



Course title: Echocardiography: Clinical Applications

**Topic 1: Clinical Benefits of New Echocardiographic Methods**

1. Which of the following is the main goal of a good echocardiographic examination?  
(A): accurate assessment of myocardial function  
(B): precise presentation of cardiac morphology  
(C): full report of chemical contents  
(D): Both A and B
  
2. Functional echocardiography enables real-time evaluation of cardiac performance that includes which of the following?  
(A): identifying the nature of cardiovascular compromise  
(B): guiding therapeutic decisions  
(C): monitoring response to treatment  
(D): all of the above
  
3. Congenital heart diseases (CHD) are highly variable, ranging from simple to complex lesions.  
(A): True                      (B): False
  
4. Functional echocardiography allows bedside use of cardiac ultrasound that brings fast and efficient investigation and recognition of which of the following?  
(A): key hemodynamic changes  
(B): an assessment of cardiac function and pulmonary hypertension  
(C): pericardial effusion and evaluation of the shunts  
(D): all of the above
  
5. Early recognition of increased pulmonary pressure may help in the early institution of pulmonary vasodilators, especially in \_\_\_\_\_ with pulmonary hypertension.  
(A): women  
(B): neonates  
(C): teenagers  
(D): elderly
  
6. Serial echocardiography evaluation to monitor treatment response may provide a better understanding of physiology and guide the duration of treatment, which minimizes \_\_\_\_\_.  
(A): hospital stay  
(B): recovery time  
(C): drug exposure  
(D): none of the above
  
7. Assessment of volume status is usually made with aorta size and collapsibility, which is also the method of choice to evaluate right heart filling pressure.  
(A): True                      (B): False
  
8. \_\_\_\_\_ is a common condition in intensive care units.  
(A): Pericardial effusion  
(B): Heart murmur  
(C): Low blood pressure  
(D): Cardiac arrest
  
9. Patent ductus arteriosus (PDA) causes which of the following which could be assessed with functional echocardiography?  
(A): Atrial Septal Defect  
(B): Coarctation of the Aorta  
(C): Pulmonary hyperperfusion and systemic hypoperfusion  
(D): none of the above
  
10. \_\_\_\_\_ parameters have diagnostic as well as prognostic values in several cardiac diseases.

- (A): Pulmonary function
- (B): Myocardial deformation
- (C): Liver metabolism
- (D): none of the above

11. Recently, \_\_\_\_\_ has been introduced as a new method to quantify myocardial strain.

- (A): PET/CT
- (B): 2D and 3D speckle-tracking echocardiography (STE)
- (C): Digital radiography
- (D): none of the above

12. Which of the following is a clinical application of myocardial deformation imaging in congenital heart disease (CHD)?

- (A): The effects of valvular disease on myocardial function
- (B): Understanding of the diastolic function
- (C): Timely treatment decisions
- (D): all of the above

13. Strain imaging is a beneficial additional echocardiographic method in assessing the extent of the ischemic myocardium and ventricular function.

- (A): True
- (B): False

14. Which of the following are clinical benefits of 3D echocardiography?

- (A): better visualization and understanding of the spatial relationships and 3D morphology of congenital heart defects
- (B): quantification of cardiac mass and volumes
- (C): planning and guiding therapeutic interventions
- (D): all of the above

## **Topic 2: Fetal Echocardiography**

15. Fetal Echocardiography is a test using sound waves to show the structure of an unborn baby's heart.

- (A): True
- (B): False

16. Congenital heart disease is the most common birth defect, occurring at a rate of \_\_\_\_\_ births.

- (A): 8/1,000
- (B): 28/1,000
- (C): 88/1,000
- (D): 108/1,000

17. Fetal Echocardiography is an important part of Genetic Ultrasound, a new test that identifies over \_\_\_\_\_ % of fetuses with Down syndrome when performed during the second-trimester of pregnancy.

- (A): 10
- (B): 25
- (C): 45
- (D): 95

18. A baby's heart begins to develop at conception but is completely formed by \_\_\_\_\_ weeks into the pregnancy.

- (A): second
- (B): third
- (C): fourth
- (D): eight

19. While there are risk factors for congenital heart defects, over 90% of heart malformations have no known cause.

- (A): True
- (B): False

20. In the fetal circulation the right and left sides of the heart connect at the level of the \_\_\_\_\_ and the ductus arteriosus.

- (A): pulmonary veins
- (B): aorta

- (C): foramen ovale
- (D): pulmonary artery

21. Blood from the placenta returns to the fetus by the \_\_\_\_\_.

- (A): superior vena cava
- (B): umbilical vein
- (C): femoral vein
- (D): pulmonary valve

22. \_\_\_\_\_ is a technique that enables the physician/ sonographer to identify the direction and speed of blood flow within a vessel or heart chamber.

- (A): Contrast Computed Tomography
- (B): Heart Color Doppler ultrasound
- (C): Digital radiography
- (D): Electrocardiogram

23. The use of color Doppler ultrasound for evaluation of the fetal heart and detection of birth defects was first reported by Dr. DeVore in 2006.

- (A): True
- (B): False

24. The transducer is always located at the top of the image so when blood flows towards the transducer it is depicted in \_\_\_\_\_, and away from the transducer in blue.

- (A): red
- (B): green
- (C): purple
- (D): yellow

25. \_\_\_\_\_ is a measurement of the compliance or stiffness of the ventricles as blood enters the chamber during diastole in fetus.

- (A): Peak velocity
- (B): Time-to-peak velocity
- (C): E/A ratio
- (D): Signal to noise ratio

26. \_\_\_\_\_ measures the speed at which blood is ejected from the ventricles.

- (A): Peak velocity
- (B): E/A ratio
- (C): Purkinje fibers
- (D): Aorta

27. \_\_\_\_\_ consists of displaying the blood flow patterns in a waveform and enables the physician to record different flow patterns during the cardiac cycle from specific parts of the heart.

- (A): Endoscopic ultrasound
- (B): Pulsed Doppler ultrasound
- (C): Duplex ultrasound
- (D): Transvaginal ultrasound

28. \_\_\_\_\_ is a recording of the electrical activity of the heart during the cardiac cycle.

- (A): Electroencephalogram (ECG)
- (B): Triplex ultrasound
- (C): Doppler ultrasound
- (D): Electrocardiogram (EKG)

29. Ultrasound systems used for fetal echocardiography should have capabilities for performing 2-dimensional, M-mode, and Doppler imaging.

- (A): True
- (B): False

30. In fetal echocardiography frames rates of \_\_\_\_\_ Hz are frequently needed to view important events occurring at heart rates in excess of 140 beats per minute.

- (A): 10 to 30
- (B): 35 to 55
- (C): 60 to 70

(D): 80 to 100

31. The initial survey of the fetus is used to estimate which of the following?

- (A): gestational age
- (B): establishment of abdominal situs
- (C): cardiac position
- (D): all of the above

32. Which of the following structures are viewed in the caval long-axis view during fetal echocardiogram?

- (A): Superior vena cava and right pulmonary artery
- (B): Inferior vena cava and eustachian valve
- (C): Patent foramen ovale
- (D): all of the above

33. \_\_\_\_\_ can restrict the amount of oxygen-rich (red) blood that can travel to the lower part of the body.

- (A): Ventricular septum
- (B): Myocardium
- (C): Coarctation of aorta
- (D): Superior vena cava

34. Hypoplastic left heart syndrome (HLHS) is a combination of several abnormalities of the heart and great blood vessels and is a congenital syndrome.

- (A): True
- (B): False

35. Pulmonary stenosis with intact ventricular septum represents \_\_\_\_\_% off all fetal cardiac anomalies.

- (A): 1
- (B): 9
- (C): 25
- (D): 48

36. In Ebstein's anomaly the abnormal flow originates from a displaced \_\_\_\_\_ which is located lower in the ventricle than it should be.

- (A): mitral valve
- (B): bicuspid valve
- (C): tricuspid valve
- (D): atrial septum

37. The color Doppler defines the underlying pathology by demonstrating the flow patterns within the heart.

- (A): True
- (B): False

38. The tricuspid regurgitation is associated with an increased risk for \_\_\_\_\_ when it is observed during the first or second trimesters of pregnancy.

- (A): Spina bifida
- (B): Down syndrome
- (C): Hydrocephalus
- (D): none of the above

39. Which of the following is the techniques of choice for the diagnosis of fetal dysrhythmias?

- (A): M-mode
- (B): Spectral Doppler ultrasound
- (C): Angiography
- (D): Both A and B

40. Congenital heart block may occur either as a consequence of a cardiac malformation or because of transplacental passage of maternal autoimmune antibodies.

- (A): True
- (B): False

### **Topic 3: The Impact of Fetal Echocardiography on the Prognosis of Congenital Heart Disease**

41. Congenital heart disease (CHD) is the most common malformation detected prenatally and at birth and occurs in approximately \_\_\_\_\_ of live births and is significantly higher in premature infants and in stillborn.

- (A): 1/1000
- (B): 3/1000

- (C): 10/1000
- (D): 40/1000

42. Approximately \_\_\_\_% of congenital heart disease occurs in association with a well-defined syndrome such as trisomies 13, 15, 18, 21 and Turner syndrome.

- (A): 1
- (B): 5
- (C): 7
- (D): 17

43. The prenatal diagnosis of CHD in the last 30 years has reached a high degree of diagnostic accuracy allowing to identify of almost all forms of CHD during fetal life.

- (A): True
- (B): False

44. Prenatal diagnosis rates for CHD increased from 23.0% in 1983–1988 to \_\_\_\_ % in 1995–2000.

- (A): 47.3
- (B): 60
- (C): 76
- (D): 80.4

45. The \_\_\_\_\_ in postnatally diagnosed infants with CHD is an established risk factor for morbidity and mortality.

- (A): postpartum depression
- (B): clinical instability
- (C): C-section delivery
- (D): gestational diabetes

46. Several fetal studies reported that structural heart disease, in particular aortic stenosis, evolves in utero, hindering the growth of the \_\_\_\_\_.

- (A): right pulmonary artery
- (B): myocardium
- (C): left ventricle
- (D): bicuspid valve

47. Fetal cardiac intervention (FCI) is a novel and advanced technique that allows in utero treatment of a subset of congenital heart disease.

- (A): True
- (B): False

48. Which of the following is a rationale for FCI in HLHS with intact or restrictive atrial septum?

- (A): to avoid severe neonatal hypoxia
- (B): to prevent worsening of the lung disease
- (C): death
- (D): all of the above

49. The fetuses with which of the following condition are potential candidates for pulmonary balloon valvuloplasty in utero?

- (A): pulmonary atresia with intact ventricular septum
- (B): severe pulmonary stenosis
- (C): hydrocephalus
- (D): both A and B

50. Discussion with parents on the long-term prognosis of fetal CHD constitutes a fundamental element of adequate counseling.

- (A): True
- (B): False

51. Which of the following forms an interdisciplinary counseling team for parents?

- (A): obstetrician and pediatrician
- (B): pediatric cardiologist
- (C): heart surgeon
- (D): all of the above

52. Since CHD is a significant cause of morbidity and mortality in the newborns, its diagnosis may lead to a

huge crisis in the affected families, considering the perceived implications of having an abnormality of such vital organ.

(A): True (B): False

53. The majority of the diagnosis of fetal congenital heart disease occurs after the \_\_\_\_\_ week of gestation, when the mother already feels the first fetal movements, and the baby is part of her body.

- (A): 2nd
- (B): 4th
- (C): 8th
- (D): 18th

**Topic 4: Role of Transthoracic Echocardiography in Visualization of the Coronary Arteries and Assessment of Coronary Flow Reserve**

54. The transthoracic and transesophageal echo can provide data regarding which of the following condition?

- (A): coronary patency
- (B): presence of coronary stenosis
- (C): presence of coronary ectasia
- (D): all of the above

55. The coronary Doppler imaging assesses which of the following parameters?

- (A): Diastolic and systolic flow velocity
- (B): Diastolic Deceleration time
- (C): Coronary flow reserve
- (D): all of the above

56. \_\_\_\_\_ increase the diameter of the epicardial artery and reduce baseline flow velocity.

- (A): Cardiac constrictors
- (B): Coronary vasodilators
- (C): Anti-inflammatory drugs
- (D): none of the above

57. Echocardiography avoids contact with the coronary artery, which may be reactive during myocardial infarction.

(A): True (B): False

58. In transthoracic echocardiography the left anterior descending artery (LAD) blood flow can be assessed by using high frequency transducers due to the proximity of this vessel to the \_\_\_\_\_.

- (A): abdominal wall
- (B): thyroid gland
- (C): chest wall
- (D): femoral artery

59. Color Doppler imaging of the coronary flow in the proximal portion of the left coronary artery is technically difficult due to which of the following reason?

- (A): orthogonal alignment of coronary flow to the ultrasound beam
- (B): interposition of the right ventricular outflow tract and pulmonary artery
- (C): myocardial infarction
- (D): both A and B

60. The distal part of the left anterior descending artery can be recorded in a modified foreshortened \_\_\_\_\_ view from an apical window.

- (A): one-chamber
- (B): two-chamber
- (C): three-chamber
- (D): five-chamber

61. To assess the distal left circumflex artery, which of the following view is used with the transducer rotated clockwise to direct the imaging plane posteriorly and inferiorly?

- (A): three-chamber
- (B): apical 5 chamber
- (C): transverse

(D): mid-sagittal oblique

62. The proximal mammary artery is best visualized from a supraclavicular view using high frequency transducer (8 MHz linear transducer).

(A): True (B): False

63. The best way to image the proximal segment of the coronary artery is a \_\_\_\_\_ at the level of the aortic bulb with a slight anteflexion of the probe.

(A): apical 6 chamber view  
(B): transesophageal short axis view  
(C): decubitus lateral view  
(D): none of the above

64. Detection of the distal LAD flow by TTDE was significantly correlated with the reperfusion as assessed by \_\_\_\_\_.

(A): electrocardiogram (ECG)  
(B): open heart surgery  
(C): coronary angiography  
(D): none of the above

65. Coronary flow can be measured by transthoracic coronary Doppler ultrasound in occluded coronary arteries receiving collateral flow.

(A): True (B): False

#### **Topic 5: 3D Myocardial Contrast Echocardiography**

66. Early restoration of coronary perfusion is the most important objective in the management of \_\_\_\_\_, and primary percutaneous coronary intervention (PCI) is established as the most effective strategy for it.

(A): hydrocephalus  
(B): acute stroke  
(C): pulmonary embolism  
(D): ST-segment elevation myocardial infarction (STEMI)

67. Myocardial contrast echocardiography (MCE) uses ultrasonic contrast agent containing \_\_\_\_\_ which are strong scatters in an ultrasonic field and send compression and rarefaction waves back to the scanner.

(A): radioisotopes  
(B): microbubbles  
(C): gadolinium  
(D): barium sulfate

68. Which of the following is an advantage of 3D- echocardiography?

(A): assessment of regional wall motion abnormalities  
(B): visualization of endocardial surface structure within a beating heart  
(C): increase in patient radiation dose  
(D): both A and B

#### **Topic 6: Cardiac Tumors**

69. Echocardiography provides which of the following useful information on cardiac tumors?

(A): size, texture, and location  
(B): extension of tumors  
(C): hemodynamic effects on heart  
(D): all of the above

70. Cardiac tumors can be found incidentally such as myxoma or left atrial thrombus in a patient with mitral stenosis.

(A): True (B): False

71. \_\_\_\_\_ are the most common malignant primary cardiac tumors.

(A): Myxomas  
(B): Lipomas  
(C): Sarcomas with primary cardiac lymphomas  
(D): Fibromas

72. Metastatic cardiac tumors are 20 to 40 times more common than primary malignant ones with prevalence of \_\_\_\_\_% in post-mortem autopsies in malignant diseases.

- (A): 1
- (B): 6
- (C): 10
- (D): 18

73. Malignant renal and hepatic tumors can metastasize to heart via hematogenous spread from \_\_\_\_\_.

- (A): coronary artery
- (B): inferior vena cava
- (C): jugular vein
- (D): subclavian artery

74. Lymphatics and direct invasion from adjacent organs such as rectum and uterine cancers is another way of tumor spread to heart.

- (A): True
- (B): False

75. Which of the following is the most common site for Myxomas?

- (A): pulmonary artery
- (B): pericardium
- (C): bicuspid valve
- (D): left atrium

76. Definite treatment for myxoma is a total excision of the mass and follow up echocardiography to rule out recurrence is recommended.

- (A): True
- (B): False

77. Papillary fibroelastoma is a rare, primary benign cardiac tumor that is most frequently found in the \_\_\_\_\_.

- (A): pulmonary artery
- (B): pericardium
- (C): cardiac valves
- (D): descending aorta

78. Papillary fibroelastoma represents \_\_\_\_\_% of benign primary cardiac tumor in adults.

- (A): 7.9
- (B): 17
- (C): 28
- (D): 46

79. \_\_\_\_\_ is the most frequent cardiac tumor of childhood (about 60% of cardiac tumors) which is frequently found by fetal echocardiography.

- (A): Lipoma
- (B): Rhabdomyoma
- (C): Myxoma
- (D): none of the above

**Topic 7: Introductory Chapter: Practical Approach to the Use of Intracardiac Echocardiography in Invasive Electrophysiology Procedures**

80. Intracardiac echocardiography plays a major role in interventional procedures in a safe and efficient way by reducing the need for fluoroscopy.

- (A): True
- (B): False

81. \_\_\_\_\_ refers to the range of ultrasound intensities that can be displayed.

- (A): Mechanical index
- (B): Frequency
- (C): Dynamic range
- (D): Gain

82. Color Doppler and continuous wave Doppler could be used in evaluating pulmonary veins and valves.

- (A): True
- (B): False

**Topic 8: Speckle-Tracking Imaging, Principles and Clinical Applications: A Review for Clinical Cardiologists**

83. Which of the following are disadvantages of Speckle-tracking imaging (STI)?

- (A): Poor image quality and Temporal resolution
- (B): Myocardial curvature
- (C): Lower frame rates in tachycardia
- (D): all of the above

84. The regional myocardial deformation is a result of which of the following?

- (A): Active forces
- (B): Passive forces
- (C): Tissue elasticity
- (D): all of the above

85. A speckle is commonly defined as the spatial distribution of gray values in the ultrasound image.

- (A): True
- (B): False

**Topic 9: Cardiac Imaging in Hypertrophic Cardiomyopathy**

86. Hypertrophic cardiomyopathy (HCM) is the most common inherited cardiac disease presented with which of the following?

- (A): exercise intolerance
- (B): heart failure and cardiac arrhythmias
- (C): sudden cardiac death
- (D): all of the above

87. Which of the following are advantages of Echocardiography in evaluation of Hypertrophic cardiomyopathy?

- (A): Real time and Repeatable
- (B): Demonstrate dynamic change
- (C): Provide hemodynamic information
- (D): all of the above

88. Reduction in ventricular compliance and increased stiffness due to myocardial fibrosis coupled with a reduction of chamber volume and suction play a role in the pathophysiology of diastolic dysfunction in patients with HCM.

- (A): True
- (B): False

**Topic 10: The Role of Echocardiography in the Management of Patients Undergoing a Ventricular Assist Device Implantation and/or Transplantation**

89. \_\_\_\_\_ is a primary imaging modality in the assessment of cardiac structure and function in patients with advanced heart failure (HF).

- (A): Angiography
- (B): Echocardiography
- (C): Nuclear Medicine
- (D): Computed Tomography

90. A growing number of heart transplant candidates require long-term support by an \_\_\_\_\_ while they await cardiac transplantation.

- (A): kidney dialysis
- (B): radiation therapy
- (C): left ventricular assist device (LVAD)
- (D): none of the above

91. Right ventricular failure (RVF) remains a major cause of morbidity and mortality following LVAD surgery.

- (A): True
- (B): False

**Topic 11: Assessment of Right Ventricle by Echocardiogram**

92. The right ventricle in the normal heart is the most anteriorly situated cardiac chamber located immediately behind the \_\_\_\_\_ and anterior to left ventricle.

- (A): diaphragm
- (B): sternum
- (C): clavicle

(D): none of the above

93. The right ventricle is crescent shaped or pyramidal, and its cavity has which of the following components?

- (A): The muscular inlet comprising of the tricuspid valve, chordae tendineae, and three papillary muscles
- (B): Immobile apex with heavy coarse trabeculations
- (C): Smooth funnel-shaped myocardial outflow tract called infundibulum
- (D): all of the above

94. The right ventricle wall thickness can be measured by \_\_\_\_\_ from either the left parasternal window or subcostal window at the level of the tip of the anterior tricuspid leaflet.

- (A): A-mode
- (B): color Doppler
- (C): M-mode or 2D echocardiography
- (D): none of the above

**Topic 12: Role of Echocardiography in the Critically Ill Patients**

95. Transthoracic echocardiography (TTE) is a widely available, inexpensive tool, which is generally the initial imaging modality in the assessment of acute cardiac conditions.

- (A): True
- (B): False

96. Assessment of the \_\_\_\_\_ is an integral part of the medical management of hemodynamically unstable critically ill patients with heart failure.

- (A): aortic stenosis
- (B): left ventricular (LV) systolic function
- (C): kidney function
- (D): cardiac tumor

97. Cardiac output and stroke volume can be established by combining Doppler data derived from blood flow velocity through a conduit and the cross-sectional area of the conduit.

- (A): True
- (B): False

**Topic 13: Detection of Intracardiac and Intrapulmonary Shunts at Rest and During Exercise Using Saline Contrast Echocardiography**

98. Intracardiac shunts include which of the following?

- (A): patent foramen ovale (PFO)
- (B): atrial septal defects (ASD)
- (C): ventricular septal defects (VSD)
- (D): all of the above

99. \_\_\_\_\_ is a proven non-invasive technique for the detection of right-to-left shunts at rest.

- (A): Angioplasty
- (B): Electrocardiogram
- (C): Saline contrast echocardiography
- (D): none of the above

100. Technique and timing are important for a successful agitated saline contrast echocardiogram with a Valsalva maneuver.

- (A): True
- (B): False