

磁振造影測驗

Magnetic Resonance Imaging

2015年8月30日星期日

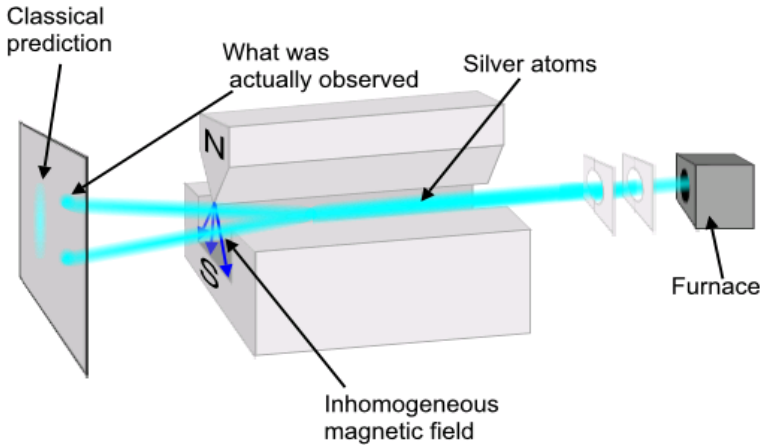
1. 除題意不清楚或是圖片有問題，禁止詢問與試題有關的問題。
2. 應答時禁止使用任何文件。
3. 請在電腦答案卡上圈選作答

項目	填寫內容：
姓名	您的中文與英文姓名
試題名稱	MRI Test
項目	不用填寫
科目	不用填寫
受試者識別代碼	您的准考證號碼 <u>1”000**”</u> 將您選定之數字的圓圈塗滿。
科目代碼	不用填寫
地點代碼	不用填寫
作答方式	本測驗共有90題問題。請使用1到90作答欄位。 請將測驗卷Q1的答案填入答案卷的解答番號1。Q2 = 解答番號2，Q3 = 解答番號3...Q90 = 解答番號90。

Q1. This is explanation about Lamor frequency. Which of the following is not correct?

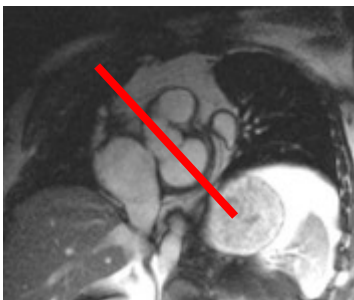
- 1) It is related to longitudinal magnetization
- 2) $F(\text{Lamor frequency}) = \gamma(\text{gyromagnetic ratio}) \times B_0(\text{strength of magnetic field})$
- 3) It is determined without outer magnetic field
- 4) Proportion to gyromagnetic ratio

Q2. Which is the correct about “Stern-Geralach experiment”?

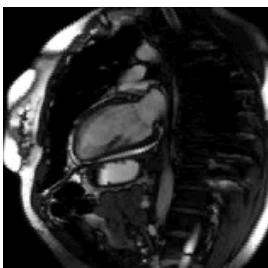


- 1) It is an important experiment in quantum mechanics on the deflection of particles
- 2) As a result of the experiment Zeeman effect was explained.
- 3) It is mainly about the separating the bulk water bounded proton.
- 4) This experiment proved that the nuclei of some atoms also have quantized angular momentum and spin.

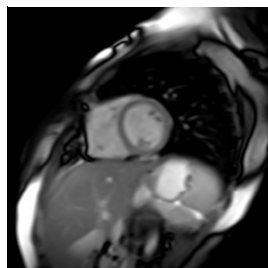
Q3. 3. This is heart image of MRI. If you do image plan like this image, which image appear?



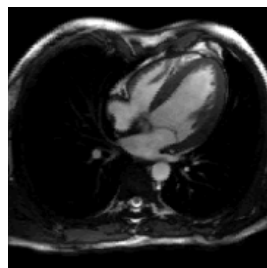
1)



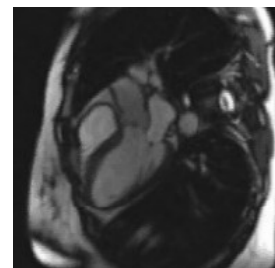
2)



3)



4)



Q4. Which is the parameter indicating the highest spatial resolution?

- 1) 256X256, 3mm slice thickness, 12cm FOV, 1 NEX

- 2) 256X256, 6mm slice thickness, 24cm FOV, 2 NEX
- 3) 512X512, 3mm slice thickness, 12cm FOV, 2 NEX
- 4) 128X128, 3mm slice thickness, 12cm FOV, 1 NEX

Q5. In case, signal average is increased by two times. How can SNR be changed?

- 1) 2times increase
- 2) 1/2 increase
- 3) 1/4 increase
- 4) $\sqrt{2}$ increase

Q6. Which is the correct about flip angle of the gradient echo sequence?

- 1) As the flip angle decreases transverse magnification increases and the signal intensity increases.
- 2) If the flip angle is too small most longitudinal signal is saturated and cannot be restored sufficiently.
- 3) Flip angle means a specific angle to maximize the signal intensity.
- 4) Tissue which has longer T1 value has smaller Ernst angle than doesn't have

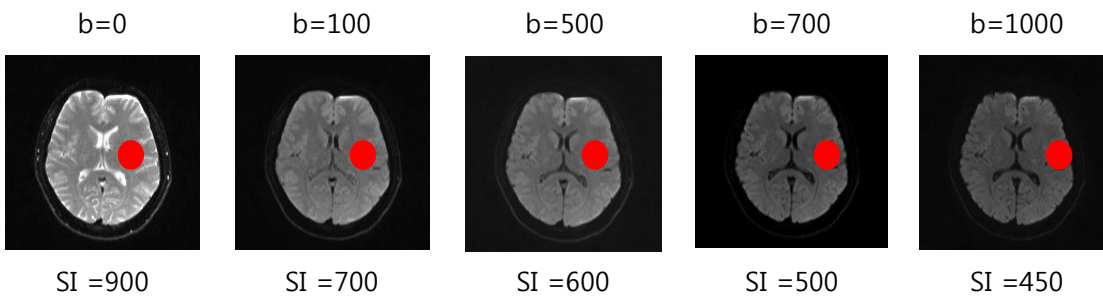
Q7. How to resolve venetian blind artifact in following TOF MRA image?

- 1) MOTSA(Multiple Overlapping Thin-Slab Acquisition)
- 2) TONE(Tilted Optimized Non-saturation Excitation)
- 3) Pre-saturation
- 4) Bipolar gradient

Q8. How does the data is acquired in phase contrast technique?

- 1) Adding the bipolar gradient.
- 2) Adding the diffusion gradient.
- 3) Adding the ramped RF.
- 4) Using subtraction

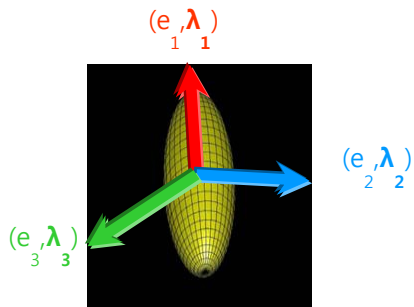
Q9. At b-value 0 to 1000, ADC value?



Ex) $\ln 1.5 = 0.41$, $\ln 2 = 0.69$

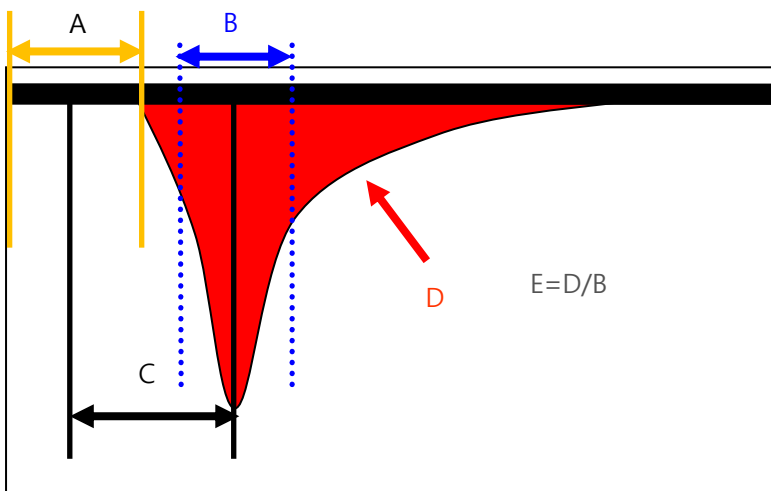
- 1) $0.41 \times 10^{-3} (\text{mm}^2/\text{sec})$
- 2) $0.41 (\text{mm}^2/\text{sec})$
- 3) $0.69 \times 10^{-3} (\text{mm}^2/\text{sec})$
- 4) $0.69 (\text{mm}^2/\text{sec})$

Q10. What is the minimum number of gradient direction to get DTI (diffusion tensor imaging)?



- 1) 1 direction 2) 3 direction 3) 5 direction 4) 6 direction

Q11. Which of the following is correct?



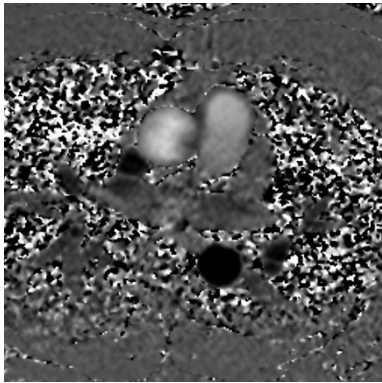
- 1) CBV(Cerebral Blood Volume): C 3) MTT(Mean Transit Time): A
 2) CBF(Cerebral Blood Flow): E 4) TTP(Time To Peak): D

Q12. What does arrow indicate?



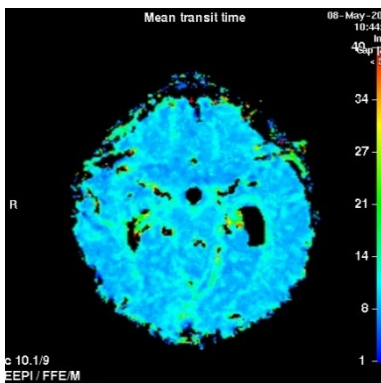
- 1) Anterior cruciate ligament
 2) posterior cruciate ligament
 3) Lateral meniscus
 4) Medial meniscus

Q13. Which is the correct about the following image?



- 1) Used by TOF sequence
- 2) Used by PC sequence
- 3) Used by Spin Echo sequence
- 4) Used by Gradient Echo sequence

Q14. Which of the following is correct?

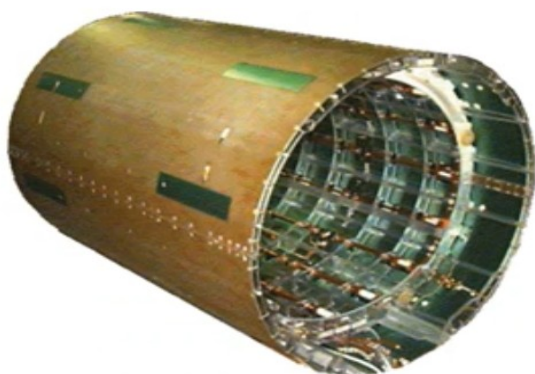


- 1) Used by spin echo sequence
- 2) Used by gradient echo sequence
- 3) Used by EPI sequence
- 4) Used by inversion recovery sequence

Q15. Which is correct to decrease SAR?

- 1) FOV 20% increase
- 2) Increase number of ETL
- 3) Increase TR
- 4) Increase flip angle

Q16. Which is the correct about the following image?



- 1) Surface coils which is placed adjacent to the imaged object collect signals.
- 2) It uses parallel technique therefore the scan time can be decreased.
- 3) It can only transit signals.
- 4) It covers large FOV.

Q17. Peak gradient strength 300mT/m, rise time 2msec, which slew rate is correct?

- 1) 600mTs/m 2) 600mTms/m 3) 150mT/m/ms 4) 150mT/m/s

Q18. Which of the following is correct?

- 1) In order not to get the patient hands hurt patient both hands must be hold at the same time
- 2) Pacemakers recently inserted are MRI safe and screening is not needed.
- 3) 5 Gauss line should be set outside of the MRI room.
- 4) More attention is needed in EPI sequence than the SE sequence in PNS(peripheral nerve stimulation)

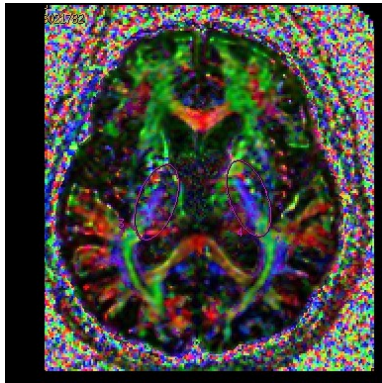
Q19. This is explanation about T2 and T2*. Which of following is not correct?

- 1) T2* depends on T2
- 2) T2 appear according to interaction between spins
- 3) T2 is more slow than T2*
- 4) T2 depends on T2*

Q20. Which is equal to the unit of tesla [T]?

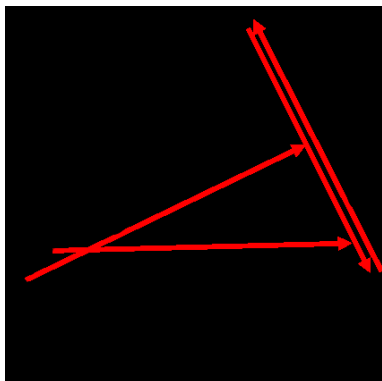
- 1) Wb(Weber) 2) J/Kg 3) Wb/m² 4) G(Gauss)

Q21. Which is not correct about the following image?



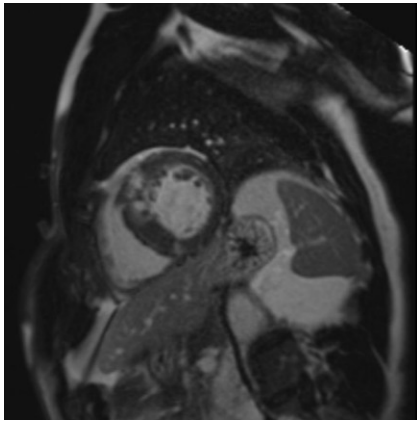
- 1) Tensor is a mathematic interpretation to quantify the geometric motions.
- 2) Neural tracts can be traced through tractography
- 3) The higher anisotropy get, FA value close 0, the lower anisotropy get, FA value close 1.
- 4) The anisotropy gets lower where fiber tracts are crossed.

Q22. The image is subtraction of vector. What is direction of $\vec{a} - \vec{b}$?



- 1) ①
- 2) ②
- 3) ③
- 4) ④

Q23. Which is the correct about the following image?

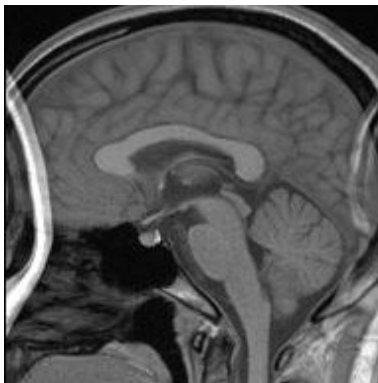


- 1) Short axis
- 2) Long axis
- 3) LVOT(left ventricular outflow tract)
- 4) RVOT(right ventricular outflow tract)

Q24. Matrix size 4X4, slice thickness 10mm, FOV 40mm. When FOV is changed from 40mm to 20mm, how to SNR?

- 1) Increased 50%.
- 2) Decreased 50%
- 3) Decreased 25%
- 4) Decreased 75%.

Q25. Which of the following is a correct about artifact on this image?



- 1) Magnetic susceptibility
- 2) Occur to exam region size small than FOV
- 3) Mainly occur to frequency-encoding direction
- 4) Prevent artifact for oversampling phase-encoding direction

Q26. What is the proper for Fast Spin-Echo technique?

- 1) Get several time echo signal in TR, no relation scan time
- 2) Higher fat signal than conventional spin-echo because of accelerate fat signal decay
- 3) Filled K-space last outline that control contrast echo of various echo
- 4) Reducing SAR because of used several times 180° RF in short during time.

Q27. There is MR spectroscopy explanation. What is the wrong thing?

- 1) Chemical shift main factor is shielding effect, same a nucleus different appear spectrum
- 2) Multi voxel spectrum method is long time but resolution excellent than single voxel spectrum.
- 3) In vivo analyze method metabolism in human body
- 4) Electron shielding effect is a molecule or atom adjacency orbital electrons that build up electron cloud and change local nuclear magnetic moment.

Q28. There is perfusion MRI. What is the wrong thing?

- 1) DSC perfusion technique is imaging technique that in arterial magnetic susceptibility of change for lesion contrast agent
- 2) Reducing imaging distortion and chemical shift used fat suppression
- 3) In MR general rCBV(regional cerebral flow), rCBF(regional cerebral blood volume), TTP(time to peak), MTT(mean transit time)
- 4) Represent blood flow direction when reconstruction color map to each image slice color mapping

Q29. Which of the following is a wrong explaining about contrast agent?

- 1) T1 contrast agent is T1 recovery time decreased that T1 effect increased
- 2) T2 contrast agent is T2 decay time decreased that T2 effect increased
- 3) A series of Gadolinium rare earth element of metal element that ligand and chelation for stability in human body
- 4) T1 contrast agent is paramagnetic material. T2 contrast agent is ferromagnetic material.

Q30. Ernst angle is _____?

- 1) increasing SNR in low flip angle.
- 2) the flip angle making maximum signal.
- 3) almost T2WI (flip angle>Ernst angle)
- 4) almost T1WI (flip angle>Ernst angle)

Q31. In the following EPI (echo planar image) description, what is the wrong thing?

- 1) Fat suppression is needed because of Chemical Shift Artifact in EPI.
- 2) Once RF use, half size of frequency step move upward and downward gradient and upward and downward gradient total is same.
- 3) High slew rate gradient is required.
- 4) Multi-shot EPI fill K-space used several time high frequency.

Q32. There is relaxation tissue explanation. What is true?

- 1) Malignancy tissue almost short T1 relaxation time.
- 2) Macro molecular of proton difficult signal detection because of decay T1 relaxation time and transverse magnetization too fast.
- 3) Likely CSF(central spinal Fluid) very short T1 relaxation time 100~200msec
- 4) Soft tissue T1 relaxation time longer than CSF(central spinal Fluid)

Q33. Which of the following is a wrong explaining about diffusion weighted imaging?

- 1) Diffusion motion has isotropy and anisotropy
- 2) Acute cerebral infarction diagnosis used isotropy
- 3) Nerve pathway fiber tracking used isotropy
- 4) The more b-value the more diffusion effect emphasized

Q34. Which is true of statement reducing magnetic susceptibility?

- 1) It is used of Long TE
- 2) It is used of narrowing of receive bandwidth
- 3) It is used of 3D more than 2D
- 4) It is used of gradient echo more than spin echo

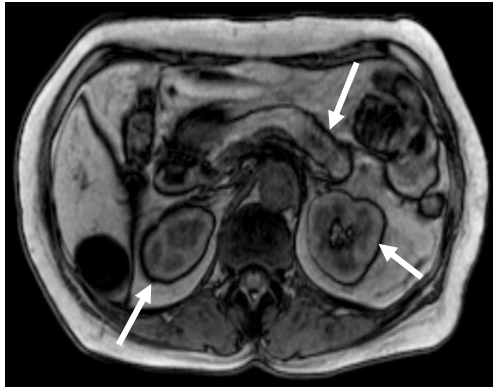
Q35. Which is true of statement parallel imaging?

- 1) Reduce of scan time caused phase-encoding number increase
- 2) Increase of SAR
- 3) It is used phase array coil
- 4) Reduction factor not relate SNR

Q36. What fat suppression technique is combined and used with frequency selective excitation and chemical shift between water proton and fat?

- 1) CHESS 2) Dixon 3) Chopper 4) STIR

Q37. What kind of artifacts is seen in this image (arrow) and what is this image?

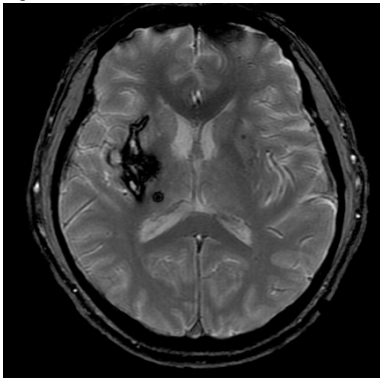


- 1) Motion Artifact, In phase
 2) Truncation Artifact, Out of phase
 3) Partial Volume Artifact, In phase
 4) Chemical Shift Artifact, Out of phase

Q38. Which is correct in Frequency encoding and phase encoding of the description?

- 1) Frequency encoding is changed in every TR.
 2) The increase in the number of frequency encoding, the spatial resolution increases.
 3) The frequency is used to find out the position of the magnetic resonance signal
 4) The size of phase encoding is always fixed.

Q39. What is this kind of effect increased?



- 1) Reduced TE
 2) High magnetic field is more effective
 3) FSE technique efficient more than GRE
 4) Thin slice thickness

Q40. Which of the following is a true explaining about wash-out effect?

- 1) Blood signal is darkened at T2 spin echo
 2) Blood signal is brightened at GE echo
 3) Blood signal is darkened at T1, brightened at T2
 4) Blood vessel signal is not related to slice thickness

Q41. What is the name of gradient, which is variable amplitude in TR?

- 1) Slice selective gradient 3) Phase encoding gradient
 2) Frequency encoding gradient 4) Phase and Frequency encoding gradient

Q42. What is the effect of reduced from 32 kHz to 16 kHz in receive bandwidth?

- 1) Same effect of SNR 3) 2 times more increase of SNR.
 2) 1.41 times more increase of SNR. 4) 2 times more decrease of SNR

Q43. Which is the statement of appropriate time for frequency encoding (read out)?

- 1) After 90° RF pulse
- 2) After 180° RF pulse
- 3) During appear echoes
- 4) After appear echoes

Q44. What is the concern about K-space of central line at fast spin echo?

- 1) Spatial resolution
- 2) ETL
- 3) TR
- 4) Effective TE

Q45. What is the not concern about CE-MRA?

- 1) Bolus track
- 2) Time resolved MRA
- 3) Test dose
- 4) Flow related enhancement

Q46. Which is true in Relaxation time?

- 1) If external magnetic field is increasing, T2 relaxation time is longer.
- 2) If external magnetic field is increasing, T1 relaxation time is longer.
- 3) If external magnetic field is increasing, T1 relaxation time is shorter.
- 4) The relaxation is that the spin will go back to the equilibrium in the excited state.

Q47. Which of the following is a wrong explaining about diffusion weighted at early acute brain ischemia?

- 1) Diffusion image early detect cellulite edema of acute brain ischemia
- 2) DWI of acute brain ischemia shows high signal intensity
- 3) It is not informative diagnosis on T2WI
- 4) If high signal is show on DWI, means of early acute brain ischemia

Q48. Which of the following explanation is not correct about magic angle artifact?

- 1) It is phenomenon which is occurred at specific angle in main magnetic field.
- 2) Ligament and tendon signals are emphasized in weighted and PD weight image.
- 3) Signal intensity of structure increase at magic angle.
- 4) It is able to be improved by boarding receive bandwidth

Q49. Which of the following is not correct about reduced artifact below shown image?



- 1) SE < FSE
- 2) SE < GRE
- 3) High bandwidth
- 4) 3T > 1.5T

Q50. Which of the following is a correct explanation about below images?



- 1) Trapezius muscle
- 2) Deltoid muscle
- 3) Supraspinatus muscle
- 4) Biceps muscle

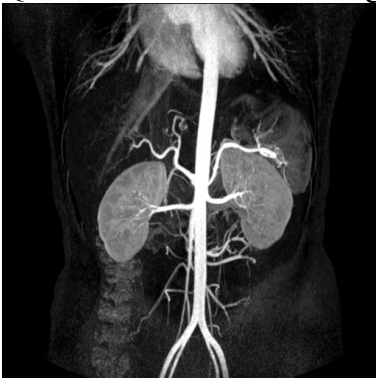
Q51. Slew rate is _____?

- 1) maximum amplitude / increasing time to maximum amplitude
- 2) maximum amplitude / area of maximum gradient
- 3) area of maximum gradient / increasing time to maximum amplitude
- 4) maximum amplitude / area of minimum gradient

Q52. Which of the following is not correct about shielding?

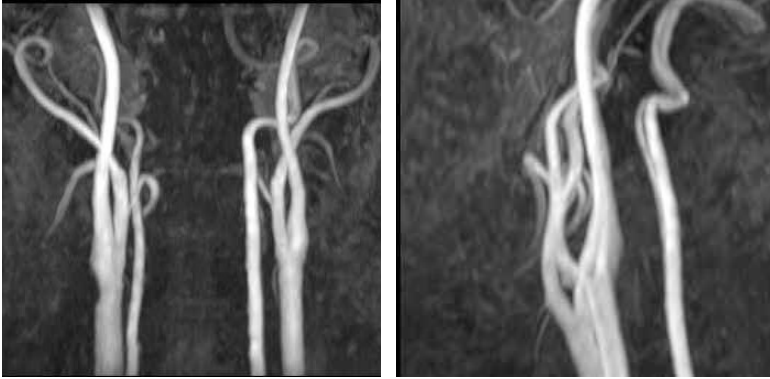
- 1) RF shielding should be attenuated under 20dB in all kind of electromagnetic wave
- 2) Copper and aluminum are used for high frequency shielding
- 3) Artifact can be observed in image on improper shielding
- 4) Iron plate is used for magnetic field shielding

Q53. Which of the following was used for this image?



- 1) 2D TOF
- 2) 2D PC
- 3) 3D PC
- 4) Contrast Enhanced MRA

Q54. Which of the following is NOT correct about these images?



- 1) Contrast media does not need to be used all the time.
- 2) Pre-saturation pulse is placed the below the slab.
- 3) 3 Dimensional volumetric data is acquired.
- 4) It is a carotid MRA.

Q55. Which type of cardiac gating is less sensitive to arrhythmia?

- 1) Respiratory gating
- 2) Prospective gating
- 3) Retrospective gating
- 4) None of above

Q56. Which of the following is correct about the equation of pixel size?

- 1) Pixel size= phase encoding number/matrix
- 2) Pixel size= FOV/matrix
- 3) Pixel size= frequency encoding number/matrix
- 4) Pixel size= matrix/FOV

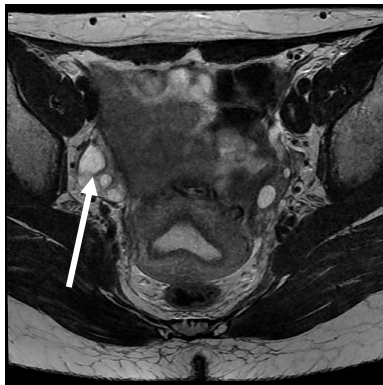
Q57. Which of the following is correct about the explanation when number of excitation (NEX) is increased?

- 1) Spatial resolution is changed.
- 2) Scan time is reduced.
- 3) Scan time is not changed.
- 4) SNR is increased.

Q58. Which is the metabolic material not to be detected long TE in brain MR spectroscopy?

- 1) ml(myoinositol)
- 2) NAA(N-acetyl aspartate)
- 3) Cho(Choline)
- 4) Lac(Lactate)

Q59. What structure does the arrow represent in the image?



- 1) Rectum
- 2) Uterus
- 3) Bladder
- 4) Ovary

Q60. If a matrix 256*128, FOV 24cm, slice thickness 3mm which is voxel volume?

- 1) 1.875 mm³
- 2) 0.9375 mm³
- 3) 3.57 mm³
- 4) 5.27 mm³

- Q61. The B1 magnetic field is produced by:
- 1) Gradient coil
 - 2) Shim coil
 - 3) Radio frequency coil
 - 4) Magnet coil
- Q62. Which direction is motion artifact toward?
- 1) Frequency encoding direction
 - 2) Phase encoding direction
 - 3) Slice selection direction
 - 4) Z axis direction
- Q63. Decreasing the receiver bandwidth:
- 1) Decreases the SNR
 - 2) Inverts the SNR
 - 3) Increases the SNR
 - 4) Has no effect on the SNR
- Q64. Pre saturation pulses are often used to:
- 1) Improve spatial resolution
 - 2) Reduce flow artifacts
 - 3) Reduce scan time
 - 4) Turn flowing blood bright
- Q65. Which is not correct explanation about partial echo technique?
- 1) To make an image by applying a fourier transform to the half of the K-space data
 - 2) Scan time is decreased by reducing the number of phase encoding step
 - 3) The acquired image used by a half scan resolution has the same resolution but the decreased SNR
 - 4) In the test for artifacts resulted from the motion, it is used in order to reduce the scan time
- Q66. Which is not correct about K-space?
- 1) The center of K-space has high frequency signal and surrounding space has low frequency signal
 - 2) Each data lines in the K-space have every information of the MR image
 - 3) Data error of an one point in K-space affect all MR image
 - 4) Data size of K-space change according to the size of FOV
- Q67. Which is not correct about the “Dielectric artifact”?
- 1) This artifact occurs as the magnetic field strength increased, the RF wavelength prolonged.
 - 2) This artifact occurs due to the standing wave RF interference.
 - 3) Signal loss occurs due to wavelength effects
 - 4) This artifact can be eliminated by an additional dielectric pad or cushion positioned on the abdomen of the patient
- Q68. Which is not correct about the “Motion artifact”?
- 1) This artifact occurs in the phase encoding direction.
 - 2) The motion artifact as a result of a pulsating aorta appears periodic.
 - 3) The flow ghost artifact can be improved by applying the spatial pre saturation technique on the outflow artery.
 - 4) Periodic motions can be compensated by using the triggering or gating technique.
- Q69. Which is not correct about the “Crosstalk artifact”?
- 1) This artifact occurs when the RF profile is narrower than the slice profile.
 - 2) This artifact occurs a result of this the adjacent slices overlap.
 - 3) This artifact can be eliminated by using the sequential acquisition technique.
 - 4) Tissue in that overlapping region results in increased signal intensity.

Q70. Which is not correct about the “Aliasing artifact”?

- 1) This artifact occurs when the selected field of view is smaller than the size of the imaged object.
- 2) This artifact occurs when the outside FOV and the inside FOV have the same position
- 3) This artifact only occurs in the frequency direction.
- 4) Aliasing in MRI can be compensated for by using the oversampling technique.

Q71. Which is not correct about the following image?



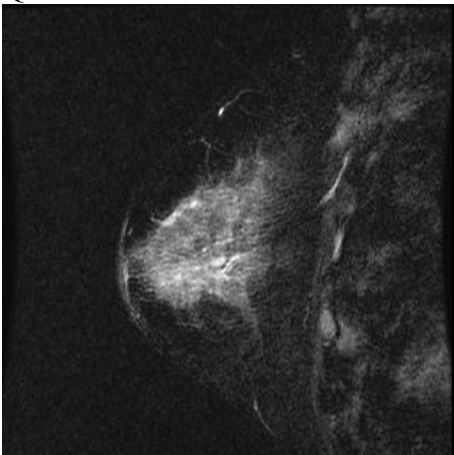
- 1) TR 600ms, TE 12ms, this image can be achieved
- 2) Decease artifact
- 3) This image can be archived after contrast media
- 4) Tumor can be seen at L3-4 level spinal canal

Q72. Which is not correct about the following image?



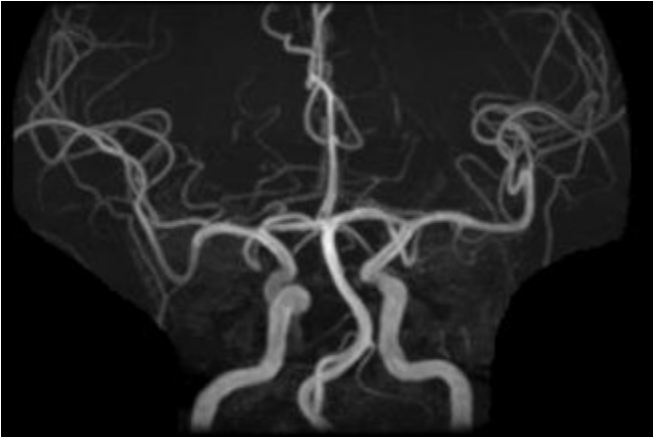
- 1) The shoulder arthrography image
- 2) The contrast media injects into the joint space
- 3) Within the joint space after contrast media injection it should scan as soon as possible before contrast media is absorbed
- 4) Intravascular contrast media is not injected

Q73. Which is not correct about the following image?



- 1) Fat suppression is essential
- 2) To keep the supine position
- 3) Doing the dynamic study
- 4) Shorter T2 relaxation time component means a high signal

Q74. Which of the following is correct?



- 1) MIP images using a Gd contrast media
- 2) The FSE sequence is better than SE sequence to reduce the acquisition time
- 3) For insert intracranial embolization coil patient to be safe CT is better than MRI
- 4) The saturation band is essential for image acquisition

Q75. Which is not correct about the following image?

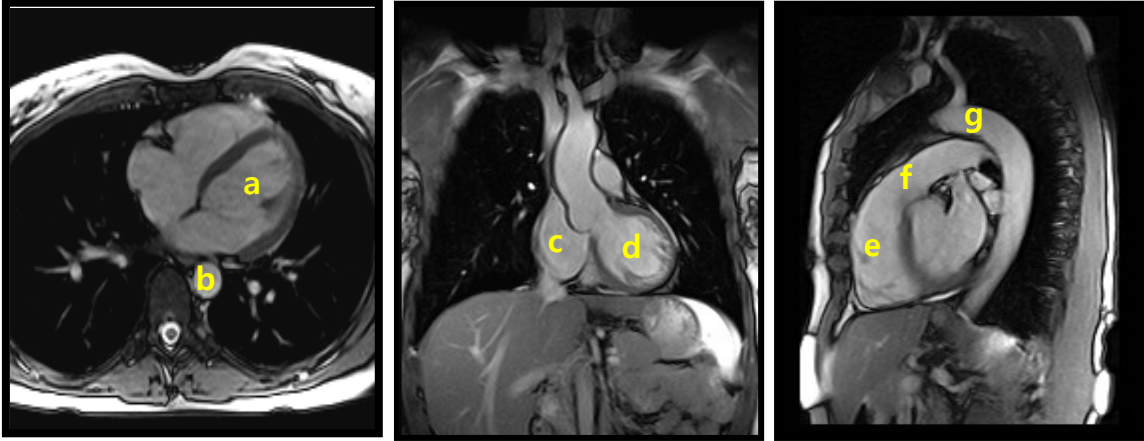


- 1) This image is acquired by using TR 400 TE 100.
- 2) Saturation band may improve the respiration artifact.
- 3) The reason fat signal gets strong as T1 effect is intense, because TR, TE values get lower.
- 4) Axial scans should be paroled to the disc space.

Q76. Which of the following is correct?

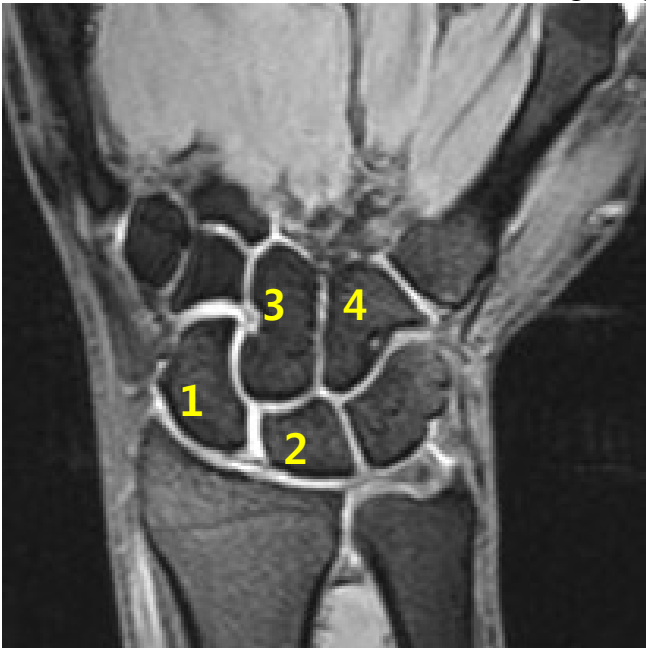
- 1) The T1 weighted image using TR 600ms, TE 10ms
- 2) Inversion recovery image using 150ms TI after 180° IR pulse
- 3) T2 weighted and fat suppression image using CHESS
- 4) The image using TR 9000ms, TI 2500ms

Q77. Which is not correct about the following image?

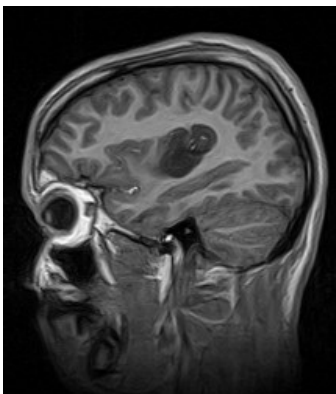


- 1) a, d is left ventricle of the heart
- 2) b, g is aorta
- 3) c, e is right ventricle
- 4) f is pulmonary artery

Q78. Which is not correct about the following image?



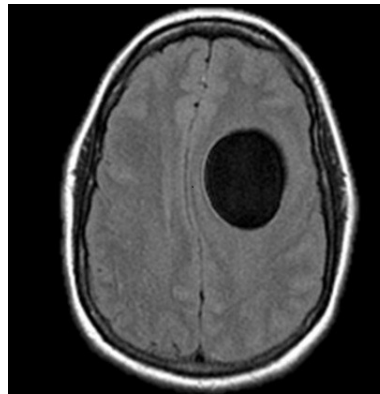
- 1) 1- Scaphoid
- 2) 2- Lunate
- 3) 3- Capitate
- 4) 4- Pisiform



①



②



③

Q79. Which is not correct about the following image?

- 1) ① is a T1-weighted images, TI value were applied to 150ms
- 2) ② is acquired by synchronizing the ECG
- 3) ③ is used FLAIR sequence. TI value were applied to 2500ms
- 4) ② is contrast enhanced image

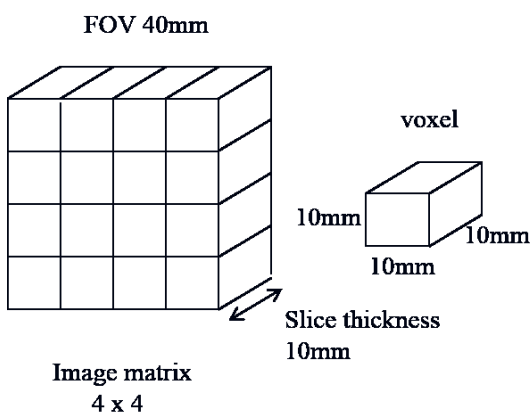
Q80. Which is not correct about the figure describing the MRA technique below?

- 1) By applying the off resonance RF pulse on the gradient echo sequence, signals of fat, CSF and blood do not change.
- 2) Small vessels appear by applying this technique on the 2D or 3D TOF images to reduce the signals of muscle or gray matter of brain.
- 3) It uses CHESS pulse.
- 4) The methemoglobin appears bright similar to the blood flow.

Q81. This is explanation about PC MRA (phase contrast MRA). Which of following is not correct?

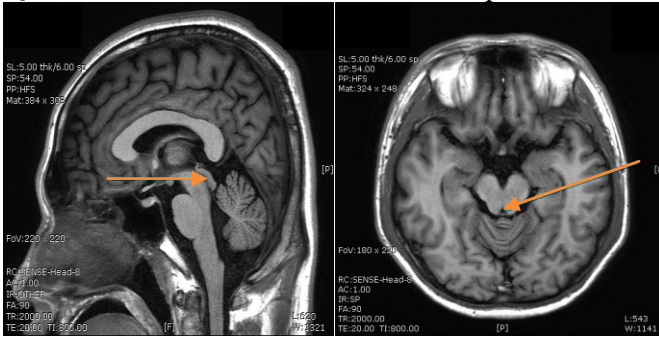
- 1) Two different images positive and negative polarity to the blood stream are acquired
- 2) This technique uses the phase shift.
- 3) According to the velocity of the bloodstream different phase encoding is applied
- 4) VENC (velocity encoding) is used to prevent the aliasing artifact which occurs when the phase shift gets over ± 90 degree.

Q82. In case, 4×4 Matrix, FOV $40\text{mm} \times 40\text{mm}$, Slice thickness 10mm . If the slice thickness reduced by half, how can SNR be changed?



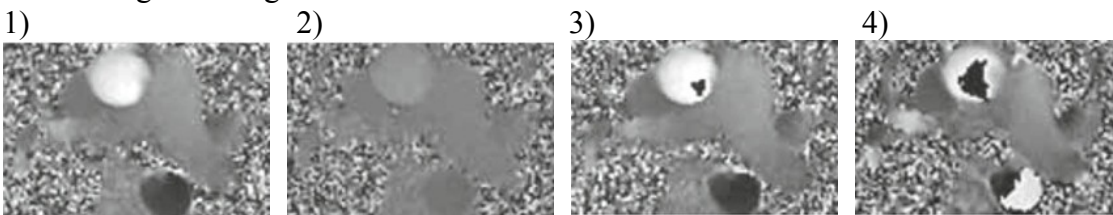
- 1) 1/2 decrease
- 2) 1/4 decrease
- 3) 1/2 decrease
- 4) 1/8 decrease

Q83. What structure does the arrow represent in the image?



- 1) Cerebral aqueduct
- 2) Fourth ventricle
- 3) Third ventricle
- 4) Lateral ventricles

Q84. This is the images of aorta of PC MRA. Which is the image of decreased SNR, because of setting much higher VENC than actual value?



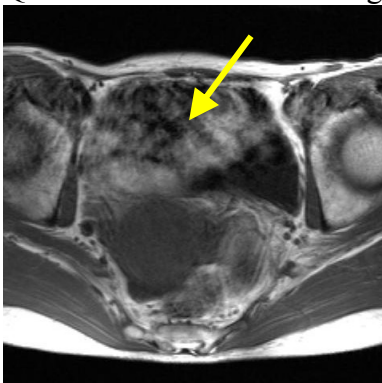
Q85. What is a metabolic material which is used in brain proton MRS as a neuronal marker?

- 1) NAA
- 2) Choline
- 3) Creative
- 4) Lactate

Q86. Which of the following is correct, when receiver bandwidth is reduced?

- 1) Decreased SNR, decreased noise
- 2) Increased SNR, decreased noise
- 3) Decreased SNR, increased noise
- 4) Increased SNR, increased noise

Q87. Which of the following is a method to reduce the arrowed artifact on the below pelvic image?



- 1) Use pre saturation technique.
- 2) Use large FOV.
- 3) Use inhibitor for bowel movement.
- 4) Use breath holding.

Q88. Which of the following is NOT correct about explanation of T1 relaxation?

- 1) When 900 applied, hydrogen absorbed energy and becomes high level.
- 2) Relaxation means that hydrogen comes back to the low energy level.
- 3) T1 relaxation ratio is the velocity of longitudinal recovery after RF pulse applied.
- 4) T2 relaxation time is slower than T1 relaxation time.

Q89. What structure does the arrow represent in the image?



- 1) Oculomotor nerve
- 2) Optic nerve
- 3) Vestibulocochlear nerve
- 4) Trigeminal nerve

Q90. What makes TR when use ECG triggering?

- 1) The number of phase encoding
- 2) Depends on user
- 3) The number of frequency encoding
- 4) Patient's heart rate