Chapter 1

1. Which of the following pathologies may cause flow within an artery to be reversed?
   a. Upstream tight stenosis
   b. Occlusion with large downstream collaterals
   c. Complex recanalization
   d. All the above

2. Which of the following is not a maneuver to try if a scan is technically difficult?
   a. Change the patient/body part position
   b. Maintain the scanning angle
   c. Change the transducer frequency
   d. Call a colleague for assistance

3. Which of the following is not useful for optimal sonographer positioning for carotid scanning?
   a. Performing hand and arm stretches
   b. Scanning with only the right hand
   c. Use elbow of scanning arm and part of the scanning hand as a fulcrum
   d. Learn to scan with the machine at both the head and foot of the patient

4. Using __________ to localize the position is helpful when comparing findings with radiographic studies.
   a. Coordinates
   b. Pictures
   c. Landmarks
   d. Notes

5. The optimization of __________ smooths the appearance of the image and reduces speckle artifact.
   a. Harmonics
   b. Tissue colorization
   c. Persistence
   d. Doppler flow

Chapter 2

6. Anatomic variants of the aortic arch occur in what percentage of cases?
   a. One eighth
   b. One fourth
   c. One third
   d. One half

7. Which of the following are main branches of the external carotid artery?
   a. Superior thyroid artery
   b. Ascending pharyngeal artery
   c. Lingual artery
   d. All the above

8. Which arteries are the principal vessels that supply collateral flow around an internal carotid occlusion?
   a. Facial and superficial temporal arteries
   b. Lingual and facial arteries
   c. Facial and superior thyroid arteries
   d. Superficial temporal and lingual arteries
9. The superficial temporal artery runs in front of the tragus of the ear and continues as a single artery that continues across the forehead.
   a. True
   b. False

10. What is the segment of the internal carotid artery (ICA) that runs between the carotid bifurcation and the carotid canal?
   a. Supraclinoid segment
   b. Cavernous segment
   c. Petrous segment
   d. Extracranial segment

11. Occlusion of the carotid artery by itself does not result in stroke if the ________ is completed and has adequate inflow.
   a. Circle of Willis
   b. Posterior communicating artery
   c. Anterior communicating artery
   d. Basilar artery

12. Brachial blood pressure is done only in one arm to identify unilateral subclavian artery stenosis.
   a. True
   b. False

13. In asymptomatic patients echo lucent plaques are associated with _______ to _______ times the risk of stroke than with echogenic plaques.
   a. One, two
   b. Two, three
   c. Two, four
   d. Three, four

14. What class recommendation is the following statement? In asymptomatic patients with known or suspected carotid stenosis, duplex ultrasonography, performed by a qualified technologist in a certified lab, is recommended as the initial diagnostic test to detect hemodynamically significant carotid stenosis.
   a. Class I
   b. Class IIa
   c. Class IIb
   d. Class III

15. Aortic insufficiency causing a bisferiens peak is seen in what percentage of cases?
   a. 20%
   b. 30%
   c. 40%
   d. 50%

16. Severe aortic stenosis does not affect the velocity of which artery?
   a. Common carotid artery
   b. Internal carotid artery
   c. Eternal carotid artery
   d. Vertebral artery

17. As referenced in table 2-5 primary parameters of an ICA PSV of >230 and plaque estimate of >50 is indicative of what percentage carotid stenosis?
   a. Normal
   b. <50%
   c. 50% - 69%
   d. ≥70% but less than near occlusion,
18. Tortuosity of the middle and distal ICA is commonplace.
   a. True
   b. False

19. What is the incidence of restenosis within two years after an endarterectomy?
   a. 3-5%
   b. 6-8%
   c. 9-15%
   d. 10-20%

20. What is the incidence of spontaneous carotid artery dissection per 100,000 population per year?
   a. 1 to 3
   b. 2 to 4
   c. 3 to 4
   d. 4 to 5

21. Carotid artery dissection usually begins ______ distal to the bulb and extends no further than the base of the skull.
   a. 1 to 3 cm
   b. 2 to 3 cm
   c. 3 to 4 cm
   d. 4 to 5 cm

22. According to the Intersocietal Commission for the Accreditation of Vascular Laboratories (ICAVL) standard for accreditation carotid testing must include a minimum of ______ completed carotid exams annually
   a. 75
   b. 100
   c. 125
   d. 150

Chapter 3

23. The main trunk of the subclavian artery is divided into how many sections?
   a. Two
   b. Three
   c. Four
   d. Five

24. The thyroid cervical trunk is absent in what percentage of cases?
   a. 14%
   b. 15%
   c. 16%
   d. 17%

25. In the presence of thoracic-scapular-humoral trauma how many arteries may arise from the axillary artery to form a collateral pathway?
   a. 1-4
   b. 5-7
   c. 6-11
   d. 7-12
26. The brachial artery bifurcation into the ulnar artery and radial artery at approximately ____ cm distal to the radiohumeral line.
   a. 1.1
   b. 1.5
   c. 1.7
   d. 1.9

27. In what percentage of cases does the radial artery have a variable origin arising from the axillary artery, or from the proximal, mid or distal brachial artery?
   a. 10% - 20%
   b. 11% - 22%
   c. 13% - 25%
   d. 14% - 29%

28. The radial artery is the more dominant of the two forearm arteries.
   a. True
   b. False

29. The superficial palmar arch is incomplete in what percentage of cases?
   a. 5%
   b. 10%
   c. 15%
   d. 20%

30. Which of the following are common indications for duplex evaluation of the upper extremities?
   a. Upper extremity ischemia
   b. Reduced pulses
   c. Bruit
   d. All the above

31. What angle should be used when using spectral Doppler measurements of the upper extremity arteries?
   a. 40 degrees
   b. 50 degrees
   c. 60 degrees
   d. 70 degrees

32. A hypoechoic, poorly delineated lesion, but possible with flow disturbance is a characteristic of what type of plaque?
   a. Calcified
   b. Irregular
   c. Anechoic
   d. Smooth

33. A connection between an artery and vein identified with color Doppler is called what?
   a. True aneurysm
   b. Pseudoaneurysm
   c. Stenosis
   d. Arteriovenous fistula

34. According to ICAVL standards, every three years how many extremity studies must be correlated with angiography findings?
   a. 20
   b. 25
   c. 30
   d. 35
Chapter 4

35. The first hemodialysis fistula was created in what year?
   a. 1966
   b. 1968
   c. 1970
   d. 1972

36. What is the normal volumetric flow through an AV fistula?
   a. >600mL/min
   b. >650 mL/min
   c. >700 mL/min
   d. >750 mL/min

37. What percentage of fistulas fail to mature?
   a. 5% to 20%
   b. 15% to 25%
   c. 20% to 50%
   d. 30% to 60%

38. For duplex interpretation what is the main venous criterion for the forearm and upper arm?
   a. Length
   b. Patency
   c. Volume
   d. Compressibility

39. Post-operative duplex scanning is generally performed _______ weeks after surgery.
   a. 2 to 3
   b. 4 to 6
   c. 6 to 8
   d. 8 to 10

40. Which is the most common fistula complication?
   a. Infection
   b. Thrombosis
   c. Stenosis
   d. B & C

41. What is the peak systolic velocity for an arteriovenous fistula with a <50% stenosis?
   a. <2m/sec
   b. <3m/sec
   c. <4m/sec
   d. >4m/sec

42. Blood flow volume greater than _____ is required for adequate dialysis.
   a. 500 mL/min
   b. 550 mL/min
   c. 575 mL/min
   d. 600 mL/min

43. The most common site of narrowing for an arteriovenous graft is in the host vein proximal to the
   venous anastomosis.
   a. True
   b. False
Chapter 5

44. In what percentage of cases does the aorta bifurcate within 1.25 cm of the iliac artery?
   a. 60%
   b. 70%
   c. 80%
   d. 90%

45. What is the average length of the internal iliac artery?
   a. 4 cm
   b. 5 cm
   c. 6 cm
   d. 7 cm

46. Which branch of the popliteal artery forms a collateral network around the knee?
   a. Paired sural arteries
   b. Genicular arteries
   c. Anterior tibial artery
   d. Posterior tibial artery

47. The posterior tibial artery is absent in approximately what percentage of the population?
   a. 2%
   b. 3%
   c. 4%
   d. 5%

48. The dorsalis pedis artery is congenitally absent in what percentage of people?
   a. <1%
   b. 2% to 3%
   c. 4% to 5%
   d. 6% to 7%

49. Which of the following is not a contraindication for duplex scanning?
   a. Ulceration
   b. Wound dressing
   c. Infection
   d. A & B

50. Which of the following are indicative of a stenotic classification between 50% and 90%?
   a. Visualized plaque
   b. Loss of reverse flow component
   c. Evidence of poststenonic turbulent/disordered flow
   d. All the above

51. What is the normal pre-exercise ankle-brachial pressure?
   a. <0.50
   b. >0.65
   c. >0.80
   d. >0.97

52. A venous graft velocity ratio greater than 2.5, a severe turbulence with reversed flow components and a PSV greater than 200/cm/sec is indicative of what percentage stenosis?
   a. <20%
   b. 20% to 50%
   c. 50% to 75%
   d. 75% to 99%
Chapter 6
53. What is the most common catheterization related complication?
   a. Hematoma
   b. False aneurysm
   c. Dissection
   d. Thrombus

54. What is the most common puncture site for catheterization-related hematomas?
   a. Axillary
   b. Brachial
   c. Femoral
   d. Subclavian

55. Which of the following is defined as a localized hematoma with tissue that are connected to the artery of origin by a tract?
   a. Bleeding tract
   b. Pseudoaneurysm
   c. Arterio-venous fistula
   d. Dissection

Chapter 7
56. Which of the following is not a visceral branch of the aorta?
   a. Iliac
   b. Renal
   c. Ovarian
   d. Lumbar

57. How long is the celiac artery?
   a. 1.0 cm
   b. 1.25 cm
   c. 1.50 cm
   d. 1.75 cm

58. Which of the following is not an artery off the celiac artery?
   a. Left gastric artery
   b. Right gastric artery
   c. Splenic artery
   d. Common hepatic arteries

59. What artery supplies the small intestines?
   a. Superior mesenteric artery
   b. Inferior mesenteric artery
   c. Celiac artery
   d. Left gastric artery

60. The inferior mesenteric artery does not supply which of the following?
   a. Left half of the transverse colon
   b. Greater part of the rectum
   c. Descending colon
   d. Pancreas

61. The lumbar arteries are a series of ______ paired vessels that arise from the back of the spine.
   a. Two
   b. Three
   c. Four
   d. Five
62. The right renal artery is _____ than the left renal artery.
   a. Longer
   b. Wider
   c. More posterior
   d. More superior

63. Abdominal aortic aneurysms (AAA) occur in what percentage of men over the age of 65?
   a. 2.0%
   b. 2.5%
   c. 3.0%
   d. 3.5%

64. A AAA of more than _____ increases the risk of rupture.
   a. 4.0 cm
   b. 4.5 cm
   c. 5.0 cm
   d. 5.5 cm

65. Which of the following is not a limitation for duplex imaging to evaluate an endovascular stent graft?
   a. Age
   b. Excessive bowel gas
   c. Obesity
   d. Abdominal tenderness

66. What type of AAA leak is described as a transgraft leak?
   a. Type I
   b. Type II
   c. Type III
   d. Type IV

Chapter 8

67. The renal arteries arise from the aorta at approximately the level of which lumbar vertebra?
   a. L1
   b. L2
   c. L3
   d. L4

68. Accessory renal arteries extend to what area?
   a. Hilum
   b. Upper or lower poles of the kidney
   c. Spleen
   d. A & B

69. Branches of each renal artery extend to what areas?
   a. Adrenal gland
   b. Ureter
   c. Muscle
   d. All the above

70. A peak systolic velocity (PSV) greater than _____ predicts the presence of significant renal artery stenosis.
   a. 0.05 – 1.20
   b. 0.80 – 1.40
   c. 1.45 – 1.75
   d. 1.80 – 2.0
71. The resistance index (RI) is the ratio of peak systolic velocity (PSV) and end diastolic velocity (EDV).
   a. True
   b. False

72. Which of the following is not a common indication for duplex imaging of renal artery stenosis?
   a. Lower abdominal bruit
   b. Follow-up renal artery stent
   c. Follow-up renal artery bypass
   d. Suspected renovascular hypertension

73. Which of the following equipment is needed for duplex imaging of the renal artery?
   a. 2- to 5- MHz sector/curved array transducers
   b. 2- to 4- MHz vector transducer
   c. Coupling gel
   d. All the above

74. According to ICAVL standards what percentage of exams must correlate with either angiographic or surgical finding?
   a. 70%
   b. 75%
   c. 80%
   d. 85%

75. A normal renal artery study has a renal-to-aorta ratio of less than what?
   a. 2.0
   b. 2.5
   c. 3.0
   d. 3.5

Chapter 9

76. How many branches of the SMA form a series of arches supplying the small intestines?
   a. 2-5
   b. 6-8
   c. 9-11
   d. 12-15

77. The IMA does not supply blood flow to which of the following areas?
   a. Transverse colon
   b. Ascending colon
   c. Greater part of the rectum
   d. Descending colon

78. A celiac artery stenosis less than _______ is not readily detected by ultrasound.
   a. 35%
   b. 40%
   c. 45%
   d. 50%

79. Duplex scans are technically adequate in what percentage of SMA studies?
   a. 97%
   b. 98%
   c. 99%
   d. 100%
80. Which of the following is not a common indication for duplex evaluation of the visceral arteries?
   a. GI bleed
   b. Upper abdominal bruit
   c. Stent surveillance
   d. Suspected bowel ischemia

81. What is the PSV for a greater than 70% stenosis of the celiac access?
   a. 90 to 110 cm/sec
   b. 100 to 150 cm/sec
   c. 160 to 180 cm/sec
   d. Greater than 200 cm/sec

82. What is the PSV for a 70% stenosis of the SMA?
   a. 125 cm/sec
   b. 180 cm/sec
   c. 250 cm/sec
   d. Greater than 275 cm/sec

83. What is the class recommendation for surgical treatment of chronic intestinal ischemia?
   a. Class I
   b. Class IIa
   c. Class IIb
   d. Class III

84. According to ICAVL standards correlation studies must be completed within ______ preceding applying for accreditation.
   a. 6 months
   b. 1 year
   c. 2 years
   d. 3 years

Chapter 10

85. What vein in the neck is clearly seen on a typical duplex of the neck?
   a. Anterior jugular vein
   b. Internal jugular vein
   c. External jugular vein
   d. B & C

86. The external jugular vein drains blood from what area?
   a. Scalp
   b. Face
   c. Neck
   d. A & B

87. The size of the external jugular vein varies inversely in size with that of its internal jugular vein.
   a. True
   b. False

88. The left and right vertebral veins drain blood from what area?
   a. Face
   b. Neck
   c. Scalp
   d. None of the above

89. There are only superficial dorsal and volar veins in the hand.
   a. True
   b. False
90. Which of the following may result in venous thrombosis of the upper extremity?
   a. Trauma
   b. Line insertion
   c. Pacemaker
   d. All the above

91. What is the contraindication for duplex evaluation of the upper extremity?
   a. Arm swelling
   b. Open wound
   c. Arm redness
   d. Palpable cord

92. What venous duplex protocol technique is used to image the internal jugular vein?
   a. SAX sweep
   b. LAX sweep
   c. SAX sweep with/without compression
   d. A & B

93. When there are signs of deep vein thrombosis which of the following veins is not a site to do a compression maneuver?
   a. Femoral vein
   b. Internal jugular vein
   c. Subclavian vein
   d. Axillary vein

Chapter 11

94. What percentage of lower extremity venous return is done by the deep venous system?
   a. 80%
   b. 85%
   c. 90%
   d. 95%

95. What percentage of people do not have a venous valve between their groin and their heart?
   a. 5%
   b. 19%
   c. 15%
   d. 20%

96. The long saphenous vein contains up to how many valves?
   a. 16
   b. 18
   c. 20
   d. 22

97. What percentage of people have a large accessory saphenous veins?
   a. 10 – 20%
   b. 25 – 40%
   c. 50 – 70%
   d. 75 – 90%
98. Communicating veins are also known as what?
   a. Gastrocnemius veins
   b. Short saphenous veins
   c. Vein of Giacomini
   d. Perforating veins

99. The superficial plantar venous arch is the venous return system for the foot.
   a. True,
   b. False

100. Which veins join to become the tibioperoneal trunk?
    a. Peroneal and posterior tibial veins
    b. Peroneal and anterior tibial veins
    c. Peroneal and popliteal veins
    d. Peroneal and superficial femoral

101. The superficial femoral vein is duplicated in what percentage of the population?
    a. 33%
    b. 38%
    c. 42%
    d. 45%

102. Which of the following veins do not drain into the external iliac vein?
    a. Pubic vein
    b. Inferior epigastric veins
    c. Deep iliac circumflex vein
    d. Deep femoral veins

103. In May-Thurner syndrome the common iliac vein is compressed by the artery against what vertebra?
    a. Second
    b. Third
    c. Fourth
    d. Fifth

104. A left-sided IVC occurs in what percentage of cases?
    a. 0.1 – 0.3%
    b. 0.2 – 0.5%
    c. 0.3 – 0.6%
    d. 0.4 – 0.7%

105. The inferior cava receives how many pairs of veins?
    a. 4
    b. 6
    c. 8
    d. 10

106. The portal veins are approximately how long?
    a. 4 cm
    b. 6 cm
    c. 8 cm
    d. 10 cm

107. Annually, what percentage of the population develops venous thromboembolism?
    a. 0.1%
    b. 0.2%
    c. 0.3%
    d. 0.4%
108. What percentage of venous thrombosis occurs within the deep lower extremity veins?
   a. 80%
   b. 85%
   c. 90%
   d. 95%

109. What percentage of pulmonary embolism cases do not have a detectable DVT by duplex scanning?
   a. 60%
   b. 70%
   c. 80%
   d. 90%

110. Which of the following is not a feature of an acute thrombus?
   a. Bright echogenic
   b. Poorly attached
   c. Spongy texture
   d. Dilated vein

**Chapter 12**

111. What is the coronary wall layer adjacent to the arterial lumen called?
   a. Intima
   b. Media
   c. Eternal elastic lamina
   d. Adventitia

112. What layer offers the architectural support to the vessel?
   a. Intima
   b. Adventitia
   c. Media
   d. External elastic lamina

113. Arterial stenting has become one of the most important applications for Intravascular ultrasound (IVUS).
   a. True
   b. False

114. To utilize IVUS preintervention what is the ischemic minimal lumen for the left main artery?
   a. 5.6 mm
   b. 5.7 mm
   c. 5.8 mm
   d. 5.9 mm

115. With bare metal stents the risk of restenosis decrease _____ for every one square millimeter increase in minimal stent area (MSA).
   a. 18%
   b. 19%
   c. 20%
   d. 21%

**Chapter 13**

116. The continued expansion of endovascular devices and procedures has not led to a major shift in the treatment of vascular disease.
   a. True
   b. False

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117. By IVUS, what is the luminal dimensions or wall thickness of normal or minimally diseased vessels?
   a. 0.04 mm
   b. 0.05 mm
   c. 0.06 mm
   d. 0.07 mm

118. IVUS has proven efficacy in vessel characterization for which of the following?
   a. Vessel diameter
   b. Stenosis
   c. Morphology
   d. All the above

119. IVUS is effective in evaluating which of the following?
   a. Assessing the result of primary intervention
   b. Establishing the need for stenting
   c. Guiding stent deployment
   d. All the above

120. The use of IVUS can significantly reduce the fluoroscopy time and contrast use during procedures.
   a. True
   b. False