磁振造影測驗

Magnetic Resonance Imaging

2025 年 8 月 24 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

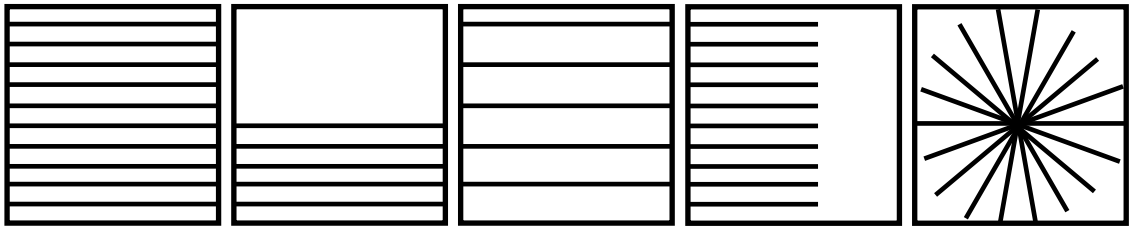
項目	**填寫內容**
姓名	您的中文與英文姓名
試題名稱	MRI Test
項目	不用填寫
科目	不用填寫
受試者識別代碼	您的准考證號碼後五碼：24XXX 將您選定之數字的圓圈塗滿。
科目代碼	不用填寫
地點代碼	不用填寫
作答方式	本測驗共有 90 題問題。請使用 1 到 90 作答欄位。 請將測驗卷 Q1 的答案填入答案卷的答案選擇 1。Q2 = 答案選擇 2，Q3 = 答案選擇 3…Q90 = 答案選擇 90。

1. What is the formula for the gyromagnetic ratio? Here, B is the magnetic flux density [T], f is the frequency [MHz], and the angular frequency is 2πf.
(A) 3f / B
(B) 6f / B
(C) 2πf / B
(D) 3πf / B
(E) 6πf / B

2. Which of the following is correct regarding the evaluation of uniformity in NEMA?
(A) The phantom temperature should be 21±4°C.
(B) The span is calculated from the average value of the measurement ROI.
(C) The TR should be set to at least three times the T1 value of the phantom.
(D) When the degree of nonuniformity is N, the uniformity is calculated as 1/N.
(E) NAAD (normalized absolute average deviation) is a method of evaluating uniformity from the absolute deviation of each pixel value within the ROI.

3. Which is the correct description for MR spectroscopy?
(A) The amount of metabolites is measured as peak height.
(B) Changing the TR changes the peak ratio.
(C) The PRESS method allows the TE to be set shorter than the STEAM method.
(D) If the magnetic field becomes inhomogeneous, the spectral width becomes narrower.
(E) Increasing the number of additions increases the spectral height.

4. The method of filling the k-space is shown below. Which is the correct description? In all k-spaces, the horizontal is the frequency and the vertical is the phase.
(A) (a) is more resistant to physical activity than (e).
(B) (d) has a shorter imaging time than (a).
(C) (b) has a smaller FOV in the phase direction than (a).
(D) (c) has a bigger FOV in the phase direction than (a).
(E) (e) is more suitable for compressed sensing reconstruction than (c).



(a) (b) (c) (d) (e)

5. Which of the following artifacts can be improved by widening the receiving bandwidth?

(A) Body movement
(B) Truncation
(C) Aliasing
(D) Chemical shift
(E) Magic angle

6. Which is the correct description for Parallel imaging?
(A) The specific absorption rate can be reduced.
(B) The frequency encoding signal collection is thinned out.
(C) Surface coils are more advantageous than volume coils.
(D) The SENSE method develops aliasing information in the k-space region.
(E) The SMASH method collects coil sensitivity maps in advance.

7. Which is the correct description for diffusion imaging?
(A) Diffusion-weighted images have a high signal in the abscess.
(B) The probability density distribution of water molecule diffusion is normally distributed in vivo.
(C) The FA (fractional anisotropy) value for perfect isotropic diffusion is 1.
(D) The ADC (apparent diffusion coefficient) value of water is lower than that of parenchymal organs.
(E) MPG (motion probing gradient) with 3 axes is sufficient for DTI (diffusion tensor imaging)

8. Which is the correct description regarding what happens when the static magnetic field weakens?
(A) The T1 value is shortened.
(B) The signal-to-noise ratio increases.
(C) The gyromagnetic ratio decreases.
(D) The wavelength of the radio wave becomes longer.
(E) The magnetic susceptibility artifact increases.

9. White smoke-like substance was observed in the MRI examination room. What could be the cause?
(A) Liquid helium evaporated.
(B) The static magnetic field strength of the device increased.
(C) The oxygen concentration in the examination room increased.
(D) Contrast agent spilled on the floor evaporated.
(E) The examination table heated up due to the switching of the gradient magnetic

field.

10. Which is the correct description?
    (A) Applying a gradient magnetic field manipulates the phase of the magnetic moment.
    (B) The lower the gradient magnetic field strength, the thinner the slice thickness can be imaged.
    (C) The wider the transmission BW (bandwidth), the thinner the slice thickness can be imaged.
    (D) The excitation RF pulse is a sink wave, and the shorter the left and right lobes, the closer the Fourier transform is to a rectangle.
    (E) Slice-selective gradient magnetic field (GZ) is not involved in phase dispersion

11. For 2D imaging, with the same FOV, if the matrix is changed from 256x256 to 512x512, the slice thickness is doubled, the receive bandwidth is doubled, and the parallel imaging factor is doubled, how many times will the SNR increase?
    * Ignore the geometry factor.
    (A) 0.18
    (B) 0.25
    (C) 0.35
    (D) 0.50
    (E) 0.71

12. Which is the correct description for the Apparent diffusion coefficient (ADC)?
    (A) The unit of ADC is [s / mm2].
    (B) The temperature of living tissue does not affect the ADC value.
    (C) The time (δ) and interval (Δ) of the motion detection gradient magnetic field do not affect the ADC value if they have the same b value.
    (D) ADC does not change depending on the b value to be imaged
    (E) ADC map is an image without the influence of T2.

13. For a 1.5T MRI using the fast SE-type FLAIR method with a TR of 10,000 ms and an effective TE of 100 ms, what is the most appropriate TI value?
    (A) 50ms.
    (B) 150ms.
    (C) 400ms.
    (D) 900ms.

(E) 2500ms.

14. During an MRI scan, quenching occurred, and the inward-opening door would not open. What is the appropriate response?
(A) Break the examination room's window glass.
(B) Request the dispatch of a fire truck.
(C) Press the emergency stop button on the device.
(D) Turn off the air conditioning in the examination room.
(E) Contact the device manufacturer.

15. Which is the correct description of the chemical shift?
(A) The chemical shift of 1H nuclei of water is about 3.5ppm smaller than that of fat.
(B) Chemical shift artifacts become stronger as the receiving bandwidth is increased.
(C) The second chemical shift artifact occurs in-phase.
(D) The second chemical shift artifact is due to a mixture of fat and water.
(E) Except for EPI, chemical shift artifacts appear in the phase encoding direction.

16. Select how many gauss 1T (Tesla) will be.
(A) 10
(B) 100
(C) 1,000
(D) 10,000
(E) 100,000

17. Which of the following is correct about gadolinium contrast agent (Gd-DTPA)?
(A) It is tissue-specific.
(B) It distributes in the intracellular fluid.
(C) Imaging after contrast administration uses T1-weighted images.
(D) The incidence of side effects is higher than that of iodine contrast agents.
(E) The higher the concentration, the higher the signal in T1-weighted images.

18. Select the correct text for the diffusion-weighted image by the EPI method.
(A) The unit of b value is sec / mm3.
(B) Set TE long.
(C) Single-shot EPI has less distortion than multi-shot EPI
(D) Frequency encoding is performed with a flip gradient magnetic field.

(E) Rectangular FOV is a way to maintain spatial resolution and reduce the number of phase encodings.

19. Choose the correct text for the MT pulse.
(A) TE extends
(B) SAR becomes high.
(C) Improved resolution characteristics.
(D) Lipids have a strong MT effect.
(E) On-resonance pulse.

20. Which of the following statements about MRI devices is incorrect?
(A) The Larmor frequency for a 0.5T MRI device is 21.3 MHz.
(B) The slice thickness increases when the gradient magnetic field strength is decreased.
(C) The static magnetic field direction of a permanent magnet device is often vertical.
(D) The noise during examination is caused by the vibration of the static magnetic field coil.
(E) The T1 value becomes longer as the magnetic field strength increases.

21. Choose the correct text about the Gradient Echo echo.
(A) Image contrast depends on flip angle.
(B) When using gadolinium contrast media, it is desirable to use the shortest value for TE.
(C) The higher the static magnetic field strength, the larger the interval between the opposed phase and the in-phase.
(D) When imaging a T1-weighted image, FA (flip angle), which maximizes the SNR, is desirable.
(E) In the balanced SSFP, the image contrast does not change when applying the dummy pulse.

22. Select the formula for the b value by the conventional spin echo method.
γ: gyromagnetic ratio, G: gradient magnetic field strength of MPG, δ: MPG application time, time between MPGs
(A) $b=\gamma 2G2\delta 2(\Delta-\delta)$
(B) $b=\gamma 2G2\delta 2(\Delta-3\delta)$
(C) $b=\gamma 2G2\delta 2\ (\Delta-\delta/3)$
(D) $b=\gamma G\delta\ (\Delta-\delta/3)$

(E) $b=\gamma G\delta(\Delta-\delta)$

23. If you use the Inversion recovery method, choose the correct formula for Mz at time TI.
(A) $Mz(TI)= M_0- M_0 \cdot \exp(-TI/ T1)$
(B) $Mz(TI)= M_0-2M_0 \cdot \exp(-TI/T1)$
(C) $Mz(TI)= M_0- 2M_0 \cdot \exp(-TI/ T1)+M_0 \cdot \exp(-TR/T1)$
(D) $Mz(TI)=M_0- M_0 \cdot \exp(-TI / T1)+2M_0 \cdot \exp(-TR/ T1)$
(E) $Mz(TI)=M_0- 2M_0 \cdot \exp(-TI/T1)+2M_0 \cdot \exp(-TR/ T1)$

24. Which is the correct description regarding the GRE method?
(A) A flow void occurs.
(B) Spoiling can be achieved by extending the TR.
(C) Proton density is enhanced at large flip angles.
(D) The effect of residual transverse magnetization cannot be ignored with the spoiled GRE method.
(E) With a 3.0T MRI, opposed phase images can be obtained when the TE is 2.25 msec.

25. Which is the Larmor frequency [MHz] of protons in a 1.5T MRI device?
(A) 42.6
(B) 56.8
(C) 63.9
(D) 85.2
(E) 127.8

26. Choose the correct text about the effects of the flow.
(A) The change of phase due to the flow affects only the phase dispersion.
(B) The phase shift of the fluid proceeds even if the application of the gradient magnetic field is stopped.
(C) Flow velocity correction is to reconverge the phase variance generated by the flow.
(D) The faster the flow, the higher the signal in the spin echo method.
(E) If the gradient magnetic field strength is doubled and the application time is tripled, the phase shift will be 6 times.

27. Select the correct description for the description of the fast (turbo) SE method compared to the SE method.

(A) Susceptible to magnetic susceptibility effect
(B) The blurring effect blurs the fine structure.
(C) Emphasize short tissues of T2 value by T2 filtering.
(D) MT effect and T2 filtering reduce fat signal.
(E) High contrast of soft tissue due to TE averaging and MT effect.

28. Select the correct one for the change in static magnetic field strength.
(A) The resonance frequency of protons is proportional to the strength of the static magnetic field.
(B) As the static magnetic field strength increases, the T1 value of white matter decreases.
(C) As the static magnetic field strength increases, the T2 value of gray matter increases.
(D) SNR is proportional to the square of the static magnetic field strength
(E) When the static magnetic field strength is doubled, the magnetic rotation ratio is also doubled.

29. Which is the correct description for quenching?
(A) Helium gas is toxic and flammable.
(B) Occurs rarely in permanent magnet MR devices.
(C) It is desirable that the door in the MR room opens inward.
(D) The first thing to check when quenching occurs is the oximeter.
(E) If a quench occurs, wait for the quench to completely subside before evacuating the patient.

30. Which of the following is considered a risk factor for nephrogenic systemic fibrosis (NSF)?
(A) Disruption of the blood-brain barrier.
(B) Significant decrease in GFR.
(C) Use of superparamagnetic iron oxide agents.
(D) Use of ionic iodine contrast agents.
(E) History of allergy to gadolinium contrast agents.

31. Which is the correct description for contrast media?
(A) All nonionic.
(B) Lactation should be avoided for 12 hours after administration.
(C) Superparamagnetic iron oxide preparation (SPIO) is contraindicated in subjects with iron overload.

(D) Gadolinium contrast media shortens only T1 values.
(E) Gadolinium contrast medium with a cyclic chelate structure accumulates in the dentate nucleus of the cerebellum after repeated use.

32. Select the correct text for the specific absorption rate.
(A) The unit is W / min.
(B) It is proportional to the strength of the static magnetic field.
(C) It is proportional to the square of the flip angle.
(D) It is proportional to the square of the duty cycle.
(E) Proportional to height.

33. Select the correct text on how to reduce B1 + rms.
(A) Shorten the echo time.
(B) Narrow the receive bandwidth.
(C) Shorten the repetition time.
(D) Reduce the pixel size.
(E) Reduce the number of echo trains.

34. A 3.0T magnet with a magnetic field uniformity of 0.3 ppm / 40 cm DSV (Diameter Spherical Volume) has a magnetic field strength difference of within (b) mT within an area of radius (a) cm from the magnetic field center. Which is the correct combination?
(A) (a) 20 (b) 0.009
(B) (a) 20 (b) 0.0003
(C) (a) 20 (b) 0.0009
(D) (a) 40 (b) 0.009
(E) (a) 40 (b) 0.0003

35. When performing an MR examination of a patient with a pacemaker, the heartbeat is continuously monitored with a biological monitor, but select the phenomenon that requires the most attention from the following.
(A) Pacing threshold
(B) Magnet mode
(C) Oversensing
(D) Unexpected nerve stimulation
(E) Pacemaker reset

36. Which of the following combinations of information obtained by MRI is correct?

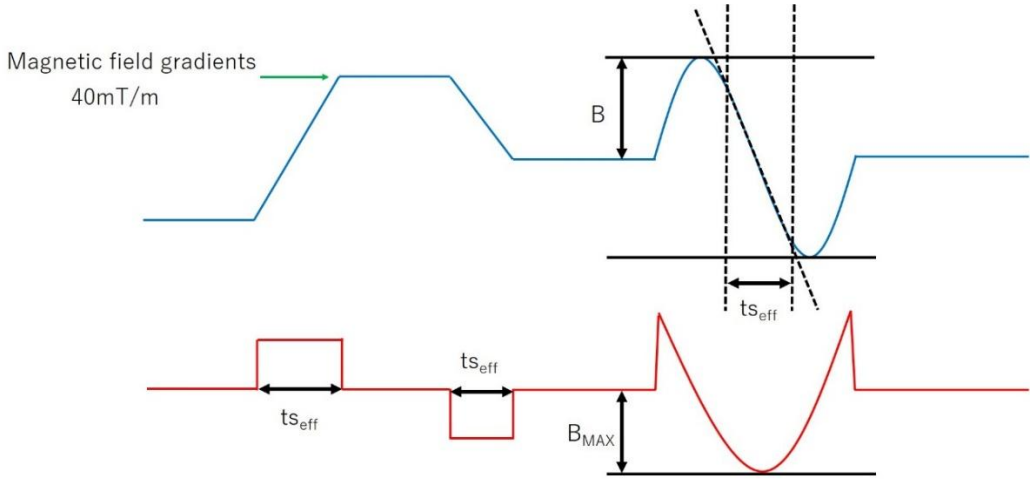
(A) Diffusion MRI - Tissue perfusion blood flow.
(B) Perfusion MRI - Water molecule diffusion.
(C) Functional MRI - Phospholipid metabolism.
(D) Susceptibility-weighted imaging – Microbleeds.
(E) Diffusion tensor imaging - Three-dimensional anatomy of blood vessels.

37. Which of the following symbol explanations is correct?

(a) (b) (c)

(A) (a): MR compliant (b): MR non-compliant (c): MR conditionally compliant
(B) (a): MR conditionally compliant (b): MR non-compliant (c): MR compliant
(C) (a): MR non-compliant (b): MR compliant (c): MR conditionally compliant
(D) (a): MR compliant(b): MR conditionally compliant (c): MR non-compliant
(E) (a): MR conditionally compliant (b): MR compliant (c): MR non-compliant

38. The figure shows the waveforms of the gradient magnetic field (blue line) and dB / dt (time change rate of magnetic field / red line). Which is the correct combination of dB / dt and slew rate when the gradient magnetic field strength is 40 mT / m and the execution stimulation time (rise time) is 0.1 ms? Calculate at a position 0.2m from the center of the magnetic field.
tseff is the execution stimulus duration.
(A) dB/dt: 200T/s, slew rate: 400T/m/s
(B) dB/dt: 80T/s, slew rate: 200T/m/s
(C) dB/dt: 40T/s, slew rate: 400T/m/s
(D) dB/dt: 80T/s, slew rate: 400T/m/s
(E) dB/dt: 80T/s, slew rate: 40T/m/s



39. Which of the following is correct regarding EPI?

(A) There is no T2 filtering effect.

(B) Phase errors in the phase direction are less likely to accumulate.

(C) Blurring due to blurring appears in the image.

(D) All collected echoes are gradient echoes.

(E) Chemical shift artifacts appear in the frequency direction.

40. Which is the correct description for artifacts?

(A) Aliasing artifacts can be improved by increasing the receiving bandwidth.

(B) Truncation artifacts can be improved by zero fill interpolation processing.

(C) Magic angle artifacts do not disappear even if the imaging section is changed.

(D) Crosstalk artifacts can be improved by reducing the slice interval.

(E) Chemical shift artifacts are a phenomenon in which fat shifts toward higher frequencies.

41. The MR image is shown below. Which is the correct way to deal with artifacts?

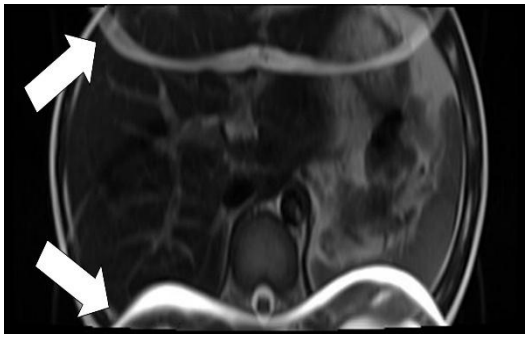
(A) Shorten the scan time.

(B) Use a high magnetic field device.

(C) Use a surface coil.

(D) Change the frequency encoding direction to L-R direction.

(E) Oversampling in the phase encoding direction.



42. The figure shows a T1-weighted sagittal image of the head. Which part is the pineal gland?

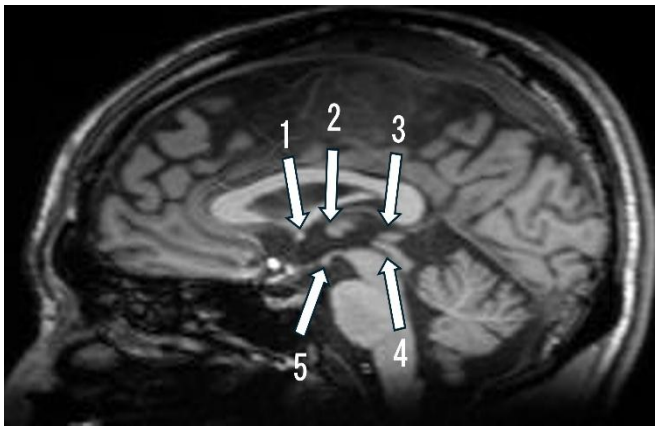
(A) 1

(B) 2

(C) 3

(D) 4

(E) 5



43. Which is the correct description for metal artifact countermeasures?

(A) Increase the slice thickness.

(B) Increase the time resolution.

(C) Increase the receiving bandwidth.

(D) Use spatial saturation pulse.

(E) Narrow the bandwidth of the transmit RF.

44. The figure is a gradient echo type T1-weighted image. Which is the correct sentence for the artifact indicated by the arrow and image in the figure?

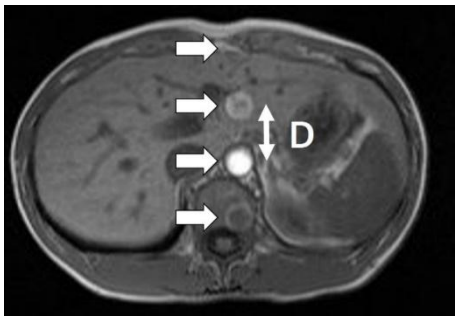
(A) The vertical direction on the image is the frequency direction.

(B) This image is T1WI with contrast media.

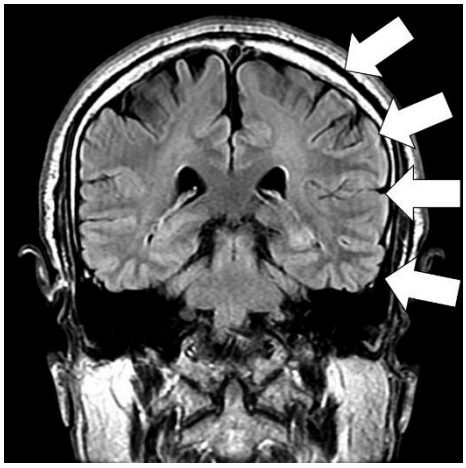
(C) The artifact interval (D) increases with higher heart rate.

(D) This phenomenon can be prevented by using a pre-saturation pulse.

(E) The interval between artifacts depends on the strength of the static magnetic field.



45. Which is the correct text for the striped artifacts shown by the arrows in the figure?
(A) It can be improved by increasing the receiving bandwidth.
(B) It can be improved by increasing the matrix size.
(C) It can be improved by using a high-pass filter.
(D) It can be improved by using Zero fill interpolation.
(E) It is a motion artifact.



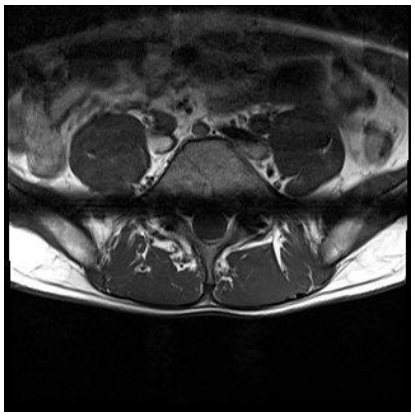
46. Find the number of pixels between ghosts of ghost artifacts due to pulsation for TR 150 ms, TE 2.2 ms, NEX 1, phase encoding 256, and heart rate 60 / min.
(A) 33 pixels
(B) 51 pixels
(C) 77 pixels
(D) 95 pixels
(E) 128 pixels

47. Which of the correct description regarding the Balanced SSFP method?
(A) Signal intensity depends on TE.
(B) Signal intensity depends on TR.
(C) FID, SE and STE signals are collected simultaneously.

(D) Signal intensity does not change even when Gd contrast agent is administered.
(E) Image contrast does not change depending on the shot interval.

48. Choose one that is related to the Paradoxical suppression artifact.
(A) RF
(B) Gradient magnetic field strength
(C) Receive bandwidth
(D) Opposed-phase
(E) in-phase

49. The figure is a T1-weighted image of the lumbar region obtained by multi-slice excitation. Select a possible description of the low signal band seen by the arrow (⇒).
(A) Due to spin-spin relaxation.
(B) The order of excited slices does not matter.
(C) Due to banding artifacts.
(D) The magnitude of the no-signal bandwidth affects the irradiation time of the RF pulse.
(E) This is due to the magnetic susceptibility.



50. What is the correct combination of artifacts and their countermeasures?
(A) Magnetic susceptibility artifacts ———————— Extending TE
(B) Ghost artifacts ————— Reducing the number of additions
(C) Chemical shift artifacts ———— Narrowing the receiving bandwidth
(D) Crosstalk artifacts ——— Use the interleaving method
(E) Truncation artifacts − Use the partial Fourier method

51. Which is the correct description for MRI examination of Gd-EOB DTPA?
(A) All are excreted in the biliary system.

(B) For adults, administer 0.2 mL / kg of this drug intravenously.
(C) Shows a higher degree of relaxation than Gd-DTPA in plasma.
(D) Hepatic hemangiomas are lesions that do not take up contrast media in the hepatobiliary phase.
(E) Focal nodular hyperplasia is a lesion that does not take up contrast medium in the hepatocellular phase.

52. What is the correct order of magnitude of phase dispersion due to the magnetic susceptibility effect?
(A) EPI>FSE>SE>GRE.
(B) EPI>GRE>SE>FSE.
(C) EPI>GRE>FSE>SE.
(D) GRE>EPI>SE>FSE.
(E) GRE>EPI>SE>FSE.

53. Which of the following is correct regarding MRI signal intensity?
(A) Myocardium has a high signal intensity on T1-weighted images.
(B) Fat has a low signal intensity on T1-weighted images.
(C) Bone cortex has a low signal intensity on T2-weighted images.
(D) Cerebrospinal fluid has a low signal intensity on T2-weighted images.
(E) Ligaments have a high signal intensity on proton density-weighted images.

54. Which is the correct description of fat suppression?
(A) The binominal pulse method uses the difference in longitudinal relaxation time.
(B) Use of fat suppression technology increases motion artifacts.
(C) In the opposed phase image of the Dixon method, the adipose tissue becomes low signal.
(D) The CHESS (chemical shift selective) method uses the frequency difference.
(E) The STIR (short TI inversion recovery) method selectively suppresses fat signals.

55. Which is the correct description for MRA (magnetic resonance angiography)?
(A) Longer TE for MRA is desirable.
(B) In the TOF (time of flight) method, a tissue with a long T1 value has a high signal.
(C) The FBI (fresh blood imaging) method uses the difference in signal intensity between systole and diastole.

(D) The TONE (tilted optimized non-saturating excitation) method reduces flip angle from the inflow side to the outflow side.
(E) In the PC (phase contrast) method, the larger the VENC (velocity encoding), the larger the plane area of the bipolar gradient.

56. Which is the correct description for the Inversion Recovery (IR) method?
(A) The STIR method has low specificity for fat.
(B) The STIR method has a better signal-to-noise ratio than his CHESS method.
(C) The FLAIR method is a method of suppressing signals other than water.
(D) The White matter attenuated IR method can suppress the gray matter signal of brain tissue.
(E) The Null point time can be calculated by multiplying the T1 value of the tissue to be suppressed by 0.693.

57. Which is the correct description of the features of multi-shot EPI for single-shot EPI (echo planar imaging)?
(A) The scan time is short.
(B) Distortion-induced artifacts are reduced.
(C) Increases susceptibility artifacts.
(D) Less likely to cause movement artifacts.
(E) Prone to N / 2 ghost.

58. Which is the correct description of fat suppression technology?
* CHESS: chemical shift selective saturation
(A) STIR has a better signal-to-noise ratio than the CHESS method.
(B) STIR has a shorter imaging time than the CHESS method.
(C) STIR is more susceptible to heating effects than the CHESS method.
(D) STIR is more susceptible to magnetic field non-uniformity than the CHESS method.
(E) STIR suppresses tissues with T1 values similar to fat.

59. Which of the following shortens the imaging time in the fast SE method?
(A) Lengthening the echo time
(B) Increasing the field of view size
(C) Lengthening the repetition time
(D) Increasing the number of refocusing pulses
(E) Increasing the number of phase encodings

60. Choose the correct text about the Gradient Echo (GRE).
(A) Ernst angle can be obtained from T1 value and TE.
(B) DESS (dual echo in the steady state) is strong against movement.
(C) The signal strength of the Balanced SSFP method is proportional to the T1 value / T2 value.
(D) Spoiled GRE can ignore the effect of residual transverse magnetization.
(E) When TR is extended, it becomes SSFP (steady-state free precession).

61. What is the method to reduce the saturation effect in TOF-MRA?
(A) Use contrast medium.
(B) Shorten the TR.
(C) Make the slab thicker.
(D) Increase the flip angle.
(E) Increase the number of additions.

62. Select the imaging time of the tertiary fast (turbo) spin echo method set to TR 2000 ms, TE 100 ms, ETL 64, NEX 1, Nx 256, Ny 224, Nz 32.
(A) 224sec
(B) 256sec
(C) 448sec
(D) 512sec
(E) 768sec

63.Select a method to reduce blurring in T2-weighted images using the single-shot high-speed spin echo method.
(A) Lengthen the TE.
(B) Lengthen the TR.
(C) Use parallel imaging.
(D) Use the oversampling method.
(E) Use pre-saturation pulses.

64. Which cranial nerve arises from the midbrain?
(A) Ophthalmic nerve
(B) Optic nerve
(C) Olfactory nerve
(D) Oculomotor nerve
(E) Glossopharyngeal nerve

65. Which of the following statements about SWI is correct?
(A) It is suitable for depicting the arterial system.
(B) It emphasizes the difference in phase difference due to magnetic susceptibility.
(C) Minimum intensity projection images can distinguish between calcification and hemorrhage.
(D) Flow velocity correction is not used to promote phase dispersion of blood flow.
(E) Maximum intensity projection is the most effective image processing method.

66. Which is the correct description for contrast-enhanced MRI of the brain?
(A) Pituitary adenomas show an earlier enhancing effect than normal pituitary glands.
(B) Meningiomas show a ring enhancement.
(C) Diffuse astrocytoma shows a strong enhancing effect.
(D) Contrast effect does not change 1 day after administration.
(E) The T1 shortening effect of contrast media depends on the dose.

67. Which is the correct description for an MRI scan of the heart?
(A) Takotsubo cardiomyopathy shows a strong delayed contrast effect.
(B) The most common site for cardiac sarcoidosis is the inner layer of the myocardium.
(C) Cardiac amyloidosis has a delayed contrast effect locally under the endocardium.
(D) If the range of the delayed contrast-enhanced myocardium is about 75%, it is judged that there is myocardial viability.
(E) The delayed contrast image of old myocardial infarction shows the contrast enhancement effect that spreads from the adventitia side to the intima side.

68. Which of the following is correct regarding the change in blood cell heme iron over time in cerebral intraparenchymal hematomas?
(A) Deoxyhemoglobin → oxyhemoglobin → methemoglobin → hemosiderin
(B) Deoxyhemoglobin → oxyhemoglobin → hemosiderin → methemoglobin
(C) Oxyhemoglobin → deoxyhemoglobin → methemoglobin → hemosiderin
(D) Oxyhemoglobin → deoxyhemoglobin → hemosiderin → methemoglobin
(E) Oxyhemoglobin → methemoglobin → deoxyhemoglobin → hemosiderin

69. Choose the correct text for MRI findings of the prostate.
(A) Prostate cancer shows hyperintensity on diffusion-weighted images.

(B) Normal marginal area shows high signal on T1-weighted image.
(C) The most common site for prostate cancer is the transition zone.
(D) The most common site for benign prostatic hyperplasia is the central region.
(E) After biopsy, T2-weighted image shows high intensity.

70. Please select the correct text for MRCP.
(A) Gallstones are hyperintense on T1 and T2-weighted images
(B) When imaging DMRCP, set the execution TE to a longer value.
(C) Rokitansli-Aschoff sinuses are malignant lesions.
(D) In the case of concentrated bile, he improves visualization by prolonging TE.
(E) Serous cysts of Intraductal papillary mucinous tumor show hyperintensity on diffusion-weighted images.

71. What is the disease that often show higher signals than the brain parenchyma in the diffusion-weighted image (b=1000 s/mm2) of the brain?
(A) Hippocampal atrophy
(B) Choroid plexus cyst
(C) Arachnoid cyst
(D) Cavernous hemangioma
(E) Chronic cerebral infarction

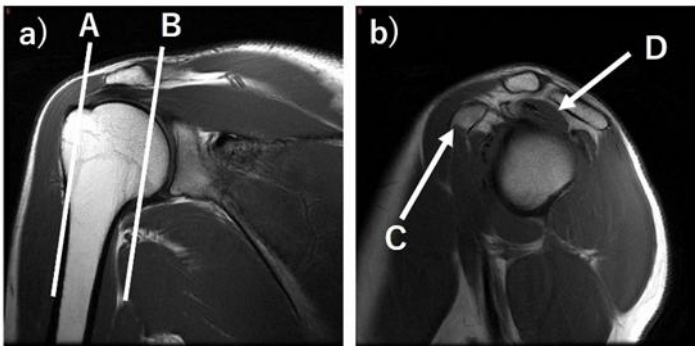
72. Select the correct sentence for MR examination of the pituitary gland.
(A) The diseased part is deeply stained earlier than the normal part by dynamic contrast examination.
(B) Rathke's cyst shows a signal intensity similar to that of cerebrospinal fluid in T1 and T2-enhanced images.
(C) Central diabetes insipidus is a disease in which the signal of the posterior pituitary gland on T1-weighted images is elevated.
(D) The size of the normal pituitary gland in adults is almost constant regardless of age and gender.
(E) Scanning of T1-weighted image with contrast media on sagittal plane, it is necessary to devise ways to avoid overlapping with flow artifacts.

73. Choose the correct description for female pelvic imaging.
(A) Adenomyosis has scattered high signals due to petechiae in T2- weighted images.
(B) Adenomyosis is an intramuscular lesion that shows low signal in T2- weighted image, and the boundary is unclear.

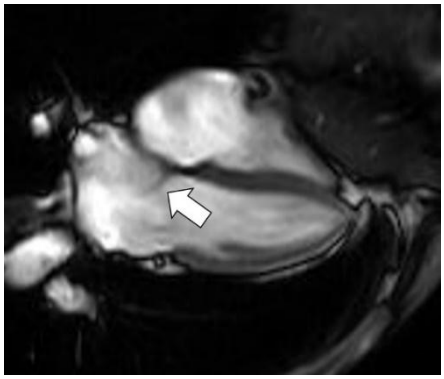
(C) In Endometriotic cyst, a chemical shift appears at the boundary between fat and non-fat components.
(D) Mature cystic teratomas contain blood components and therefore show hyperintensity on T1 and T2- weighted images.
(E) The low signal of T1-weighted images of endometriotic cysts is thought to be due to coagulated blood, decidual epithelium, and its necrotic material.

74. What is the purpose of administering saline after contrast administration in contrast-enhanced MRI?
(A) To prevent contrast extravasation.
(B) To label the contrast agent with sodium.
(C) To prevent anaphylaxis-like symptoms.
(D) To reduce dehydration associated with contrast administration.
(E) To prevent contrast agent from remaining in the veins.

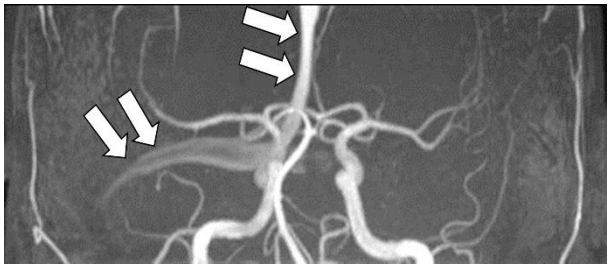
75. The figure is a T1-weighted image of the shoulder joint. Which is the correct description?
(A) The cross section of A is b.
(B) C is the clavicle.
(C) C is the acromion.
(D) D is the supraspinatus muscle.
(E) D is the infraspinatus muscle.



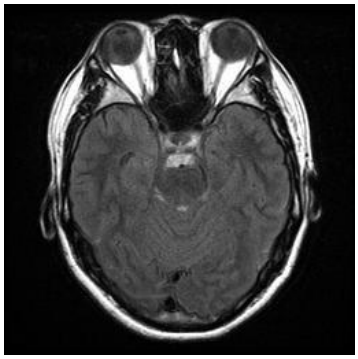
76. Which is the correct anatomy indicated by the arrow in the figure?
(A) Tricuspid valve
(B) Mitral valve
(C) Left ventricular outflow tract
(D) Aortic valve
(E) Pulmonary valve



77. This is a maximum intensity projection image of TOF-MRA. Which of the following is an effective method to reduce the vein signal indicated by the arrow?
(A) Reduce TE
(B) Increase frequency encoding
(C) Increase phase encoding
(D) Apply spatial saturation pulses to the head of the imaging range
(E) Apply spatial saturation pulses to the foot of the imaging range



78. What is the most likely cause of the contrast in this FLAIR image? The image is an axial section of the right ankle.
(A) Subarachnoid hemorrhage
(B) Incorrect TI and TR settings
(C) No Sat pulse in the foot space
(D) The IR pulse is thicker than the set slice thickness
(E) Artifacts due to body movement



79. Select the cranial nerve indicated by the arrow in the figure

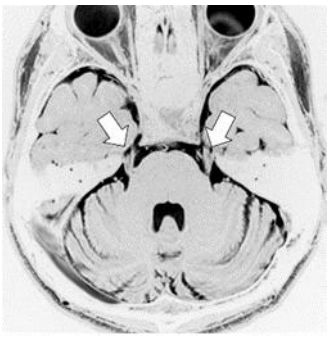
(A) Olfactory nerve

(B) Optic nerve

(C) Oculomotor nerve

(D) Trochlear nerve

(E) Abducens nerve



80. Select the anatomical name indicated by the arrow in the figure

The height of the lumbar spine is at the 3.4 level.

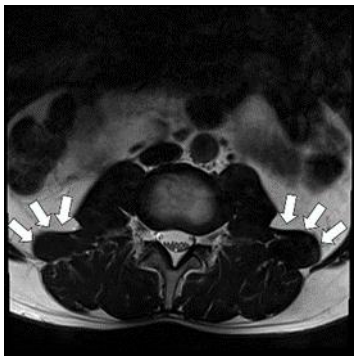
(A) Erector spinae muscles (multifidus muscles)

(B) Erector spinae muscle (longissimus muscle)

(C) Erector spinae muscles (lumbar iliocostalis)

(D) Quadratus lumborum

(E) Psoas major



81. Select the anatomical name indicated by the arrow in the figure

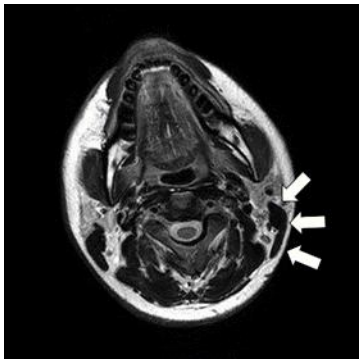
(A) Sternocleidomastoid muscle

(B) Masseter muscle

(C) Levator scapula

(D) Longus colli muscle

(E) Trapezius muscle



82. Which of the following is the most likely disease?

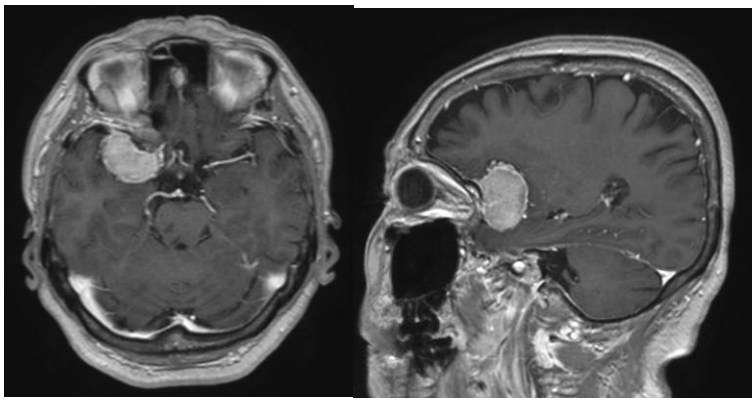
(A) Glioblastoma

(B) Astrocytoma

(C) Meningeal species

(D) Craniopharyngioma

(E) Malignant lymphoma



Post-contrast T1-weighted image (axial and sagittal)

83. Which of the following is the most likely disease?

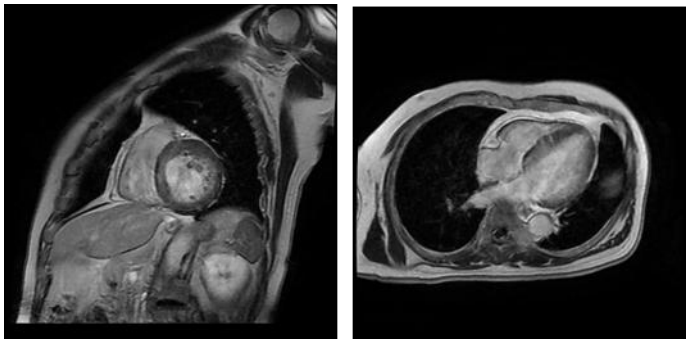
(A) Cardiac amyloidosis

(B) Acute myocardial infarction

(C) Takotsubo cardiomyopathy

(D) Hypertrophic cardiomyopathy

(E) Fabry disease



Delayed contrast images

(a)short axis (b) four chamber

84. Which of the following is the most likely disease?

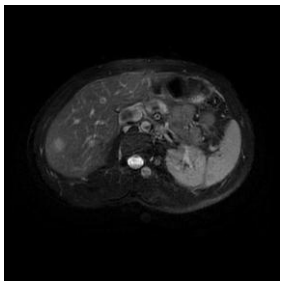
(A) Hepatic hemangioma

(B) Hepatocellular carcinoma

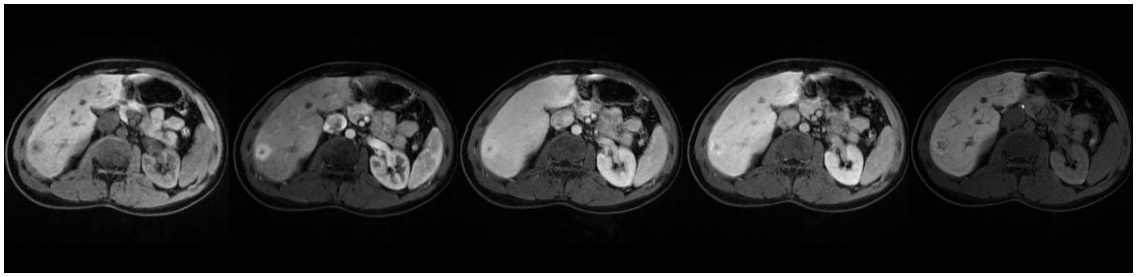
(C) focal nodular hyperplasia: FNH

(D) Non-alcoholic steatohepatitis: NASH

(E) Liver metastasis



Fat suppressed T2-weighted image



Dynamic images

(a)Pre injection (b) early (c) portal (d) equilibrium (e) hepatobiliary

85. Which of the following ligaments is most suspected of being damaged?

(A) Anterior cruciate ligament

(B) Posterior cruciate ligament

(C) Medial collateral ligament

(D) Fibular collateral ligament

(E) Patellar ligament

(a)T2-weighted image (b) T2*-weighted image

86. Which of the following is the most likely disease?

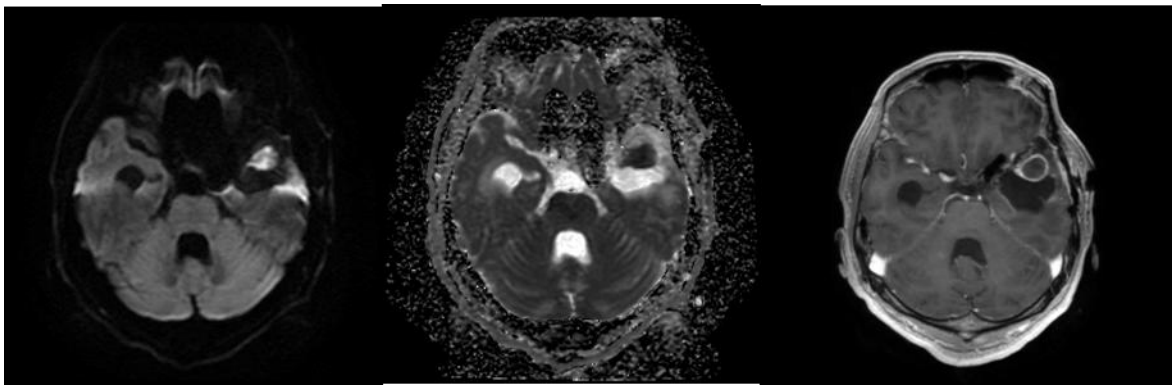
(A) Subcortical bleeding

(B) Acute cerebral infarction

(C) Brain abscess

(D) Cerebral arteriovenous malformation

(E) Metastatic brain tumor



(a)DWI (b) ADC (c) gadolinium enhanced T1-weighted

87. From the images, when is the closest time from the onset of left internal capsule hind leg lacunar infarction?

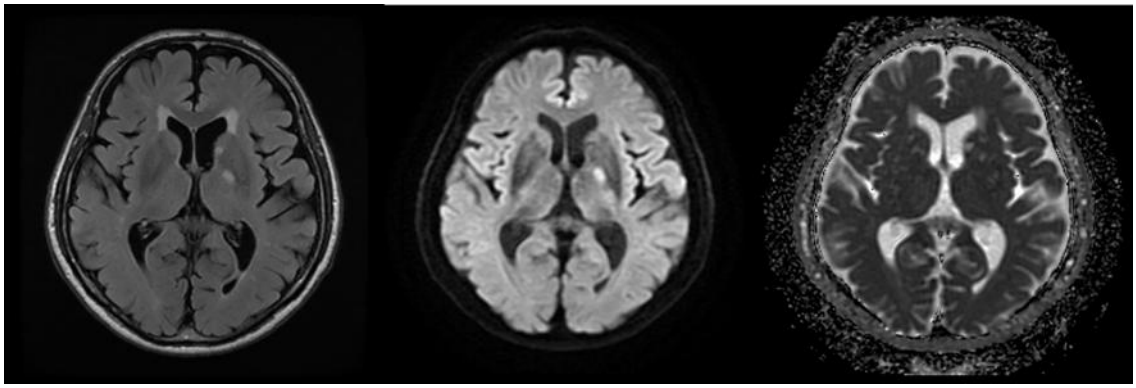
(A) Immediately after onset (about 30 minutes)

(B) Hyperacute phase (about 1 hour)

(C) Acute phase (about 1 day)

(D) Subacute phase (about 2 weeks)

(E) Chronic phase (about 1 month)



(a)FLAIR (b) DWI (c) ADC

88. Which is the most suspected disease from the image?

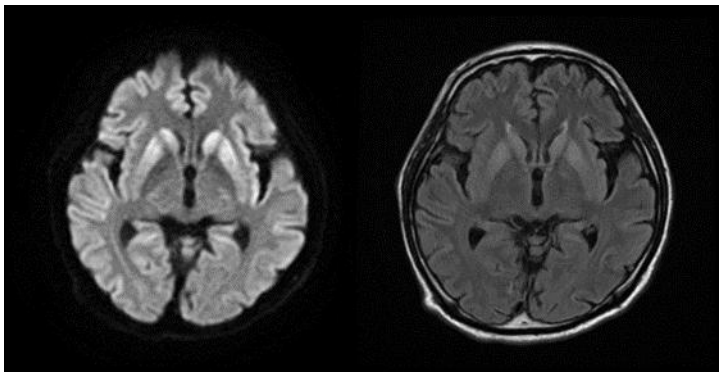
(A) Multiple sclerosis

(B) Acute cerebral infarction

(C) Creutzfeldt-Jakob disease

(D) Carbon monoxide poisoning

(E) Encephalitis



(a)DWI (b) FLAIR

89. Which is the most suspected disease from the image?

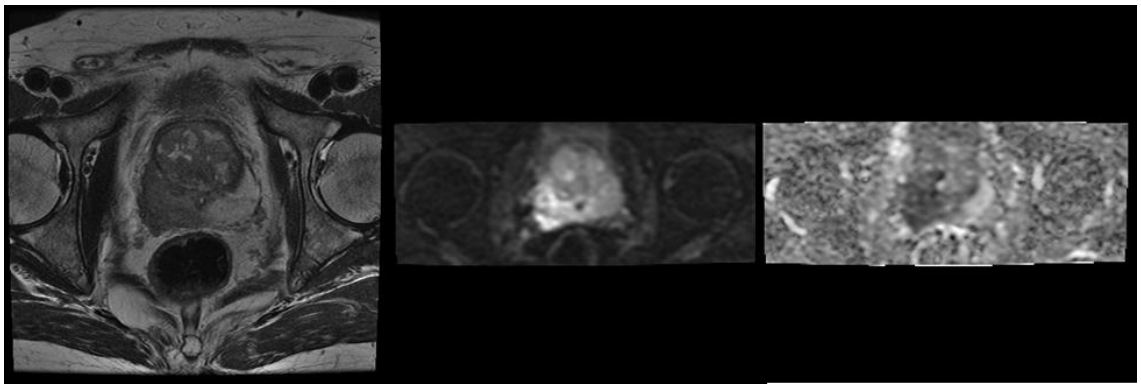
(A) Benign prostatic hyperplasia

(B) Prostate cancer

(C) Acute prostatitis

(D) Chronic prostatitis

(E) Rectal cancer Prostate infiltration



(a) T2-weighted image (b) DWI (c) ADC

90. Which is the most suspected disease from the image?

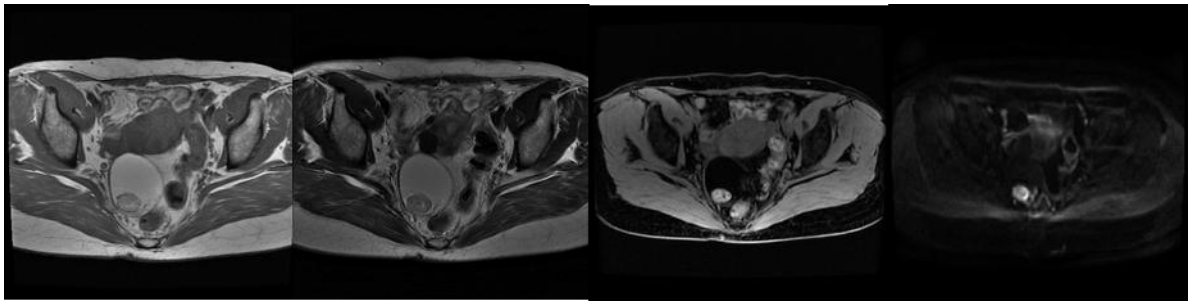
(A) Cervical cancer

(B) Endometrial cancer

(C) Chocolate cyst

(D) Ovarian cancer

(E) nature cystic teratoma



(a) T1-weighted image (b) T2-weighted image (c) DIXON water image (d) DWI