flow. Renal venous and carotid findings are unrelated, and persistent sac perfusion is not assumed to be normal. The reconstructed circuit should be followed from inflow through outflow.

53. B — The ankle-brachial index equals ankle systolic pressure divided by the higher brachial systolic pressure. Dividing 98 by 140 gives 0.70, an abnormal value consistent with peripheral arterial disease. The other choices result from using the wrong operation or incorrectly reversing the pressure ratio. Waveforms, pressures, symptoms, and test technique should be interpreted together.

54. C — Postprocedural duplex should confirm cessation of flow in the pseudoaneurysm while demonstrating preserved flow in the native artery and distal circulation. This detects incomplete treatment or embolic complication promptly. Carotid, respiratory, and portal assessments do not address the treated region. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

55. D — The resistive index is calculated as PSV minus EDV, divided by PSV. It summarizes the relative loss of velocity during diastole and reflects downstream impedance, though interpretation depends on organ and clinical context. The other formulas measure neither the standard RI nor equivalent physiology. The selected control should correct the problem without introducing another artifact.

56. B — Critical findings require prompt communication through the laboratory's established escalation pathway, with documentation of whom was contacted, when, and what was conveyed. Sonographers should not independently render a final diagnosis to the patient or suppress images that show technical limitations. Clear documentation gives the interpreting clinician the necessary examination context.

57. A — The superior mesenteric vein typically joins the splenic vein posterior to the pancreatic neck to form the main portal vein. Hepatic veins drain the liver into the inferior vena cava, and the left renal vein drains the left kidney. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

58. C — Expiration can accentuate downward diaphragmatic and ligamentous compression of the proximal celiac artery, increasing velocity and curvature. Inspiration may relieve compression and reduce velocity. This dynamic pattern helps distinguish compression from fixed atherosclerotic disease,

though clinical correlation remains essential. Grayscale, color, and spectral findings should agree before disease is assigned.

59. B — Very low graft velocities can indicate poor inflow, poor outflow, diffuse graft disease, or an oversized conduit, all of which promote thrombosis. Surveillance must assess the entire circuit and compare prior studies. The alternative conditions are unrelated to bypass graft hemodynamics. The reconstructed circuit should be followed from inflow through outflow.

60. A — An ABI above about 1.40 suggests the ankle arteries could not be compressed reliably, often because of medial arterial calcification. Toe pressures or other testing may be more informative. Lower values indicate borderline or varying degrees of occlusive disease rather than noncompressibility. Waveforms, pressures, symptoms, and test technique should be interpreted together.

61. C — Tumescence fluid surrounds and compresses the vein, improves contact between the vein wall and treatment catheter, provides local anesthesia, and creates a thermal buffer protecting adjacent tissues. It is not intended to alter distant arterial, portal, or carotid hemodynamics. Continuous visualization and immediate patency assessment remain essential procedural safeguards. The laboratory protocol should guide sterile technique and postprocedure documentation.

62. D — Resistive index equals peak systolic velocity minus end-diastolic velocity, divided by peak systolic velocity. Substituting the values gives $(100 - 30) / 100$, or 0.70. The distractors reflect incomplete subtraction, an incorrect denominator, or addition rather than subtraction. The selected control should correct the problem without introducing another artifact.

63. A — Clear documentation of technical limitations, omitted segments, and relevant reasons allows the interpreting clinician to judge study completeness and decide whether additional testing is needed. Guessing findings or omitting limitations can mislead interpretation. Equipment identifiers alone do not describe the examination's diagnostic constraints. Clear documentation gives the interpreting clinician the necessary examination context.

64. D — The transtemporal window provides access to the middle, anterior, and posterior cerebral arteries in many patients. The suboccipital window evaluates vertebral and basilar arteries, the transorbital window assesses orbital vessels and carotid siphon, and the submandibular approach samples the distal internal carotid artery. Normal anatomy and expected hemodynamics should support the final interpretation.

65. C — Fibromuscular dysplasia commonly affects the mid-to-distal renal artery with alternating stenosis and dilation, producing a string-of-beads appearance. Atherosclerosis preferentially affects the ostium and proximal segment. Venous thrombosis and cortical necrosis do not produce this arterial morphology. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

66. B — Transjugular intrahepatic portosystemic shunt surveillance evaluates flow direction and velocities within the portal system and along the entire shunt for stenosis or occlusion. Carotid plaque, ankle pressures, and arm reflux do not evaluate TIPS function. The reconstructed circuit should be

followed from inflow through outflow. Comparison with prior postoperative studies helps identify meaningful interval change.

67. A — A substantial pressure gradient between adjacent limb levels localizes arterial obstruction to the intervening segment, provided cuff size and technique are appropriate. Small differences can be normal. Venous thrombosis and Doppler gain do not explain a reproducible segmental systolic pressure drop. Waveforms, pressures, symptoms, and test technique should be interpreted together.

68. B — After superficial venous ablation, the treated vein is expected to become noncompressible and echogenic. The critical assessment is whether thrombus extends toward or into the adjacent deep vein at the junction. Normal remote venous and arterial findings do not answer that safety question. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

69. D — Lower ultrasound frequencies attenuate less and penetrate more deeply, while a curvilinear array provides a broad abdominal field of view. High-frequency linear probes favor superficial resolution. A continuous-wave pencil probe lacks two-dimensional localization, and a standoff pad cannot replace a transducer. The selected control should correct the problem without introducing another artifact.

70. C — Fasting reduces bowel gas and limits postprandial changes in mesenteric blood flow, improving visualization and standardizing velocity interpretation. The exact duration follows laboratory protocol. A large meal changes hemodynamics, leg exercise is unrelated, and routine duplex does not require injected contrast. Clear documentation gives the interpreting clinician the necessary examination context.

71. B — After crossing the ankle, the anterior tibial artery continues as the dorsalis pedis artery on the dorsal foot. The posterior tibial passes behind the medial malleolus, the peroneal remains posterolateral, and the deep femoral arises proximally in the thigh. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

72. A — Hepatofugal flow travels away from the liver and may develop when portal pressure is sufficiently elevated and collateral pathways open. Normal main portal flow is hepatopetal. Hepatic arterial resistance and inferior vena cava phasicity are separate findings that do not define reversed portal flow. Grayscale, color, and spectral findings should agree before disease is assigned.

73. C — Exercise increases muscle demand and can unmask arterial insufficiency when resting pressures appear normal or borderline. A significant pressure decline with delayed recovery supports flow-limiting disease. The test is not designed for venous thrombosis, carotid stenosis, or portal hypertension. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

74. D — Preprocedural imaging must define pseudoaneurysm sac dimensions, neck length and width, flow pattern, thrombus, and relationship to the native artery and nearby structures. This information guides safe needle placement and helps assess embolic risk. Unrelated vascular measurements cannot

substitute for local mapping. Continuous visualization and immediate patency assessment remain essential procedural safeguards.

75. B — A new persistent dropout zone may indicate damaged transducer elements, cable failure, or system malfunction and should be investigated before it affects diagnostic studies. Stable, uniform, repeatable phantom performance matching baseline supports proper equipment function rather than a new defect. The selected control should correct the problem without introducing another artifact.

76. C — Prior studies help the sonographer identify previous lesions, interventions, anatomic variants, and technical challenges, allowing focused comparison for interval change. They do not replace current imaging or history, and physiologic measurements will not be identical across examinations even with proper technique. Clear documentation gives the interpreting clinician the necessary examination context.

77. D — During inspiration, reduced intrathoracic pressure increases venous return to the right heart and usually narrows the inferior vena cava. The degree varies with volume status and respiration, but complete rigidity, doubling, or sustained reversal is not the expected normal response. Normal anatomy and expected hemodynamics should support the final interpretation.

78. A — Chronic mesenteric ischemia reduces the circulation's ability to meet increased intestinal demand after meals, producing postprandial pain and food avoidance with weight loss. The other symptoms point toward venous, thoracic outlet, or musculoskeletal processes rather than mesenteric arterial insufficiency. Grayscale, color, and spectral findings should agree before disease is assigned.

79. A — Venous photoplethysmography assesses calf pump emptying and the time required for venous volume to refill. Incompetent valves permit rapid retrograde filling, shortening refill time. Arterial waveform morphology and toe systolic pressure evaluate different aspects of circulation. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

80. B — Continuous ultrasound visualization confirms that the needle tip remains inside the pseudoaneurysm sac and away from the neck, reducing the chance of thrombin entering the native artery. Placement in the artery, vein, or surrounding tissue creates avoidable complications. Continuous visualization and immediate patency assessment remain essential procedural safeguards. The laboratory protocol should guide sterile technique and postprocedure documentation.

81. C — Velocity error increases rapidly at high insonation angles because the Doppler equation depends on the cosine of the angle. Keeping the angle at or below 60 degrees and aligning it with the flow direction improves reproducibility. A 90-degree angle produces essentially no Doppler shift. The selected control should correct the problem without introducing another artifact.

82. D — A concise explanation of the examination, expected positioning, transducer pressure, and patient role builds rapport and improves cooperation. Questions should be welcomed within the sonographer's scope. Technical jargon, premature diagnostic promises, and withholding practical information undermine understanding and trust. Clear documentation gives the interpreting clinician the

necessary examination context. Facility policy should guide escalation, patient communication, and record completion.

83. D — The vertebral artery ascends through the cervical transverse foramina and joins its counterpart to form the basilar artery. The external carotid and its facial and superior thyroid branches supply extracranial structures rather than the posterior intracranial circulation. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

84. A — A Baker cyst typically arises between the semimembranosus tendon and medial head of the gastrocnemius in the medial popliteal fossa. It can mimic deep vein thrombosis symptoms. The carotid bifurcation, renal hilum, and anterior ankle are not characteristic locations. Grayscale, color, and spectral findings should agree before disease is assigned.

85. C — A cuff that is too narrow requires greater pressure to occlude the artery and can yield falsely high systolic measurements. An excessively wide cuff can bias results in the opposite direction. Proper sizing is therefore essential for reliable segmental pressures and indices. Waveforms, pressures, symptoms, and test technique should be interpreted together.

86. B — Pulsed Doppler samples at a finite pulse repetition frequency, and the Nyquist limit equals one-half that frequency. Shifts beyond this limit wrap to the opposite side of the display. Acoustic impedance, bandwidth, and grayscale dynamic range describe different imaging properties. The selected control should correct the problem without introducing another artifact.

87. D — Two approved identifiers, such as full name and date of birth, reduce wrong-patient errors before imaging or intervention. Room number, appearance, and diagnosis are not unique identifiers. Identification should follow facility policy and be completed before the examination proceeds. Clear documentation gives the interpreting clinician the necessary examination context. Facility policy should guide escalation, patient communication, and record completion.

88. A — The common carotid artery supplies both the low-resistance internal carotid and higher-resistance external carotid beds, producing an intermediate-resistance waveform with forward diastolic flow. Absent or reversed diastolic flow suggests abnormal resistance, while pulsatile venous flow describes a venous rather than arterial tracing. Normal anatomy and expected hemodynamics should support the final interpretation.

89. B — A carotid body tumor arises at the carotid bifurcation and may separate or splay the internal and external carotid arteries. It is typically hypervascular. Thyroid lesions, jugular valves, and vertebral loops do not characteristically create this bifurcation-splaying pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

90. C — Digital arteries are less commonly affected by medial calcification than tibial arteries, so toe pressures and the toe-brachial index can assess perfusion when ABI values are noncompressible. The

other choices do not quantify distal lower-extremity arterial perfusion in this setting. Waveforms, pressures, symptoms, and test technique should be interpreted together.

91. B — Raising the color velocity scale or pulse repetition frequency increases the Nyquist limit and can reduce aliasing. Baseline shift may also help display direction. Lowering the scale worsens aliasing, while persistence and wall filter adjustments do not directly increase the aliasing threshold. The selected control should correct the problem without introducing another artifact.

92. D — Critical findings require prompt communication through the laboratory's established escalation pathway, with documentation of whom was contacted, when, and what was conveyed. Sonographers should not independently render a final diagnosis to the patient or suppress images that show technical limitations. Clear documentation gives the interpreting clinician the necessary examination context.

93. C — The internal carotid normally gives off no branches in the neck, whereas the external carotid has multiple cervical branches. Size and position can vary, and temporal tapping commonly produces oscillations in the external carotid waveform, so those features are supportive rather than absolute. Normal anatomy and expected hemodynamics should support the final interpretation.

94. A — Diffuse monophasic waveforms with delayed systolic upstroke indicate reduced pulsatility transmitted from a proximal inflow obstruction, often in the aortoiliac segment. Normal resting peripheral waveforms are usually multiphasic. Superficial venous reflux does not directly cause this arterial pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

95. B — The ankle-brachial index equals ankle systolic pressure divided by the higher brachial systolic pressure. Dividing 98 by 140 gives 0.70, an abnormal value consistent with peripheral arterial disease. The other choices result from using the wrong operation or incorrectly reversing the pressure ratio. Waveforms, pressures, symptoms, and test technique should be interpreted together.

96. C — A larger sample volume collects Doppler shifts from more red blood cells across a wider region, potentially increasing spectral broadening and mixing flow components. It does not inherently improve axial resolution, eliminate broadening, or change the transmitted ultrasound frequency. The selected control should correct the problem without introducing another artifact.

97. D — Respiration changes intrathoracic and intra-abdominal pressure, modulating venous return and creating phasic flow in proximal lower-extremity veins. Cardiac pulsatility may be superimposed, but normal respiratory variation is not generated by calf motion or carotid baroreceptor activity. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

98. A — May-Thurner anatomy involves compression of the left common iliac vein between the right common iliac artery and the spine, predisposing to left-sided venous obstruction or thrombosis. The alternative relationships describe unrelated vascular territories and mechanisms. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

99. D — An ABI above about 1.40 suggests the ankle arteries could not be compressed reliably, often because of medial arterial calcification. Toe pressures or other testing may be more informative. Lower values indicate borderline or varying degrees of occlusive disease rather than noncompressibility. Waveforms, pressures, symptoms, and test technique should be interpreted together.

100. C — A strong specular reflector can redirect sound so the system assigns returning echoes to a false mirrored location, duplicating anatomy or Doppler signals. Recognizing the symmetry and reflector prevents misdiagnosis. The duplicate is artifactual, not an independently perfused vessel. The selected control should correct the problem without introducing another artifact.

101. B — The posterior tibial artery travels behind the medial malleolus with paired venae comitantes. The anterior tibial artery crosses the interosseous membrane and continues as dorsalis pedis, while the peroneal artery remains deeper and more lateral in the calf. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

102. A — Plantar flexion or dorsiflexion maneuvers can reproduce dynamic compression of the popliteal artery by adjacent musculotendinous structures. Duplex assessment compares waveforms and flow with neutral and provocative positions. Respiratory, venous, and upper-extremity maneuvers do not test this mechanism. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

103. C — A substantial pressure gradient between adjacent limb levels localizes arterial obstruction to the intervening segment, provided cuff size and technique are appropriate. Small differences can be normal. Venous thrombosis and Doppler gain do not explain a reproducible segmental systolic pressure drop. Waveforms, pressures, symptoms, and test technique should be interpreted together.

104. B — ALARA means keeping acoustic exposure as low as reasonably achievable while obtaining necessary diagnostic information. Operators should optimize positioning, frequency, gain, and time before increasing output. Routine maximum power and prolonged dwell time create avoidable exposure without guaranteed diagnostic benefit. The selected control should correct the problem without introducing another artifact.

105. D — The classic celiac trunk trifurcation gives rise to the common hepatic, splenic, and left gastric arteries. The superior and inferior mesenteric and renal arteries arise separately from the aorta, and the iliac arteries originate at the aortic bifurcation. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

106. A — Dissection creates an intimal flap that may separate true and false lumens with differing flow patterns. Plaque can narrow the lumen but does not usually form a longitudinal flap dividing channels. Enhancement and uniform normal filling do not establish dissection. Grayscale, color, and spectral findings should agree before disease is assigned.

107. C — Exercise increases muscle demand and can unmask arterial insufficiency when resting pressures appear normal or borderline. A significant pressure decline with delayed recovery supports flow-limiting disease. The test is not designed for venous thrombosis, carotid stenosis, or portal hypertension. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

108. A — Waveform truncation at the display boundary usually reflects an insufficient velocity range or baseline position. Raising the scale or shifting the baseline brings the trace into view. Lowering pulse repetition frequency worsens aliasing, while persistence and excessive filtering do not correct display range. The selected control should correct the problem without introducing another artifact.

109. D — Renal parenchymal perfusion requires continuous flow, so normal renal arterial waveforms show substantial forward flow throughout diastole. Reversal, absent end-diastolic flow, or a triphasic pattern indicates elevated downstream resistance or sampling of a different vascular bed. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

110. B — Failure of the vein walls to coapt under adequate transducer pressure is the primary sonographic sign of acute deep vein thrombosis. Hypoechoic thrombus and venous enlargement support acuity. A small echogenic vein with collaterals is more typical of chronic post-thrombotic change. Grayscale, color, and spectral findings should agree before disease is assigned.

111. B — Venous photoplethysmography assesses calf pump emptying and the time required for venous volume to refill. Incompetent valves permit rapid retrograde filling, shortening refill time. Arterial waveform morphology and toe systolic pressure evaluate different aspects of circulation. Waveforms, pressures, symptoms, and test technique should be interpreted together. Standardized cuff placement and provocative maneuvers improve measurement reliability.

112. A — The resistive index is calculated as $\text{PSV} - \text{EDV}$, divided by PSV. It summarizes the relative loss of velocity during diastole and reflects downstream impedance, though interpretation depends on organ and clinical context. The other formulas measure neither the standard RI nor equivalent physiology. The selected control should correct the problem without introducing another artifact.

113. C — Normal portal venous flow is hepatopetal, meaning it travels toward the liver. Hepatofugal flow is abnormal and may accompany portal hypertension. Mild respiratory variation can occur, but normal portal flow does not alternate direction with each cardiac cycle. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

114. D — Chronic thrombotic change commonly produces a smaller, irregular lumen with echogenic wall thickening, fibrous bands, recanalized channels, and collateral flow. Acute thrombosis more often enlarges the vein and appears relatively hypoechoic. Complete compression argues against residual thrombus. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

115. B — A cuff that is too narrow requires greater pressure to occlude the artery and can yield falsely high systolic measurements. An excessively wide cuff can bias results in the opposite direction. Proper sizing is therefore essential for reliable segmental pressures and indices. Waveforms, pressures, symptoms, and test technique should be interpreted together.

116. A — Resistive index equals peak systolic velocity minus end-diastolic velocity, divided by peak systolic velocity. Substituting the values gives (100 minus 30) divided by 100, or 0.70. The distractors reflect incomplete subtraction, an incorrect denominator, or addition rather than subtraction. The selected control should correct the problem without introducing another artifact.

117. D — The superior mesenteric vein typically joins the splenic vein posterior to the pancreatic neck to form the main portal vein. Hepatic veins drain the liver into the inferior vena cava, and the left renal vein drains the left kidney. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

118. C — Sustained retrograde venous flow after a provocative maneuver reflects failure of venous valves to close effectively. The exact threshold depends on vessel segment and laboratory protocol. The finding concerns venous competence, not arterial obstruction, respiratory variation, or arterial resistance. Grayscale, color, and spectral findings should agree before disease is assigned.

119. B — Lower ultrasound frequencies attenuate less and penetrate more deeply, while a curvilinear array provides a broad abdominal field of view. High-frequency linear probes favor superficial resolution. A continuous-wave pencil probe lacks two-dimensional localization, and a standoff pad cannot replace a transducer. The selected control should correct the problem without introducing another artifact.

120. A — The transtemporal window provides access to the middle, anterior, and posterior cerebral arteries in many patients. The suboccipital window evaluates vertebral and basilar arteries, the transorbital window assesses orbital vessels and carotid siphon, and the submandibular approach samples the distal internal carotid artery. Normal anatomy and expected hemodynamics should support the final interpretation.

121. D — A tardus-parvus waveform has delayed systolic acceleration and reduced amplitude caused by damping beyond a hemodynamically important proximal obstruction. Normal peripheral arteries are brisk and often multiphasic. Venous reflux and a local fistula create different spectral patterns. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

122. B — A new persistent dropout zone may indicate damaged transducer elements, cable failure, or system malfunction and should be investigated before it affects diagnostic studies. Stable, uniform, repeatable phantom performance matching baseline supports proper equipment function rather than a new defect. The selected control should correct the problem without introducing another artifact.

123. C — After crossing the ankle, the anterior tibial artery continues as the dorsalis pedis artery on the dorsal foot. The posterior tibial passes behind the medial malleolus, the peroneal remains posterolateral, and the deep femoral arises proximally in the thigh. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

124. A — Narrowing conserves volume flow by increasing velocity through the stenotic jet, commonly accompanied by aliasing and spectral broadening. Distal damping may follow. Uniform slowing, proximal absence of systolic flow, or isolated venous changes do not characterize the stenotic segment itself. Grayscale, color, and spectral findings should agree before disease is assigned.

125. D — Velocity error increases rapidly at high insonation angles because the Doppler equation depends on the cosine of the angle. Keeping the angle at or below 60 degrees and aligning it with the flow direction improves reproducibility. A 90-degree angle produces essentially no Doppler shift. The selected control should correct the problem without introducing another artifact.

126. C — During inspiration, reduced intrathoracic pressure increases venous return to the right heart and usually narrows the inferior vena cava. The degree varies with volume status and respiration, but complete rigidity, doubling, or sustained reversal is not the expected normal response. Normal anatomy and expected hemodynamics should support the final interpretation.

127. A — A true aneurysm is dilation involving the intima, media, and adventitia. A pseudoaneurysm is contained outside the normal arterial wall and communicates through a neck. Graft dilation is a separate postoperative process and does not define a native true aneurysm. Grayscale, color, and spectral findings should agree before disease is assigned.

128. C — Pulsed Doppler samples at a finite pulse repetition frequency, and the Nyquist limit equals one-half that frequency. Shifts beyond this limit wrap to the opposite side of the display. Acoustic impedance, bandwidth, and grayscale dynamic range describe different imaging properties. The selected control should correct the problem without introducing another artifact.

129. D — The vertebral artery ascends through the cervical transverse foramina and joins its counterpart to form the basilar artery. The external carotid and its facial and superior thyroid branches supply extracranial structures rather than the posterior intracranial circulation. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

130. B — Blood enters the pseudoaneurysm during systole and exits during diastole, producing the characteristic to-and-fro spectral pattern in its neck. Swirling bidirectional color may appear in the sac. Hepatopetal flow describes portal circulation, while the other choices lack the neck's directional reversal. Grayscale, color, and spectral findings should agree before disease is assigned.

131. D — The common carotid artery supplies both the low-resistance internal carotid and higher-resistance external carotid beds, producing an intermediate-resistance waveform with forward diastolic flow. Absent or reversed diastolic flow suggests abnormal resistance, while pulsatile venous flow

describes a venous rather than arterial tracing. Normal anatomy and expected hemodynamics should support the final interpretation.

132. A — A proximal subclavian stenosis can lower pressure beyond the lesion and draw blood retrograde through the ipsilateral vertebral artery. Early steal may alternate direction; complete steal is retrograde. Portal and femoral venous findings are unrelated, and continuous antegrade vertebral flow argues against steal. Grayscale, color, and spectral findings should agree before disease is assigned.

133. C — The internal carotid normally gives off no branches in the neck, whereas the external carotid has multiple cervical branches. Size and position can vary, and temporal tapping commonly produces oscillations in the external carotid waveform, so those features are supportive rather than absolute. Normal anatomy and expected hemodynamics should support the final interpretation.

134. B — Expiration can accentuate downward diaphragmatic and ligamentous compression of the proximal celiac artery, increasing velocity and curvature. Inspiration may relieve compression and reduce velocity. This dynamic pattern helps distinguish compression from fixed atherosclerotic disease, though clinical correlation remains essential. Grayscale, color, and spectral findings should agree before disease is assigned.

135. C — Respiration changes intrathoracic and intra-abdominal pressure, modulating venous return and creating phasic flow in proximal lower-extremity veins. Cardiac pulsatility may be superimposed, but normal respiratory variation is not generated by calf motion or carotid baroreceptor activity. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

136. D — Fibromuscular dysplasia commonly affects the mid-to-distal renal artery with alternating stenosis and dilation, producing a string-of-beads appearance. Atherosclerosis preferentially affects the ostium and proximal segment. Venous thrombosis and cortical necrosis do not produce this arterial morphology. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

137. A — The posterior tibial artery travels behind the medial malleolus with paired venae comitantes. The anterior tibial artery crosses the interosseous membrane and continues as dorsalis pedis, while the peroneal artery remains deeper and more lateral in the calf. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

138. B — Hepatofugal flow travels away from the liver and may develop when portal pressure is sufficiently elevated and collateral pathways open. Normal main portal flow is hepatopetal. Hepatic arterial resistance and inferior vena cava phasicity are separate findings that do not define reversed portal flow. Grayscale, color, and spectral findings should agree before disease is assigned.

139. A — The classic celiac trunk trifurcation gives rise to the common hepatic, splenic, and left gastric arteries. The superior and inferior mesenteric and renal arteries arise separately from the aorta, and the iliac arteries originate at the aortic bifurcation. Normal anatomy and expected hemodynamics should

support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

140. D — Chronic mesenteric ischemia reduces the circulation's ability to meet increased intestinal demand after meals, producing postprandial pain and food avoidance with weight loss. The other symptoms point toward venous, thoracic outlet, or musculoskeletal processes rather than mesenteric arterial insufficiency. Grayscale, color, and spectral findings should agree before disease is assigned.

141. B — Renal parenchymal perfusion requires continuous flow, so normal renal arterial waveforms show substantial forward flow throughout diastole. Reversal, absent end-diastolic flow, or a triphasic pattern indicates elevated downstream resistance or sampling of a different vascular bed. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

142. C — A Baker cyst typically arises between the semimembranosus tendon and medial head of the gastrocnemius in the medial popliteal fossa. It can mimic deep vein thrombosis symptoms. The carotid bifurcation, renal hilum, and anterior ankle are not characteristic locations. Grayscale, color, and spectral findings should agree before disease is assigned.

143. C — Normal portal venous flow is hepatopetal, meaning it travels toward the liver. Hepatofugal flow is abnormal and may accompany portal hypertension. Mild respiratory variation can occur, but normal portal flow does not alternate direction with each cardiac cycle. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

144. A — A carotid body tumor arises at the carotid bifurcation and may separate or splay the internal and external carotid arteries. It is typically hypervascular. Thyroid lesions, jugular valves, and vertebral loops do not characteristically create this bifurcation-splaying pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

145. B — The superior mesenteric vein typically joins the splenic vein posterior to the pancreatic neck to form the main portal vein. Hepatic veins drain the liver into the inferior vena cava, and the left renal vein drains the left kidney. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

146. D — Diffuse monophasic waveforms with delayed systolic upstroke indicate reduced pulsatility transmitted from a proximal inflow obstruction, often in the aortoiliac segment. Normal resting peripheral waveforms are usually multiphasic. Superficial venous reflux does not directly cause this arterial pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

147. D — The transtemporal window provides access to the middle, anterior, and posterior cerebral arteries in many patients. The suboccipital window evaluates vertebral and basilar arteries, the

transorbital window assesses orbital vessels and carotid siphon, and the submandibular approach samples the distal internal carotid artery. Normal anatomy and expected hemodynamics should support the final interpretation.

148. B — May-Thurner anatomy involves compression of the left common iliac vein between the right common iliac artery and the spine, predisposing to left-sided venous obstruction or thrombosis. The alternative relationships describe unrelated vascular territories and mechanisms. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

149. A — After crossing the ankle, the anterior tibial artery continues as the dorsalis pedis artery on the dorsal foot. The posterior tibial passes behind the medial malleolus, the peroneal remains posterolateral, and the deep femoral arises proximally in the thigh. Normal anatomy and expected hemodynamics should support the final interpretation. Correlation across multiple imaging planes helps prevent misidentification of normal variants.

150. C — Plantar flexion or dorsiflexion maneuvers can reproduce dynamic compression of the popliteal artery by adjacent musculotendinous structures. Duplex assessment compares waveforms and flow with neutral and provocative positions. Respiratory, venous, and upper-extremity maneuvers do not test this mechanism. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

151. A — During inspiration, reduced intrathoracic pressure increases venous return to the right heart and usually narrows the inferior vena cava. The degree varies with volume status and respiration, but complete rigidity, doubling, or sustained reversal is not the expected normal response. Normal anatomy and expected hemodynamics should support the final interpretation.

152. C — Dissection creates an intimal flap that may separate true and false lumens with differing flow patterns. Plaque can narrow the lumen but does not usually form a longitudinal flap dividing channels. Enhancement and uniform normal filling do not establish dissection. Grayscale, color, and spectral findings should agree before disease is assigned.

153. D — Failure of the vein walls to coapt under adequate transducer pressure is the primary sonographic sign of acute deep vein thrombosis. Hypoechoic thrombus and venous enlargement support acuity. A small echogenic vein with collaterals is more typical of chronic post-thrombotic change. Grayscale, color, and spectral findings should agree before disease is assigned.

154. B — Chronic thrombotic change commonly produces a smaller, irregular lumen with echogenic wall thickening, fibrous bands, recanalized channels, and collateral flow. Acute thrombosis more often enlarges the vein and appears relatively hypoechoic. Complete compression argues against residual thrombus. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

155. D — Sustained retrograde venous flow after a provocative maneuver reflects failure of venous valves to close effectively. The exact threshold depends on vessel segment and laboratory protocol. The

finding concerns venous competence, not arterial obstruction, respiratory variation, or arterial resistance. Grayscale, color, and spectral findings should agree before disease is assigned.

156. C — A tardus-parvus waveform has delayed systolic acceleration and reduced amplitude caused by damping beyond a hemodynamically important proximal obstruction. Normal peripheral arteries are brisk and often multiphasic. Venous reflux and a local fistula create different spectral patterns. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

157. B — Narrowing conserves volume flow by increasing velocity through the stenotic jet, commonly accompanied by aliasing and spectral broadening. Distal damping may follow. Uniform slowing, proximal absence of systolic flow, or isolated venous changes do not characterize the stenotic segment itself. Grayscale, color, and spectral findings should agree before disease is assigned.

158. A — A true aneurysm is dilation involving the intima, media, and adventitia. A pseudoaneurysm is contained outside the normal arterial wall and communicates through a neck. Graft dilation is a separate postoperative process and does not define a native true aneurysm. Grayscale, color, and spectral findings should agree before disease is assigned.

159. A — Blood enters the pseudoaneurysm during systole and exits during diastole, producing the characteristic to-and-fro spectral pattern in its neck. Swirling bidirectional color may appear in the sac. Hepatopetal flow describes portal circulation, while the other choices lack the neck's directional reversal. Grayscale, color, and spectral findings should agree before disease is assigned.

160. D — A proximal subclavian stenosis can lower pressure beyond the lesion and draw blood retrograde through the ipsilateral vertebral artery. Early steal may alternate direction; complete steal is retrograde. Portal and femoral venous findings are unrelated, and continuous antegrade vertebral flow argues against steal. Grayscale, color, and spectral findings should agree before disease is assigned.

161. C — Expiration can accentuate downward diaphragmatic and ligamentous compression of the proximal celiac artery, increasing velocity and curvature. Inspiration may relieve compression and reduce velocity. This dynamic pattern helps distinguish compression from fixed atherosclerotic disease, though clinical correlation remains essential. Grayscale, color, and spectral findings should agree before disease is assigned.

162. B — Fibromuscular dysplasia commonly affects the mid-to-distal renal artery with alternating stenosis and dilation, producing a string-of-beads appearance. Atherosclerosis preferentially affects the ostium and proximal segment. Venous thrombosis and cortical necrosis do not produce this arterial morphology. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

163. C — Hepatofugal flow travels away from the liver and may develop when portal pressure is sufficiently elevated and collateral pathways open. Normal main portal flow is hepatopetal. Hepatic arterial resistance and inferior vena cava phasicity are separate findings that do not define reversed portal flow. Grayscale, color, and spectral findings should agree before disease is assigned.

164. D — Chronic mesenteric ischemia reduces the circulation's ability to meet increased intestinal demand after meals, producing postprandial pain and food avoidance with weight loss. The other symptoms point toward venous, thoracic outlet, or musculoskeletal processes rather than mesenteric arterial insufficiency. Grayscale, color, and spectral findings should agree before disease is assigned.

165. A — A Baker cyst typically arises between the semimembranosus tendon and medial head of the gastrocnemius in the medial popliteal fossa. It can mimic deep vein thrombosis symptoms. The carotid bifurcation, renal hilum, and anterior ankle are not characteristic locations. Grayscale, color, and spectral findings should agree before disease is assigned.

166. B — A carotid body tumor arises at the carotid bifurcation and may separate or splay the internal and external carotid arteries. It is typically hypervascular. Thyroid lesions, jugular valves, and vertebral loops do not characteristically create this bifurcation-splaying pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

167. B — Diffuse monophasic waveforms with delayed systolic upstroke indicate reduced pulsatility transmitted from a proximal inflow obstruction, often in the aortoiliac segment. Normal resting peripheral waveforms are usually multiphasic. Superficial venous reflux does not directly cause this arterial pattern. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

168. D — May-Thurner anatomy involves compression of the left common iliac vein between the right common iliac artery and the spine, predisposing to left-sided venous obstruction or thrombosis. The alternative relationships describe unrelated vascular territories and mechanisms. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

169. A — Plantar flexion or dorsiflexion maneuvers can reproduce dynamic compression of the popliteal artery by adjacent musculotendinous structures. Duplex assessment compares waveforms and flow with neutral and provocative positions. Respiratory, venous, and upper-extremity maneuvers do not test this mechanism. Grayscale, color, and spectral findings should agree before disease is assigned. Clinical history and technical factors must also be considered during interpretation.

170. C — Dissection creates an intimal flap that may separate true and false lumens with differing flow patterns. Plaque can narrow the lumen but does not usually form a longitudinal flap dividing channels. Enhancement and uniform normal filling do not establish dissection. Grayscale, color, and spectral findings should agree before disease is assigned.