Black Blood Imaging
Taylor Chung, MD

1. For black blood imaging using the time-of-flight effect with Spin Echo, it is best to set the TE to shortest possible time on your MR scanner.

   A. True
   B. False

Correct Answer: B

2. For black blood imaging using inversion recovery technique, it is best to have a single inversion pulse to null the blood as there is enough difference between the T₁ of myocardium and blood such that the myocardium will be seen well.

   A. True
   B. False

Correct Answer: B

References
1. Mulkern RV, Chung T. From signal to image: magnetic resonance imaging physics for cardiac MR. Pediatr Cardiol 2000; 21:5-17

Dynamic Bright Blood Imaging
Amol Pednekar

3. What is the main cause of the bright blood signal in cardiac gradient echo images?

   A. Small flip angle used in gradient echo
   B. Longer T₁ and T₂ of the blood with respect to myocardium
   C. Saturation of static tissue relative to moving blood
   D. Gradient echo uses non-selective RF pulses

Correct Answer: C
4. What is required for the good cine cardiac imaging?

A. Rapid data acquisition
B. Cardiac synchronization
C. Respiratory synchronization or compensation
D. All of the above

Correct Answer: D

References


3D SSFP
Raja Muthupillai, PhD

5. A typical coronary MR angiography protocol:

A. Acquires coronary artery anatomy as a series of 2D slices over multiple breathholds
B. Uses respiratory compensation methods such as respiratory navigators
C. Includes Magnetization preparation methods such as T2 preparation and fat suppression to maximize contrast
D. (a) and (b) only
E. Both (b) and (c)

Correct Answer: E

References

Assess Segmental Cardiac Anatomy
Shi Joon Yoo, MD

6. Among the following options, which is the most predictive of the atrial situs or arrangement?

   A. Aortic position relative to trachea
   B. Bronchial branching pattern
   C. Heart position
   D. Liver configuration
   E. Stomach position

Correct Answer: B

Reference

7. In a newborn infant with biliary atresia, which of the followings can be associated?

   A. Congenital heart block
   B. Intestinal malrotation
   C. Polysplenia
   D. None of the above
   E. All of the above

Correct Answer: E

Reference

8. Which of the following structures does not always characterize the morphologically right ventricle?

   A. Atrioventricular valve attachment to the septum
   B. Conus or infundibulum
   C. Moderator band
   D. Septomarginal trabecula

Correct Answer: B
Assess Ventricular Systolic and Diastolic Function
*Robert J. Fleck, MD*

9. **Choose the statement that best describes the typical MR picture of restrictive cardiomyopathy in children:**

A. Increased left ventricular volume with decreased ejection fraction and thickened pericardium
B. Increased left ventricular volume with normal ejection fraction and normal pericardium
C. Normal left ventricular volume with decreased ejection fraction and thickened pericardium
D. Normal left ventricular volume with normal ejection fraction and normal pericardium
E. Normal left ventricular volume with decreased ejection fraction and dilated left atrium

**Correct Answer: D**

References

Evaluate Valvular Stenosis or Regurgitation
*Sadaf T. Bhutta, MD, MBBS*

10. **The different parameters measured by flow analysis of a vessel include all EXCEPT:**

A. Mean velocity
B. Area
C. Peak velocity
D. Pressure gradient
E. Regurgitant fraction

**Correct Answer: D**

References

Perform Qp:Qs
Randolph K. Otto, MD

11. How is Qp best determined following bidirectional Glenn in the setting of single ventricle?

A. Phase contrast acquisition through the main pulmonary artery
B. Phase contrast acquisitions through the branch pulmonary arteries
C. Qp cannot be determined in this clinical setting
D. Phase contrast acquisitions through the pulmonary veins
E. Phase contrast acquisition of the superior vena cava.

Correct Answer: D

References

How to Set Up a Contrast-Enhanced MRA
Dianna M.E. Bardo, MD

12. All protocol parameters listed below are important for improving spatial and temporal resolution of contrast enhanced MRA EXCEPT?

A. Sensitivity encoding - parallel imaging techniques
B. Time-resolved imaging sequences
C. Peripheral ordered k-space filling
D. Administration of IV gadolinium
E. ECG and respiratory gating or navigator assisted MRA

Correct Answer: D

References
2. Liu X et al., Contrast-enhanced whole-heart coronary magnetic resonance angiography at 3.0T: comparison with steady-state free precession technique at 1.5T. Investigative Radiology • Volume 43, Number 9, September (2008) 663-668.
Evaluate the Systemic and Pulmonary Veins
Prakash M. Masand, MD

13. The protocol for imaging the pulmonary veins in pediatric age group, should include bright blood sequences like cine SSFP/spoiled GRE as well as a post contrast MR angiogram.

A. True
B. False

Correct Answer: A

Reference

14. What modality specific study protocol is essential to calculate QP/QS for shunt quantification in a patient with anomalous pulmonary venous connection?

A. CT Angiography with intravenous contrast
B. Cardiac MRI with morphology and without flow quantification
C. Cardiac MRI with morphology and flow quantification
D. MR Angiography with intravenous contrast

Correct Answer: C

Reference
1. Principles and Practice of Cardiac Magnetic Resonance in Congenital Heart Disease: Form, function and flow by Mark A. Fogel MD, 2010

Evaluate Pulmonary Blood Flow
J. A. Gordon Culham, MD

15. You are shown a plot of pulmonary artery flow from a child who has had surgery for pulmonary valve disease and known Pulmonary Regurgitation. (Fig 1)

The flow profile is best explained by

A. Pulmonary Stenosis
B. Pulmonary Hypertension
C. Bigeminy
D. Poor Gating
E. Velocity Encoding too low
F. Velocity Encoding too high

Correct Answer: E
Here is the flow plot with a higher Velocity Encoding (150 vs 100).

Evaluate the Neonate with Heterotaxy

Rajesh Krishnamurthy, MD

16. Typical MR indications for evaluating the neonate with heterotaxy include all the following except:

A. Screen for obstruction of anomalous pulmonary vein
B. Assess the status of branch pulmonary arteries prior to modified Blalock Taussig shunt placement
C. Enable treatment planning for single versus two ventricle repair
D. Assess presence, type and severity of aortic arch obstruction
E. Assess hepatic venous anatomy to plan Fontan palliation

Correct Answer: E
17. Which of the following adults with repaired TOF would meet criteria for intervention based on published guidelines?

A. Mild pulmonary insufficiency with exercise intolerance
B. Severe pulmonary insufficiency with mild tricuspid insufficiency
C. Severe pulmonary insufficiency with moderate aortic root dilation
D. RVOT obstruction, residual VSD with QP:QS 1.2 : 1
E. Severe pulmonary insufficiency with severe RV enlargement (asymptomatic)

Correct Answer: E

Reference
1. 2008 ACC/AHA Guidelines for the Management of Adults with CHD

18. Of the following recognized complications after arterial switch operation (ASO) for correcting D-TGA, which one is the most commonly observed?

A. Post-operative coronary artery thrombosis
B. Neoaortic valve insufficiency
C. Supravalvular neopulmonary stenosis
D. Neoaortic root dilation

Correct Answer: C

Reference

19. Which of the following are predictors for morbidity following Arterial Switch Operation performed for surgical repair of d-Transposition of the Great Arteries (TGA)?

A. Complex TGA
B. Ventricular Septal Defect
C. Coronary Anomalies
D. Left Sided Outflow Obstructive Lesions (e.g. ventricular outflow obstruction, aortic coarctation, aortic arch hypoplasia)
E. Moderate Pulmonary Arterial Stenosis
F. All of the above
Correct Answer: F

References

Pre-Glenn and Pre-Fontan
Shaine A. Morris, MD

20. You are performing a cardiac MRI/MRA on a patient with a patient with tricuspid atresia and pulmonary atresia who is status post a right-sided BT shunt. Your flow data is the following:

**Ascending aorta:**  
12 ml/beat  
SVC: 3 ml/beat  
IVC: 6 ml/beat  
RPA: 4 ml/beat  
LPA: 3 ml/beat

What is the best explanation of these findings?

A. Significant pulmonary overcirculation with Qp:Qs>2  
B. A large proportion of pulmonary blood flow is supplied by aortopulmonary collaterals  
C. Shunt narrowing  
D. Recoarctation of the aorta  
E. Partial anomalous return of the pulmonary veins

Correct answer: E

References
21. Following the Fontan operation, under what condition are pulmonary AVM’s most likely to form?

A. Pulmonary arterial hypertension  
B. Systemic atrioventricular valve regurgitation  
C. Asymmetric distribution of IVC blood flow  
D. Pulmonary emboli  
E. Protein losing enteropathy

Correct Answer: C

References

22. Which of the following congenital heart defects have an increased incidence of coronary artery anomalies?

A. Tetralogy of Fallot  
B. Truncus Arteriosus  
C. Pulmonary valve atresia with Intact IV Septum  
D. Transposition of Great Arteries (dTGA and lTGA)  
E. All of the above

Correct Answer: E

References
Vascular Rings and Slings
Prachi P. Agarwal, MD

23. Which of the following is NOT an MRI imaging feature of a double aortic arch with atretic left arch?

A. Diverticulum from proximal descending aorta
B. Extrinsic mass effect on the trachea
C. 4-artery sign
D. Hypointense cord (atretic arch) on T1W image

Correct Answer: D

Reference

Cardiac Tumors
Maryam Ghadimi-Mahani, MD

24. A 12-year-old boy with osteosarcoma has a right atrial mass seen on chest CT. Cardiac MRI is ordered to evaluate the right atrial mass. Which sequence is most helpful to differentiate between a tumor and a thrombus?

A. Cine SSFP sequence
B. T1 weighted TSE sequence before contrast administration
C. Phase contrast image
D. Late gadolinium enhancement image with TI time of 600 ms

Correct Answer: D

References