# 磁振造影測驗

# **Magnetic Resonance Imaging**

2023 年 8 月 27 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 23XXX<br>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 80 題問題。請使用 1 到 80 作答欄位。<br>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。 |

Q1 Which nuclide has a spin quantum number of 1/2?

    1. 1H

    2. 2H

    3. 17O

    4. 23Na

    5. 32P

Q2 Which is the correct description?

    1. $T2 \leq T2\ *$

    2. Vertical relaxation speed $\leq$ horizontal relaxation speed

    3. J-coupling is also called spin-spin bond.

    4. Longitudinal relaxation is also called spin-spin relaxation.

    5. Lateral relaxation is also called spin-spin lattice relaxation

Q3 Which is the correct description for MR spectroscopy?

    1. The amount of metabolite measures the peak height.

    2. Biotransforms with short T2 values have wider peak widths.

    3. The peak value (ppm) of metabolites depends on the strength of the static magnetic field.

    4. NAA (N-acetyl aspartete) increases as the number of nerve cells decreases.

    5. The PRESS (point resolved spectroscopy) method can shorten TE compared to the STEAM (stimulated echo acquisition mode) method.

Q4 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.

    1. (a) is more resistant to physical activity than (e).

    2. (d) has a shorter imaging time than (a).

    3. (b) has a smaller FOV in the phase direction than (a).

    4. (c) has a bigger FOV in the phase direction than (a).

    5. (e) is more suitable for compressed sensing reconstruction than (c).



(a)        (b)        (c)        (d)        (e)
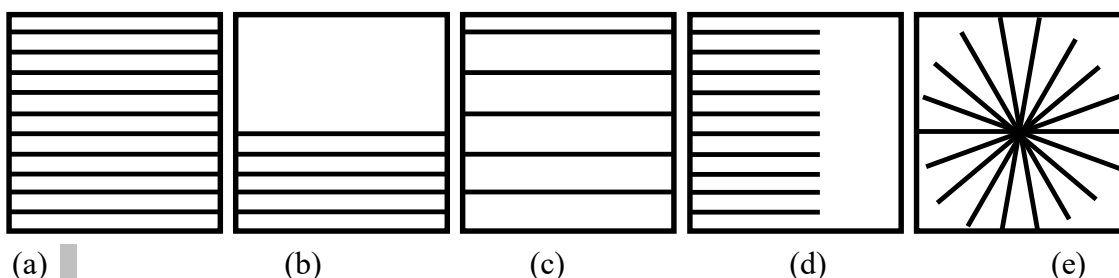
Q5 Which is the correct description when increasing the reception bandwidth?

    1. Sampling time is extended.

    2. Chemical shift artifacts are reduced.

    3. The number of slices that can be imaged decreases.

4. Motion artifacts become noticeable.

5. SNR (signal-to-noise ratio) improves.

Q6 Which is the correct description for Parallel imaging?

1. Specific absorption rate can be reduced.

2. Frequency encoded signal collection is thinned out.

3. Arrange multiple coils orthogonally to the thinning direction.

4. The larger the g-factor, the higher the signal-to-noise ratio.

5. The SMASH method collects coil sensitivity maps in advance.

Q7 Which is the correct description for diffusion imaging?

1. Diffusion-weighted images have a high signal in the abscess.

2. The probability density distribution of water molecule diffusion is normally distributed in vivo.

3. The FA (fractional anisotropy) value for perfect isotropic diffusion is 1.

4. The ADC (apparent diffusion coefficient) value of water is lower than that of parenchymal organs.

5. MPG (motion probing gradient) with 3 axes is sufficient for DTI (diffusion tensor imaging)

Q8 Which is the correct description of what happens when the static magnetic field becomes stronger?

1. The T1 value becomes longer.

2. The signal-to-noise ratio becomes smaller.

3. Gyromagnetic ratio increases.

4. The wavelength of the radio wave becomes longer.

5. The magnetic susceptibility artifact becomes small.

Q9 When a gradient magnetic field of 20 mT / m is applied to the X-axis, which is the magnetic field at a point 15 cm away from the center of the magnetic field in the X-axis direction and 15 cm in the Y-axis direction?

1. 1.5mT

2. 2.1mT

3.3mT

4.6mT

5. 15mT

Q10 Which is the correct description?

1. Applying a gradient magnetic field manipulates the phase of the magnetic moment.

2. The lower the gradient magnetic field strength, the thinner the slice thickness can be imaged.

3. The wider the transmission BW (bandwidth), the thinner the slice thickness can be imaged.

4. 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.

5. Slice-selective gradient magnetic field (GZ) is not involved in phase dispersion

Q11 What is the SNR when the parallel imaging factor is increased from 1 to 2, the receive bandwidth is doubled, and the slice thickness is doubled?

* Ignore the geometry factor.

1. 1/2
2. 1 / √2
3.1
4.1 × √2
5.2

Q12 Which is the correct description for the Apparent diffusion coefficient (ADC)?

1. The unit of ADC is [s / mm2].

2. The temperature of living tissue does not affect the ADC value.

3. 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.

4. ADC does not change depending on the b value to be imaged

5. ADC map is an image without the influence of T2

Q13 Which is the correct description of the Arterial spin labeling (ASL) method for assessing cerebral blood flow?

1. Set a long TE.

2. Intravascular signals may be high if there is delayed blood flow.

3. Post labeling delay (PLD) time must be set to the shortest.

4. The only way to apply RF pulses that signal blood flow is continuous waves.

5.CBF, CBV, MTT can be calculated

Q14 Which is the correct description for Proton MR spectroscopy (MRS)?

1. Hepatic encephalopathy lowers glutamine.

2. Cerebral ischemia lowers lactate.

3. The peak of citric acid decreases in prostate cancer.

4. Lipids increase in pathological conditions such as radiation necrosis.

5. Diffuse axonal injury increases his NAA (N-acetyl-aspartate).

Q15 Which is the correct description of the chemical shift?

1. The chemical shift of 1H nuclei of water is about 3.5ppm smaller than that of fat.

2. Chemical shift artifacts become stronger as the receiving bandwidth is increased.

3. The second chemical shift artifact occurs in-phase.

4. The second chemical shift artifact is due to a mixture of fat and water.

5. Except for EPI, chemical shift artifacts appear in the phase encoding direction.

Q16 Select how many gauss 1T (Tesla) will be.

1. 10

2. 100

3. 1,000

4. 10,000

5. 100,000

Q17 Select the correct text for the MRS peak.

1. The higher the proton density, the lower.

2. The shorter the lateral relaxation time, the wider the width.

3. The higher the shimming accuracy, the wider the width.

4. The higher the static magnetic field strength, the worse the separation accuracy.

5. The lower the chemical shift (ppm) value, the more it appears on the left side of the spectrum.

Q18 Select the correct text for the diffusion-weighted image by the EPI method.

1. The unit of b value is sec / mm$^3$.

2. Set TE long.

3. Single-shot EPI has less distortion than multi-shot EPI

4. Frequency encoding is performed with a flip gradient magnetic field.

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

Q19 Choose the correct text for the MT pulse.

1. TE extends

2. SAR becomes high.

3. Improved resolution characteristics.

4. Lipids have a strong MT effect.

5. On-resonance pulse.

Q20 Select the correct text for widening the receive bandwidth.

1. SNR is improved.

2. Short TE can be set.

3. The load on the gradient magnetic field system increases.

4. The magnetic susceptibility artifact increases.

5. Chemical shift artifacts increase.

Q21 Choose the correct text about the Gradient Echo echo.

1. Image contrast does not depend on flip angle

2. When using gadolinium contrast media, it is desirable to use the shortest value for TE.

3. The higher the static magnetic field strength, the larger the interval between the opposed phase and the in-phase.

4. When imaging a T1-weighted image, FA (flip angle), which maximizes the SNR, is desirable.

5. In balanced SSFP, the image contrast changes depending on the application method and number of dummy pulses.

Q22 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

1. $b=\gamma^2 G^2 \delta^2 (\Delta - \delta)$

2. $b=\gamma^2 G^2 \delta^2 (\Delta - 3\delta)$

3. $b=\gamma^2 G^2 \delta^2 (\Delta - \delta/3)$

4. $b=\gamma G \delta (\Delta - \delta/3)$

5. $b=\gamma G \delta (\Delta - \delta)$

Q23 If you use the Inversion recovery method, choose the correct formula for Mz at time TI.

1. $Mz(TI) = M_0 - M_0 \cdot \exp(-TI/T1)$

2. $Mz(TI) = M_0 - 2M_0 \cdot \exp(-TI/T1)$

3. $Mz(TI) = M_0 - 2M_0 \cdot \exp(-TI/T1) + M_0 \cdot \exp(-TR/T1)$

4. $Mz(TI) = M_0 - M_0 \cdot \exp(-TI/T1) + 2M_0 \cdot \exp(-TR/T1)$

5. $Mz(TI) = M_0 - 2M_0 \cdot \exp(-TI/T1) + 2M_0 \cdot \exp(-TR/T1)$

Q24 Which is the correct formula for the Larmor equation?

$\omega_0$: angular frequency, γ: gyromagnetic ratio, $B_0$: static magnetic field strength

1. $\omega_0 = \gamma^2 B_0$

2. $\omega_0 = \gamma B_0^2$

3. $\omega_0 = \gamma B_0$

4. $\omega_0^2 = \gamma B_0$

5. $\omega_0 = \gamma^2 B_0^2$

Q25 If each of the values 1 to 5 below increases, select the one that increases the strength of the MR signal.

1. Sample temperature

2. Sample consistency

3. Vertical relaxation time

4. Lateral relaxation time

5. Distance between sample and receiving coil

Q26 Choose the correct text about the effects of the flow.

1. The change of phase due to the flow affects only the phase dispersion.

2. The phase shift of the fluid proceeds even if the application of the gradient magnetic field is stopped.

3. Flow velocity correction is to reconverge the phase variance generated by the flow.

4. The faster the flow, the higher the signal in the spin echo method.

5. If the gradient magnetic field strength is doubled and the application time is tripled, the phase shift will be 6 times.

Q27 Select the correct description for the description of the fast (turbo) SE method compared to the SE method.

1. Susceptible to magnetic susceptibility effect

2. The blurring effect blurs the fine structure.

3. Emphasize short tissues of T2 value by T2 filtering.

4. MT effect and T2 filtering reduce fat signal.

5. High contrast of soft tissue due to TE averaging and MT effect.

Q28 Select the correct one for the change in static magnetic field strength.

1. The resonance frequency of protons is proportional to the strength of the static magnetic field.

2. As the static magnetic field strength increases, the T1 value of white matter decreases.

3. As the static magnetic field strength increases, the T2 value of gray matter increases.

4. SNR is proportional to the square of the static magnetic field strength

5. When the static magnetic field strength is doubled, the magnetic rotation ratio is also doubled.

Q29 Which is the correct description for quenching?

1. Helium gas is toxic and flammable.

2. Occurs rarely in permanent magnet MR devices.

3. It is desirable that the door in the MR room opens inward.

4. The first thing to check when quenching occurs is the oximeter.

5. If a quench occurs, wait for the quench to completely subside before evacuating the patient.

Q30 Which is the correct description for a conditional MRI-compatible pacemaker?

1. Tachycardia occurs when oversensing occurs.

2. A biological monitor must be worn during MRI examinations.

3. Set the pacemaker mode longer than patient's pulse.

4. There are no restrictions on the position to be scanned.

5. If only the generator is replaced with his MRI compatible model, it will be conditional MRI compatible.

Q31 Which is the correct description for contrast media?
　　1. All nonionic.
　　2. Lactation should be avoided for 12 hours after administration.
　　3. Superparamagnetic iron oxide preparation (SPIO) is contraindicated in subjects with iron overload.
　　4. Gadolinium contrast media shortens only T1 values.
　　5. Gadolinium contrast medium with a cyclic chelate structure accumulates in the dentate nucleus of the cerebellum after repeated use.

Q32 Select the correct text for the specific absorption rate.
　　1. The unit is W / min.
　　2. It is proportional to the strength of the static magnetic field.
　　3. It is proportional to the square of the flip angle.
　　4. It is proportional to the square of the duty cycle.
　　5. Proportional to height.

Q33 Select the correct text on how to reduce $B1 + rms$.
　　1. Shorten the echo time.
　　2. Narrow the receive bandwidth.
　　3. Shorten the repetition time.
　　4. Reduce the pixel size.
　　5. Reduce the number of echo trains.

Q34 What is the upper limit of whole-body SAR in normal operation mode when using a volume transmission coil?
　　1. 2.0 W / kg
　　2. 3.2 W / kg
　　3. 4.0 W / kg
　　4. 10.0 W / kg
　　5. 20.0 W / kg

Q35 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.
　　1. Pacing threshold
　　2. Magnet mode
　　3. Oversensing

4. Unexpected nerve stimulation

5. Pacemaker reset

Q36 This is a B1 + RMS FPO limit applicable to circular MR systems. What is X?

Parameter; FPO-B

Static magnetic field strength; 1.5T

Adaptive coil; RF transmission coil for whole body and RF transmission coil for head (quadracha transmission only)

(| dB / dt | PEAK) FPO 100T / S or less

(| dB / dt | RMS) FPO 56T / S or less

B1 + PEAK; 30μT or less

B1 + RMS; X μT or less

1. 8

2. 16

3. 24

4. 32

5. 40

Q37 Which of the following symbol explanations is correct?

(A)                          (B)                          (C)



1. (A) shows MR conformance

2. (B) shows the controlled area

3. (A) shows that it may affect the captured image.

4. (C) prohibits access to patients with active implantable cardiac devices

5. All of (A), (B) and (C) must be posted at the entrance of the MRI room.

Q38 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. $ts_{eff}$ is the execution stimulus duration.

1. dB/dt: 200T/s, slew rate: 400T/m/s

2. dB/dt: 80T/s, slew rate: 200T/m/s

3. dB/dt: 40T/s, slew rate: 400T/m/s

4. dB/dt: 80T/s, slew rate: 400T/m/s

5. dB/dt: 80T/s, slew rate: 40T/m/s



Magnetic field gradients
40mT/m

B

$ts_{eff}$

$ts_{eff}$

$ts_{eff}$

$B_{MAX}$
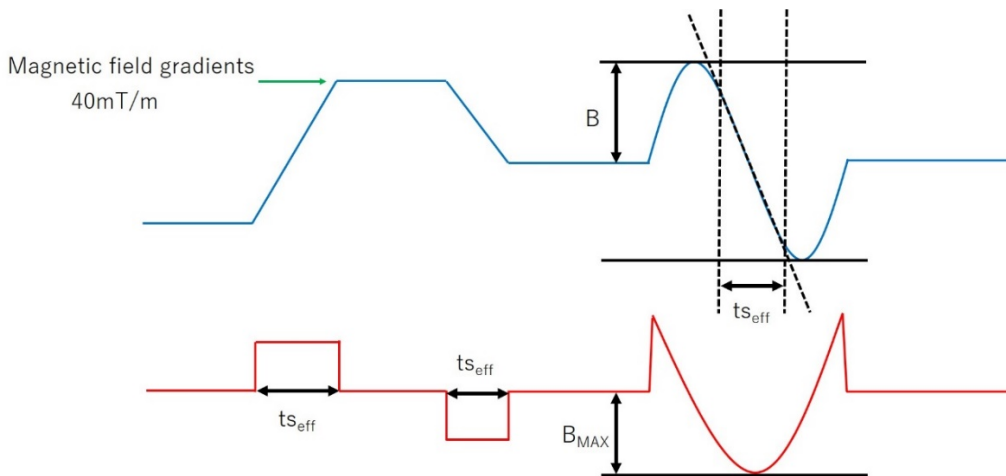
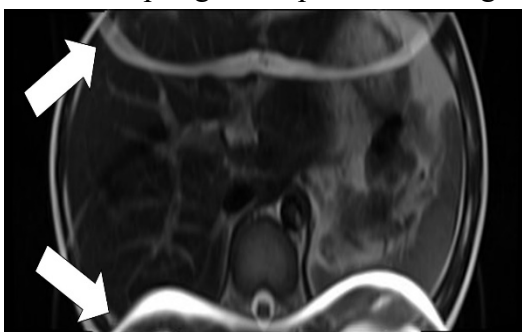Q39 Which is the correct description for distortion improvement in EPI?

1. Extend TE.

2. Extend the Echo space

3. Use parallel imaging

4. Increase the matrix size in the phase direction

5. Increase the time of the frequency-encoded gradient magnetic field

Q40 Which is the correct description for crosstalk artifacts?

1. Independent of slice interval

2. It can be reduced by setting TR short.

3. RF pulse application time is irrelevant.

4. It can be reduced by setting TR longer.

5. The lower the static magnetic field strength, the more likely it is to appear.

Q41 The MR image is shown below. Which is the correct way to deal with artifacts?

1. Shorten the scan time.

2. Use a high magnetic field device.

3. Use a surface coil.

4. Change the frequency encoding direction to L-R direction.

5. Oversampling in the phase encoding direction.

Q42 The MR image is shown below. What is the cause of the artifacts that are occurring?

1. Blood flow
2. Body movement
3. Magnetic susceptibility
4. Wrap
5. Chemical shift
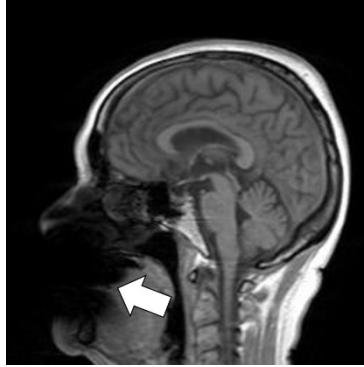


Q43 Which is the correct description for metal artifact countermeasures?

1. Increase the slice thickness.
2. Increase the time resolution.
3. Increase the receiving bandwidth.
4. Use spatial saturation pulse.
5. Narrow the bandwidth of the transmit RF.

Q44 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?

1. The vertical direction on the image is the frequency direction.
2. This image is T1WI with contrast media.
3. The artifact interval (D) increases with higher heart rate.
4. This phenomenon can be prevented by using a pre-saturation pulse.
5. The interval between artifacts depends on the strength of the static magnetic field.
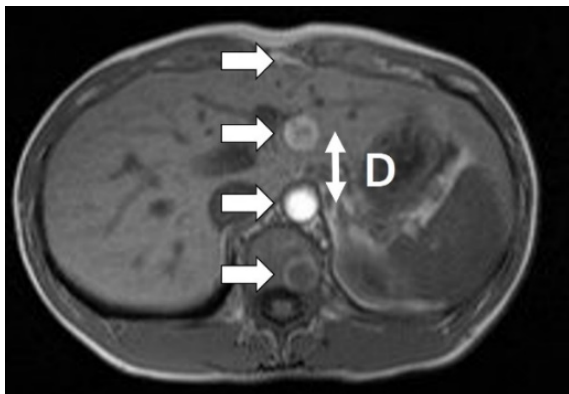
Q45 Which is the correct text for the striped artifacts shown by the arrows in the figure?

    1. It can be improved by increasing the receiving bandwidth.

    2. It can be improved by reducing the matrix size.

    3. It can be improved by using a high-pass filter.

    4. It can be improved by using Zero fill interpolation.

    5. This is due to the finite number of samplings in the Fourier transform.
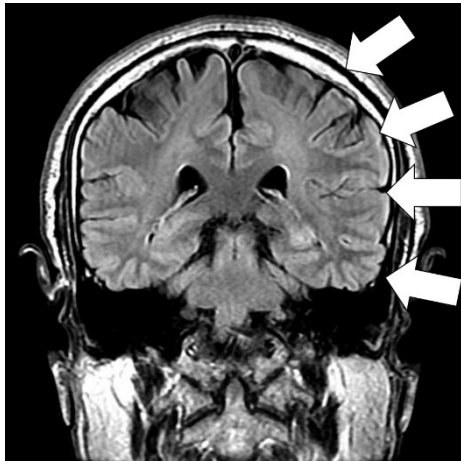


Q46 Find the number of pixels between ghosts of ghost artifacts due to pulsation for TR 150 ms, TE 2.2 ms, NEX 1, phase encoding 256, and heart rate 60 / min.

    1. 17 pixels

    2. 26 pixels

    3. 37 pixels

    4. 43 pixels

    5. 48 pixels

Q47 Select the artifacts that are observed as low signals.

    1. N / 2 artifact

    2. Lip like artifact

    3. Cross talk artifact

    4. Ailiasing artifact

    5. Magic angle artifact

Q48 Choose one that is related to the Paradoxical suppression artifact.

    1.RF

    2. Gradient magnetic field strength

    3. Receive bandwidth

    4. Opposed-phase

    5. in-phase

Q49 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 (⇒).

1. Due to spin-spin relaxation.

2. The order of excited slices does not matter.

3. Due to banding artifacts.

4. The magnitude of the no-signal bandwidth affects the irradiation time of the RF pulse.

5. This is due to the magnetic susceptibility.
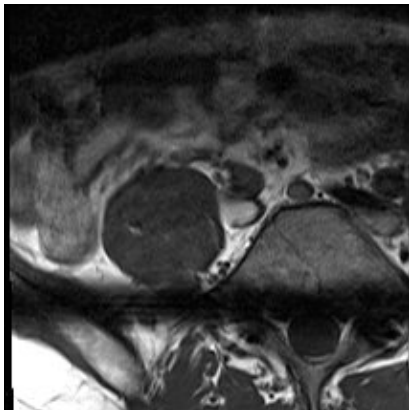


Q50 Choose the correct text for chemical shift artifacts

1. If TR is extend, it will not be noticeable.

2. Chemical shift is not seen in the slice selection direction.

3. Increasing the receive bandwidth also increases the chemical shift.

4. At 3T, the chemical shift between water and fat is 7 ppm.

5. For a receive bandwidth of 32KHz and 512 pixels, the 1.5T chemical shift is about 4 pixels.

Q51 Which is the correct description for MRI examination of Gd-EOB DTPA?

1. All are excreted in the biliary system.

2. For adults, administer 0.2 mL / kg of this drug intravenously.

3. Shows a higher degree of relaxation than Gd-DTPA in plasma.

4. Hepatic hemangiomas are lesions that do not take up contrast media in the hepatobiliary phase.

5. Focal nodular hyperplasia is a lesion that does not take up contrast medium in the hepatocellular phase.

Q52 Choose the correct text for a cardiac MRI scan.

1. Myocardial perfusion testing takes advantage of T2 * shortening effect of gadolinium contrast media.

2. The Phase-sensitive inversion recovery (PSIR) method does not require detailed TI settings.

3. The value of ECV tends to depend on the strength of the static magnetic field.

4. Retrospective ECG-gated cine imaging produces flash artifacts.

5. The black blood method using the Double-inversion recovery method suppresses the blood

signal using two non-selective inversion pulses.

Q53 Choose the right one for arterial spin labeling (ASL).
1. PASL has a higher SNR than CASL.
2. PASL has a higher SAR than CASL.
3. PASL has a greater magnetization transfer (MT) effect than CASL.
4. FAIR (flow-sensitive altering inversion recovery) is one of CASL.
5. The perfusion image of ASL is the difference between the image with labeling and the control image without labeling.

Q54 Which is the correct description of fat suppression?
1. The binominal pulse method uses the difference in longitudinal relaxation time.
2. Use of fat suppression technology increases motion artifacts.
3. In the opposed phase image of the Dixon method, the adipose tissue becomes low signal.
4. The CHESS (chemical shift selective) method uses the frequency difference.
5. The STIR (short TI inversion recovery) method selectively suppresses fat signals.

Q55 Which is the correct description for MRA (magnetic resonance angiography)?
1. Longer TE for MRA is desirable.
2. In the TOF (time of flight) method, a tissue with a long T1 value has a high signal.
3. The FBI (fresh blood imaging) method uses the difference in signal intensity between systole and diastole.
4. The TONE (tilted optimized non-saturating excitation) method reduces flip angle from the inflow side to the outflow side.
5. In the PC (phase contrast) method, the larger the VENC (velocity encoding), the larger the plane area of the bipolar gradient.

Q56 Which is the correct description for the Inversion Recovery (IR) method?
1. The STIR method has low specificity for fat.
2. The STIR method has a better signal-to-noise ratio than his CHESS method.
3. The FLAIR method is a method of suppressing signals other than water.
4. The White matter attenuated IR method can suppress the gray matter signal of brain tissue.
5. The Null point time can be calculated by multiplying the T1 value of the tissue to be suppressed by 0.693.

Q57 Which is the correct description of the features of multi-shot EPI for single-shot EPI (echo planar imaging)?
1. The scan time is short.
2. Distortion-induced artifacts are reduced.
3. Increases susceptibility artifacts.

4. Less likely to cause movement artifacts.

5. Prone to N / 2 ghost.

Q58 Which is the correct description of fat suppression technology?

* CHESS: chemical shift selective saturation

1. STIR has a better signal-to-noise ratio than the CHESS method.

2. STIR has a shorter imaging time than the CHESS method.

3. STIR is more susceptible to heating effects than the CHESS method.

4. STIR is more susceptible to magnetic field non-uniformity than the CHESS method.

5. STIR suppresses tissues with T1 values similar to fat.

Q59 Which is the correct description for SWI (susceptibility weighted imaging)?

1. Suitable for depiction of the arterial system.

2. Emphasizes the difference in phase dispersion due to magnetic susceptibility.

3. The lower the static magnetic field strength, the easier it is to capture minute differences in magnetic susceptibility.

4. The larger the voxel size, the easier it is to catch minute differences in magnetic susceptibility.

5. MIP (maximum intensity projection) processing is useful.

Q60 Choose the correct text about the Gradient Echo (GRE).

1. Ernst angle can be obtained from T1 value and TE.

2. DESS (dual echo in the steady state) is strong against movement.

3. The signal strength of the Balanced SSFP method is proportional to the T1 value / T2 value.

4. Spoiled GRE can ignore the effect of residual transverse magnetization.

5. When TR is extended, it becomes SSFP (steady-state free precession).

Q61 Select the correct text for MR angiography (MRA).

1. Increase the slab thickness to improve the visualization of peripheral blood vessels.

2. Applying MT pulses to the TOF method improves the ability to visualize fast-flowing blood vessels.

3. Increasing his VEC (velocity encoding) value in the PC method improves the ability to visualize slow-flowing blood vessels.

4. If a decrease in cerebral blood flow is expected, in the TOF method he improves the ability to visualize blood vessels by prolonging TE.

5. The PC method can quantify the flow velocity.

Q62 Select the imaging time of the tertiary fast (turbo) spin echo method set to TR 2000 ms, TE 100 ms, ETL 64, NEX 2, Nx 256, Ny 224, Nz 32.

1. 224 seconds

2. 256 seconds

3. 448 seconds

4. 512 seconds

5. 768 seconds

Q63 Select a method to reduce blurring in T2-weighted images using the single-shot high-speed spin echo method.

1. Lengthen the TE.

2. Lengthen the TR.

3. Use parallel imaging.

4. Use the oversampling method.

5. Use pre-saturation pulses.

Q64 Choose the correct description for the black blood image of the cervical blood vessels.

1. Turbulence and laminar flow do not affect the flow void effect.

2. ECG synchronization must be done

3. The GRE method uses the principle of flow void to suppress blood signals.

4. Bleeding plaque is equivalent to the sternocleidomastoid muscle on T1-weighted images.

5. It is useful to add a fat suppression pulse to evaluate the properties of vulnerable plaque.

Q65 Which is the correct description for MRI examination of cerebral hemorrhage?

1. In the chronic phase, T1-weighted image shows high signal.

2. In the acute phase, T2- weighted image shows high signal.

3. In the hyperacute phase, T1-weighted images show high signal.

4. Methemoglobin has a T1 shortening effect.

5. T2 * weighted images cannot detect hemosiderin

Q66 Which is the correct description for contrast-enhanced MRI of the brain?

1. Pituitary adenomas show an earlier enhancing effect than normal pituitary glands.

2. Meningiomas show a ring enhancement.

3. Diffuse astrocytoma shows a strong enhancing effect.

4. Contrast effect does not change 1 day after administration

5. The T1 shortening effect of contrast media depends on the dose

Q67 Which is the correct description for an MRI scan of the heart?

1. Takotsubo cardiomyopathy shows a strong delayed contrast effect.

2. The most common site for cardiac sarcoidosis is the inner layer of the myocardium.

3. Cardiac amyloidosis has a delayed contrast effect locally under the endocardium.

4. If the range of the delayed contrast-enhanced myocardium is about 75%, it is judged that there is myocardial viability.

5. The delayed contrast image of old myocardial infarction shows the contrast enhancement effect that spreads from the adventitia side to the intima side.

Q68 Which is the correct description for MRI examination of the female pelvis?
1. Nabothian cysts occur in the body of the uterus.
2. Most uterine fibroids show hyperintensity with T2-enhanced images.
3. The signal provided is not related to the menstrual cycle
4. The components of endometriotic cysts show hypointensity in both T1 and T2-weighted images.
5. Fat suppression is useful for distinguishing between Endometriotic cysts and dermoid cysts.

Q69 Choose the correct text for MRI findings of the prostate.
1. Prostate cancer shows hyperintensity on diffusion-weighted images.
2. Normal marginal area shows high signal on T1-weighted image.
3. The most common site for prostate cancer is the transition zone.
4. The most common site for benign prostatic hyperplasia is the central region.
5. After biopsy, T2-weighted image shows high intensity.

Q70 Please select the correct text for MRCP.
1. Gallstones are hyperintense on T1 and T2-weighted images
2. When imaging DMRCP, set the execution TE to a longer value.
3. Rokitansli-Aschoff sinuses are malignant lesions.
4. In the case of concentrated bile, he improves visualization by prolonging TE.
5. Serous cysts of Intraductal papillary mucinous tumor show hyperintensity on diffusion-weighted images.

Q71 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?
1. Hippocampal atrophy
2. Choroid plexus cyst
3. Arachnoid cyst
4. Cavernous hemangioma
5. Chronic cerebral infarction

Q72 Select the correct sentence for MR examination of the pituitary gland.
1. The diseased part is deeply stained earlier than the normal part by dynamic contrast examination.
2. Rathke's cyst shows a signal intensity similar to that of cerebrospinal fluid in T1 and T2-enhanced images.
3. Central diabetes insipidus is a disease in which the signal of the posterior pituitary gland on

T1-weighted images is elevated.

4. The size of the normal pituitary gland in adults is almost constant regardless of age and gender.

5. Scanning of T1-weighted image with contrast media on sagittal plane, it is necessary to devise ways to avoid overlapping with flow artifacts.

Q73 Choose the correct description for female pelvic imaging.

1. Adenomyosis has scattered high signals due to petechiae in T2- weighted images.

2. Adenomyosis is an intramuscular lesion that shows low signal in T2- weighted image, and the boundary is unclear.

3. In Endometriotic cyst, a chemical shift appears at the boundary between fat and non-fat components.

4. Mature cystic teratomas contain blood components and therefore show hyperintensity on T1 and T2- weighted images.

5. The low signal of T1-weighted images of endometriotic cysts is thought to be due to coagulated blood, decidual epithelium, and its necrotic material.

Q74 Choose the correct text for a prostate MR test.

1. Prostate cancer is generally hyperintense with T2-enhanced images.

2. MRS for prostate cancer is evaluated with lactic acid and choline.

3. Prostate cancer has a high apparent diffusion coefficient.

4. Prostate cancer is diffuse-weighted and susceptible to T2-Shine through.

5. When prostate cancer is visualized as a diffusion-weighted image with high signal, set the b value to a large value.

Q75 The figure is a T1-weighted image of the shoulder joint. Which is the correct description?

1. The cross section of A is b.

2. C is the clavicle.

3. C is the acromion.

4. D is the supraspinatus muscle.

5. D is the infraspinatus muscle.
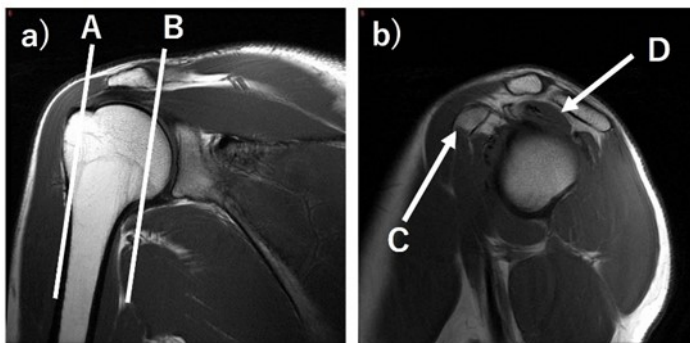
Q76 Which is the correct anatomy indicated by the arrow in the figure?
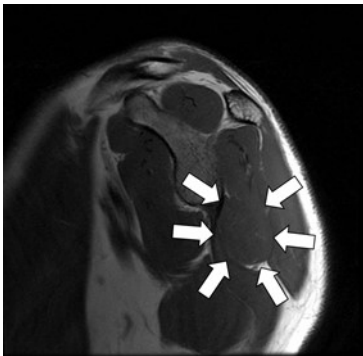
1. Tricuspid valve

2. Mitral valve

3. Left ventricular outflow tract

4. Aortic valve

5. Pulmonary valve
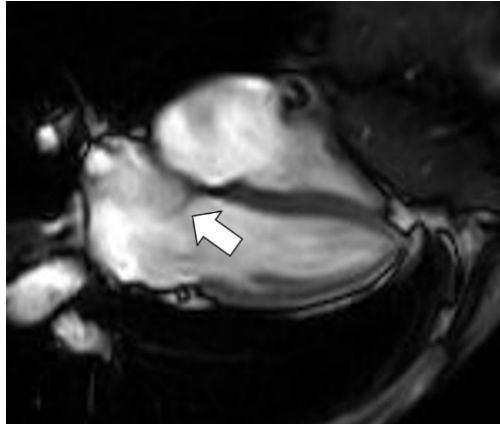


Q77 Select the muscle indicated by the arrow in the figure.

The image is a sagittal plane for right shoulder.

1. Supraspinatus

2. Trapezius muscle

3. Deltoid muscle

4. Infraspinatus

5. Teres minor muscle



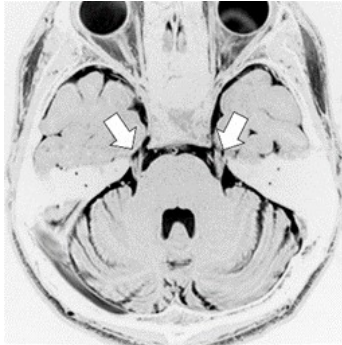Q78 Select the ligament indicated by the arrow in the figure

The image is a axial plane for right ankle.

1. Anterior talofibular ligament

2. Posterior talofibular ligament

3. Deltoid ligament

4. Dorsal range boat ligament

5. Flexor striate
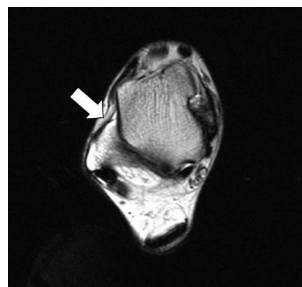
Q79 Select the cranial nerve indicated by the arrow in the figure

    1. Olfactory nerve

    2. Optic nerve

    3. Oculomotor nerve

    4. Trochlear nerve

    5. Abducens nerve



Q80 Select the anatomical name indicated by the arrow in the figure

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

    1. Erector spinae muscles (multifidus muscles)

    2. Erector spinae muscle (longissimus muscle)

    3. Erector spinae muscles (lumbar iliocostalis)

    4. Quadratus lumborum

    5. Psoas major
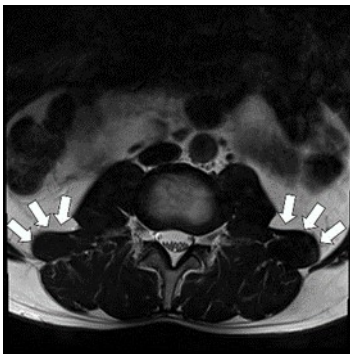
Q81 Select the anatomical name indicated by the arrow in the figure

1. Sternocleidomastoid muscle

2. Masseter muscle

3. Levator scapula

4. Longus colli muscle

5. Trapezius muscle
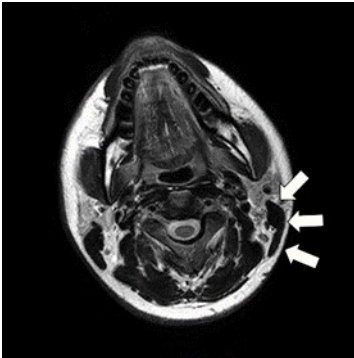


Q82 Which of the following is the most likely disease?

1. Glioblastoma

2. Astrocytoma

3. Meningeal species

4. Craniopharyngioma

5. Malignant lymphoma
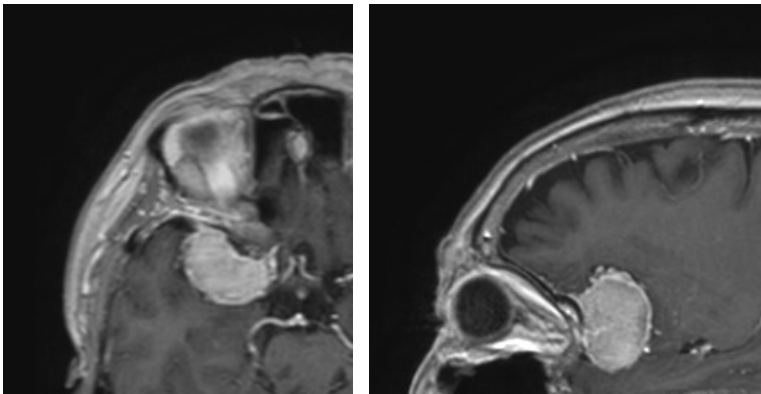


Post-contrast T1-weighted image (axial and sagittal)

Q83 Which of the following is the most likely disease?

1. Cardiac amyloidosis

2. Acute myocardial infarction

3. Takotsubo cardiomyopathy

4. Hypertrophic cardiomyopathy

5. Fabry disease
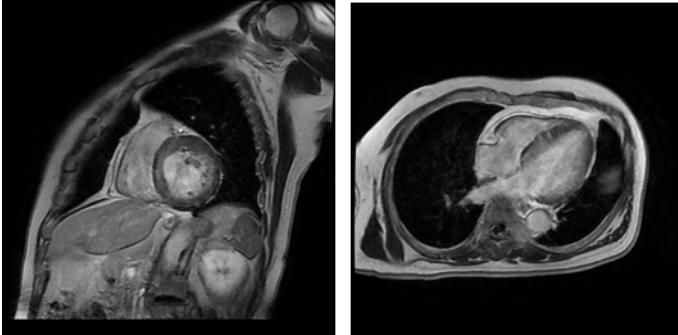

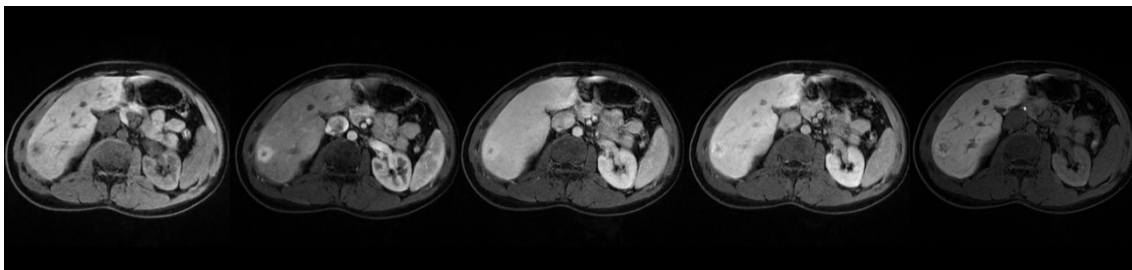
Delayed contrast images

(a) short axis (b) four chamber

Q84 Which of the following is the most likely disease?

1. Hepatic hemangioma

2. Hepatocellular carcinoma

3. focal nodular hyperplasia: FNH

4. Non-alcoholic steatohepatitis: NASH

5. Liver metastasis
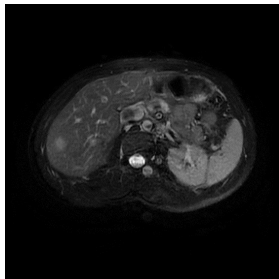


Fat suppressed T2-weighted image



Dynamic images

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

Q85 Which of the following ligaments is most suspected of being damaged?

    1. Anterior cruciate ligament

    2. Posterior cruciate ligament

    3. Medial collateral ligament

    4. Fibular collateral ligament

    5. Patellar ligament



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

Q86 Which of the following is the most likely disease?

    1. Subcortical bleeding

    2. Acute cerebral infarction

    3. Brain abscess

    4. Cerebral arteriovenous malformation

    5. Metastatic brain tumor
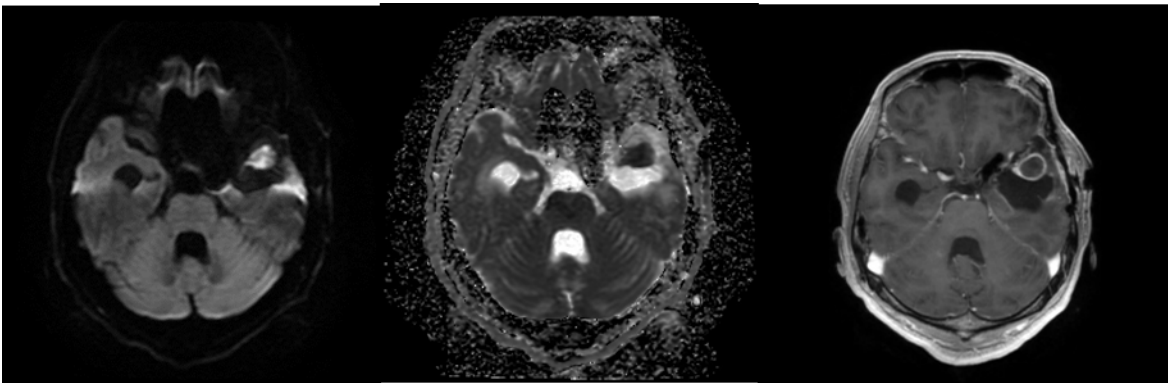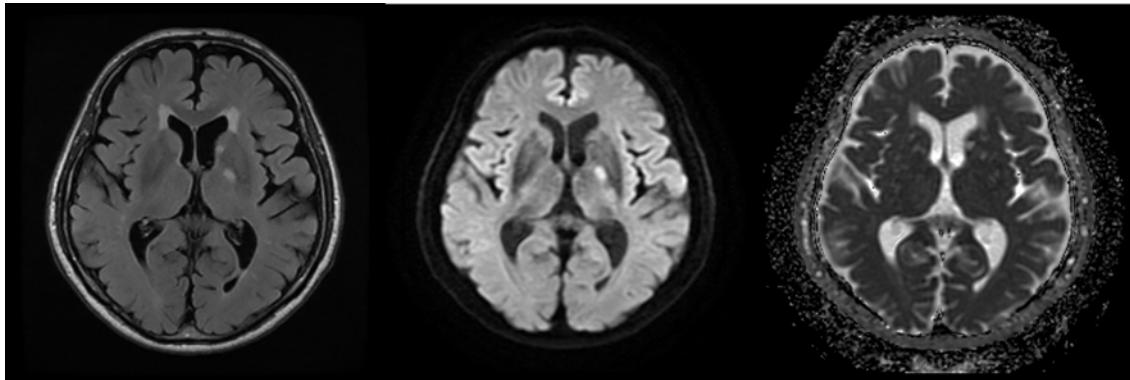


(a) DWI      (b) ADC      (c) gadolinium enhanced T1-weighted

Q87 From the images, when is the closest time from the onset of left internal capsule hind leg
   lacunar infarction?
   1. Immediately after onset (about 30 minutes)
   2. Hyperacute phase (about 1 hour)
   3. Acute phase (about 1 day)
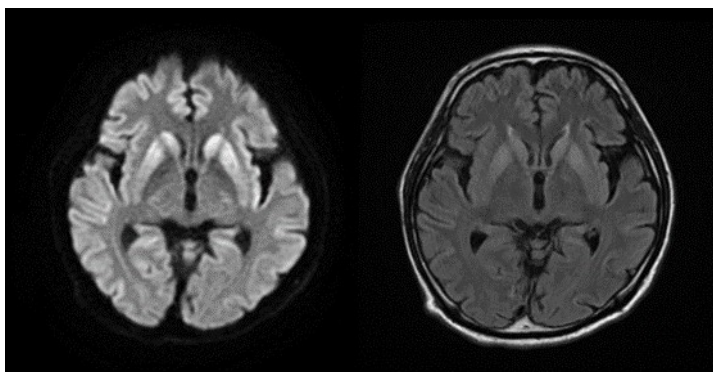   4. Subacute phase (about 2 weeks)
   5. Chronic phase (about 1 month)



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

Q88 Which is the most suspected disease from the image?
   1. Multiple sclerosis
   2. Acute cerebral infarction
   3. Creutzfeldt-Jakob disease
   4. Carbon monoxide poisoning
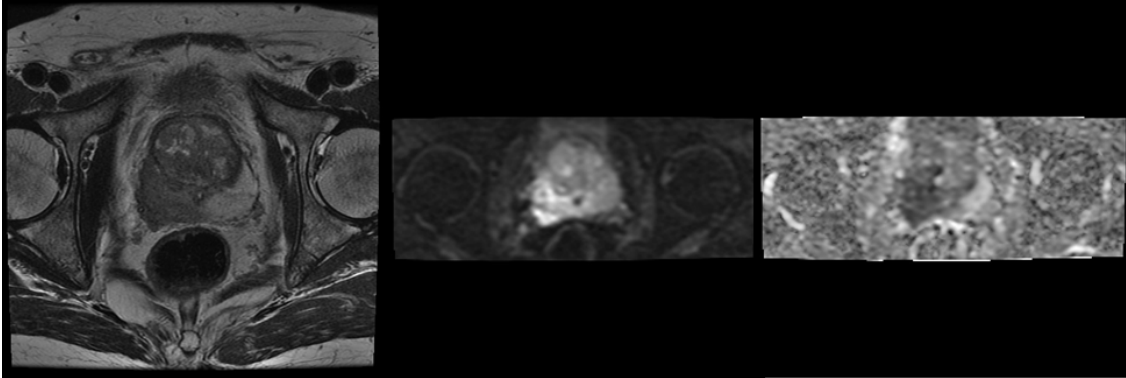   5. Encephalitis



(a) DWI            (b) FLAIR

Q89 Which is the most suspected disease from the image?

1. Benign prostatic hyperplasia

2. Prostate cancer

3. Acute prostatitis

4. Chronic prostatitis

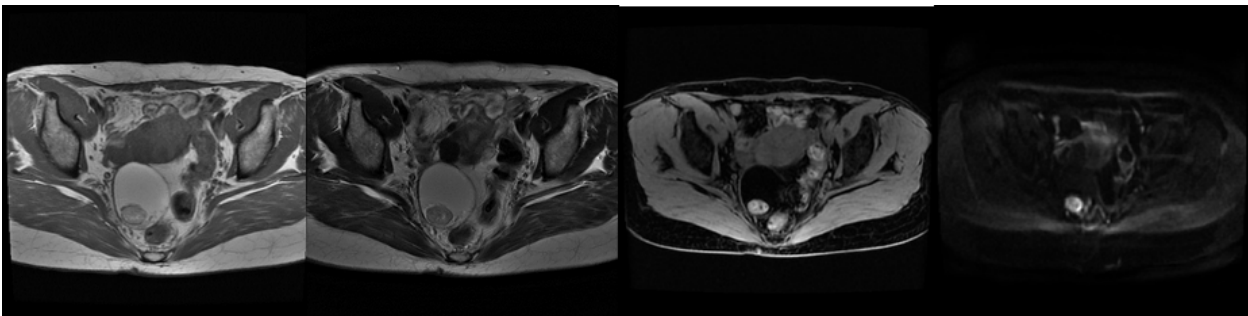5. Rectal cancer Prostate infiltration



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

Q90 Which is the most suspected disease from the image?

1. Cervical cancer

2. Endometrial cancer

3. Chocolate cyst

4. Ovarian cancer

5. nature cystic teratoma



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