

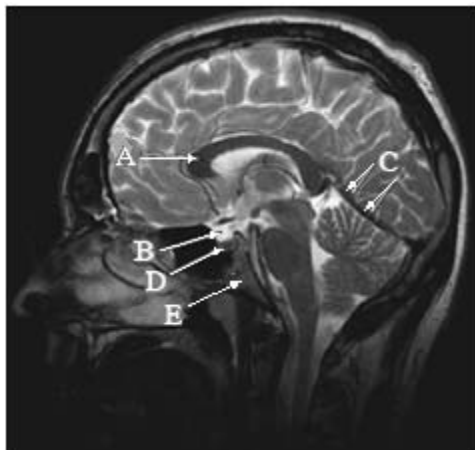
EANS/UEMS Европейский экзамен по нейрохирургии

Варианты вопросов с ответами (составление и перевод - Ботев Вячеслав Семенович, Кафедра нейрохирургии, Донецкий национальный медицинский университет им. М. Горького)

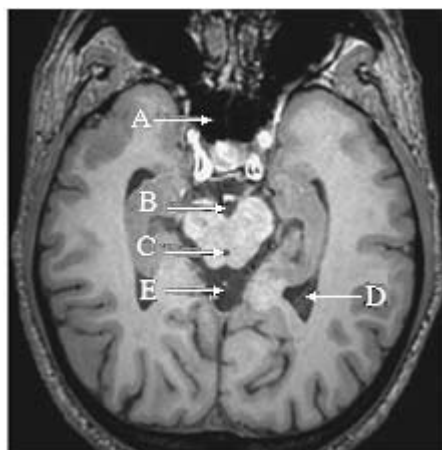
Нейроанатомия/Neuroanatomy. Часть I/ Part I

Назовите обозначенные структуры / Name the labelled structures:

1.



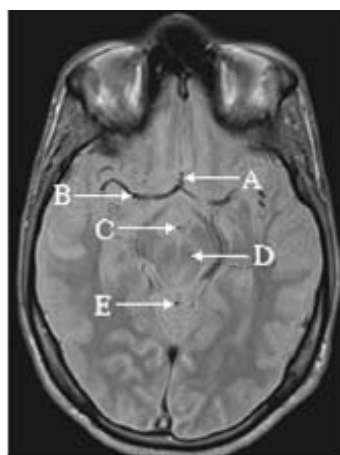
2.



3.



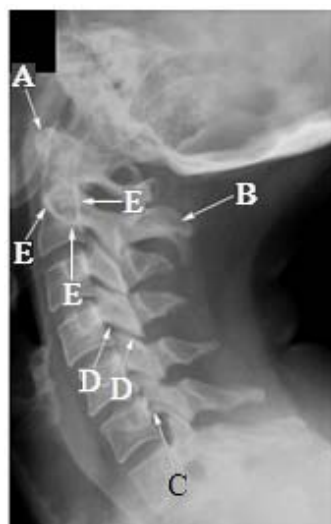
4.



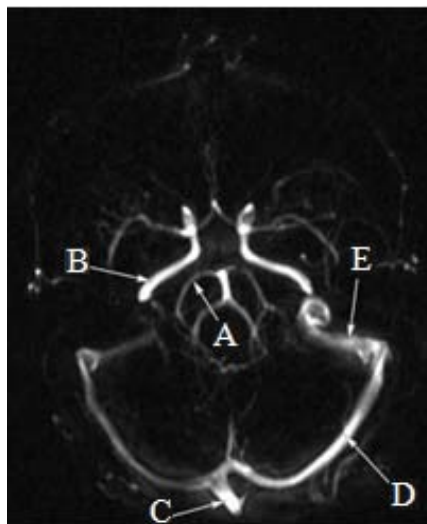
5.



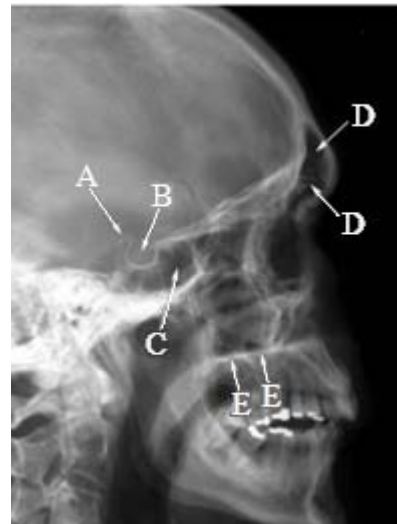
6.



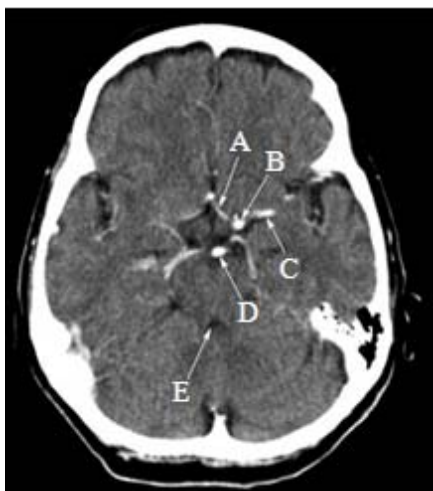
7.



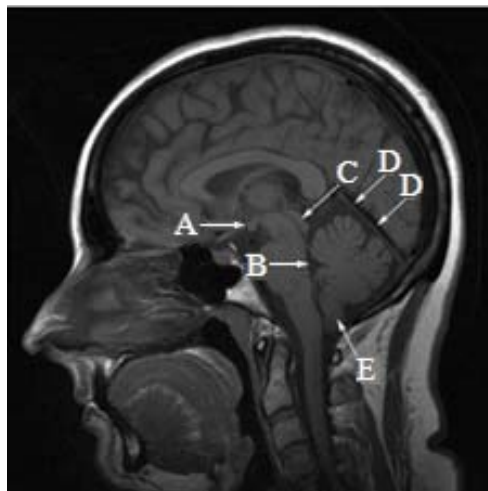
8.



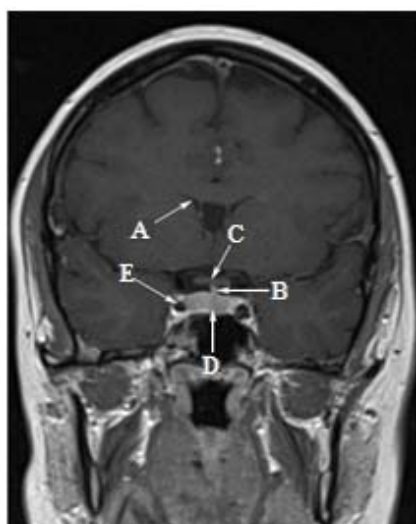
9.



10.



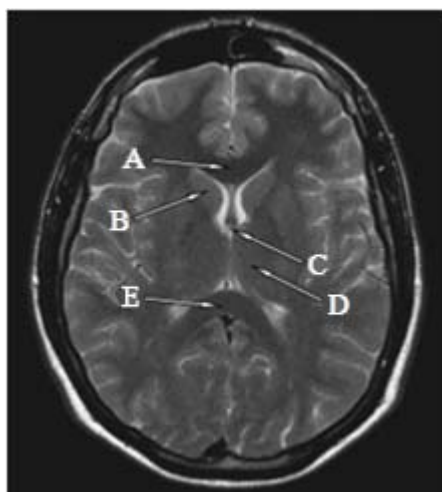
11.



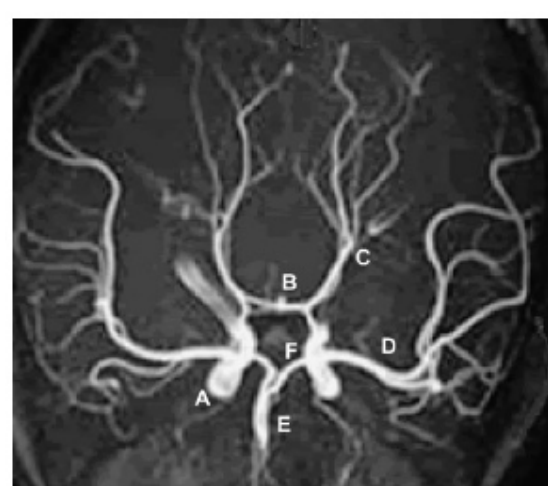
12.



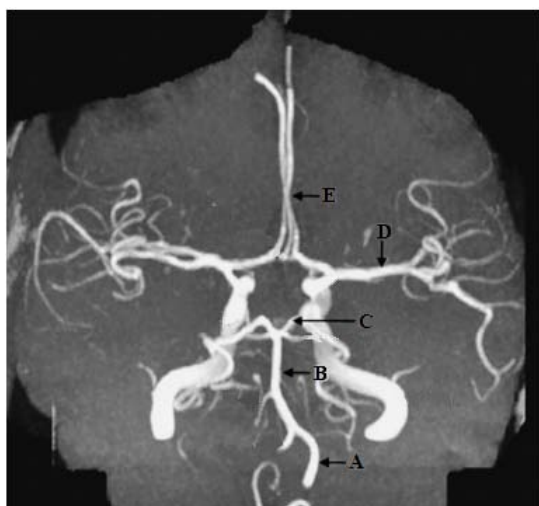
13.



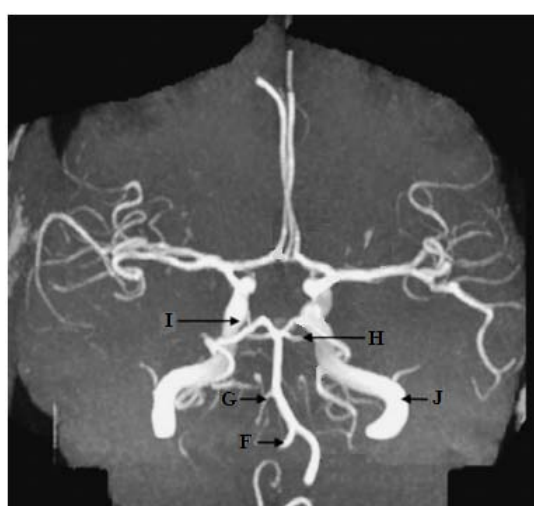
14.



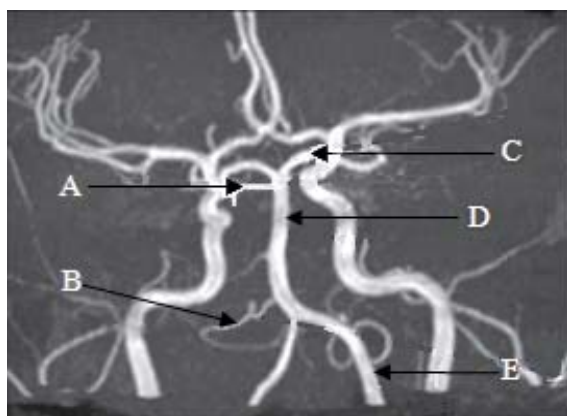
15.



16.



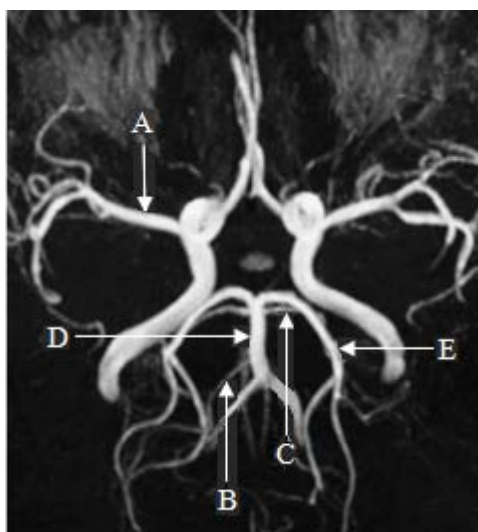
17.



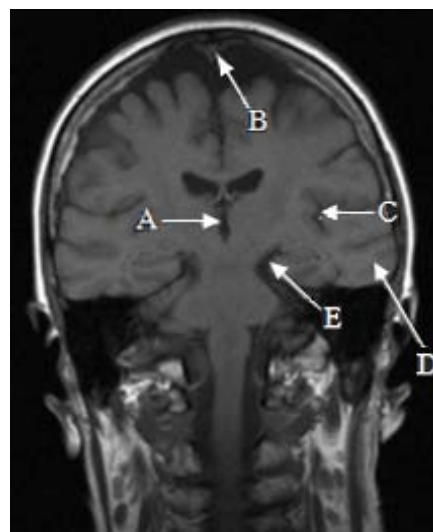
18.



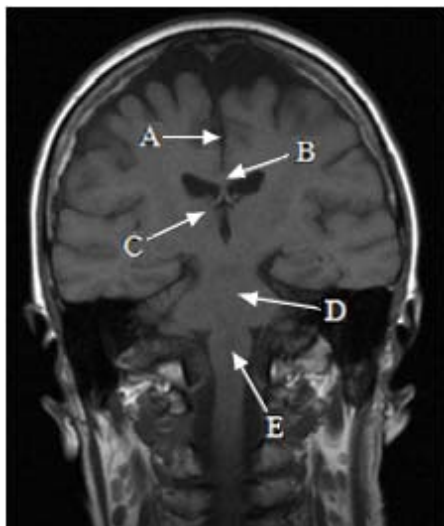
19.



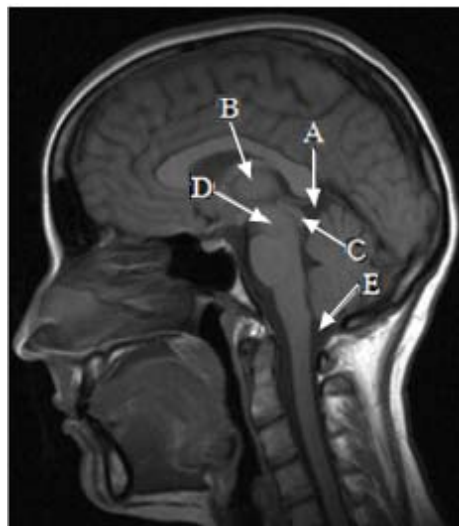
20.



21.



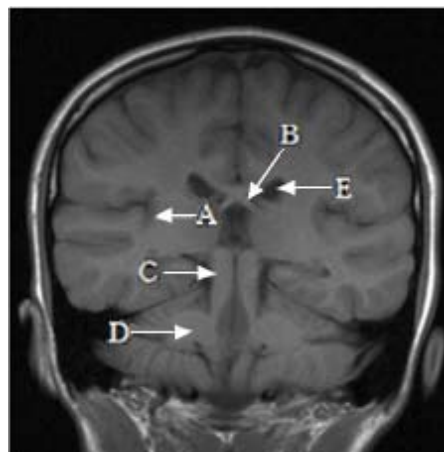
22.



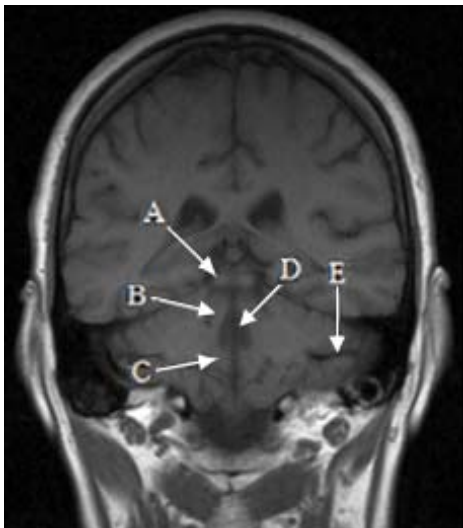
23.



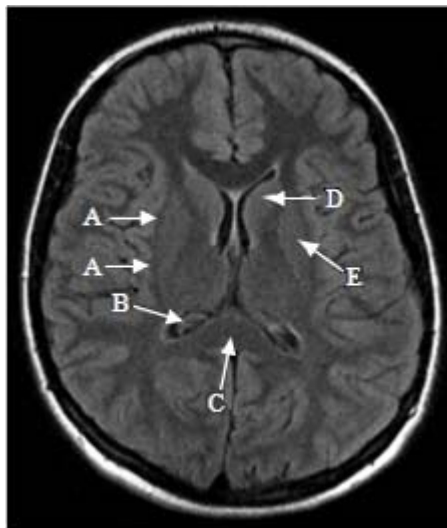
24.



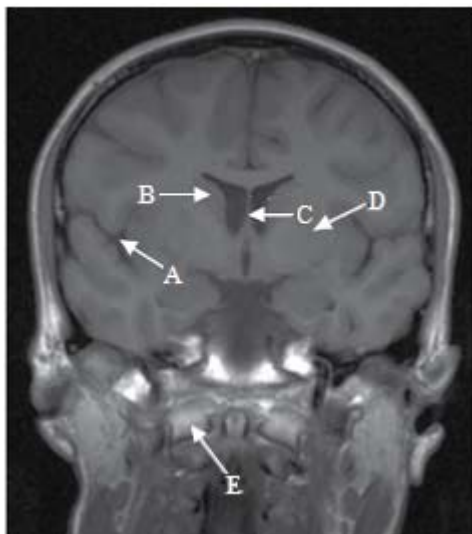
25.



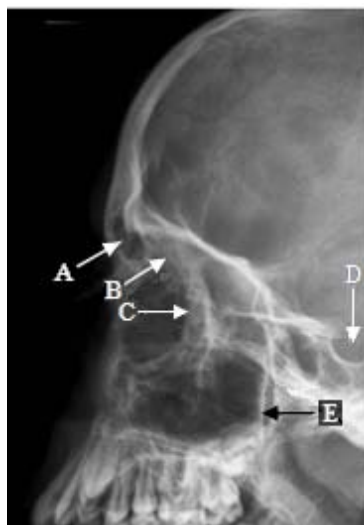
26.



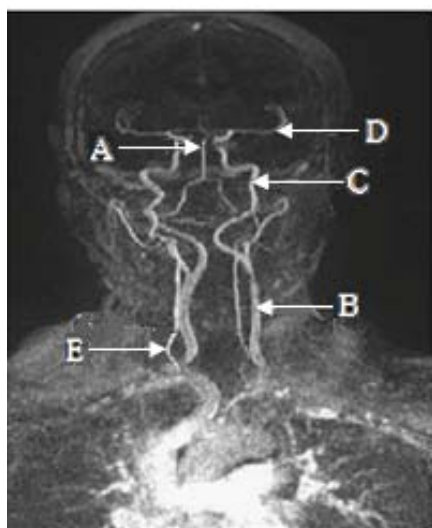
27.



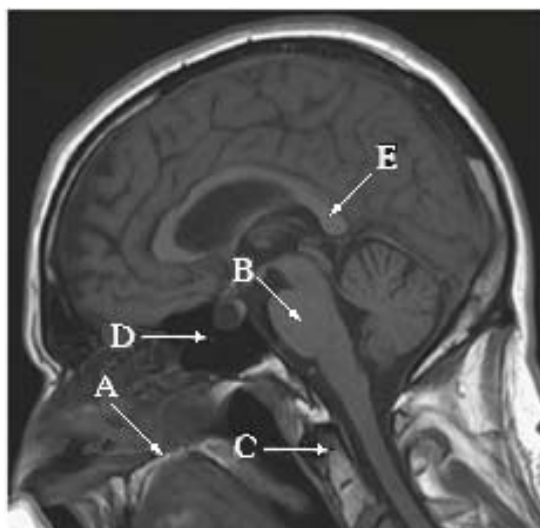
28.



29.



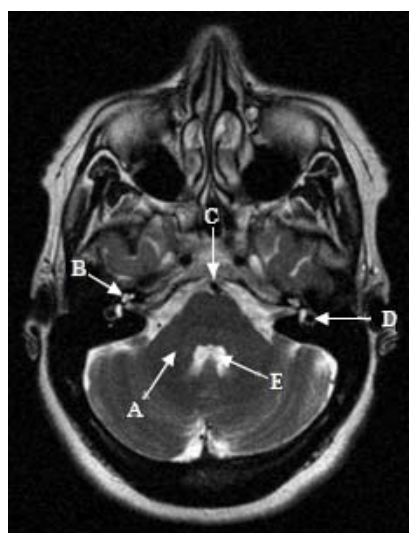
30.



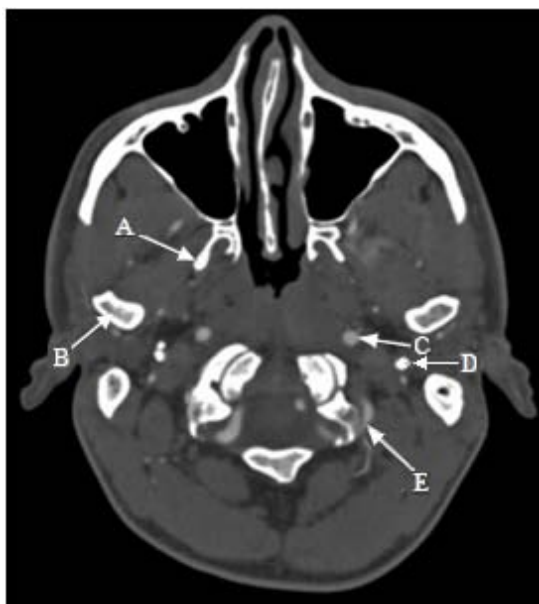
31.



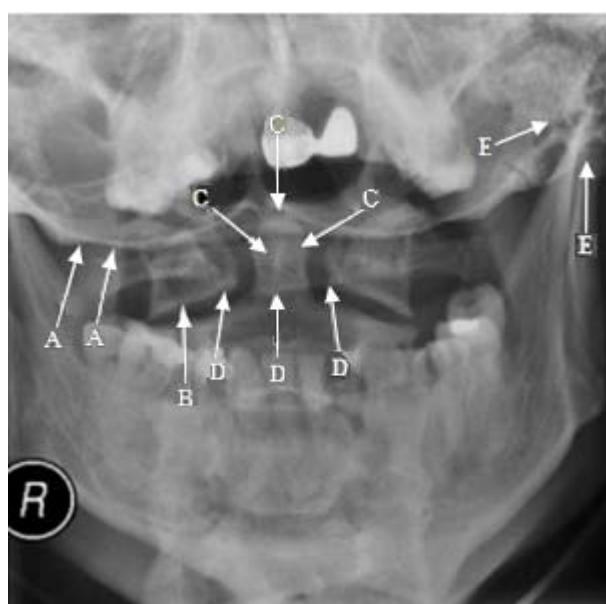
32.



33.



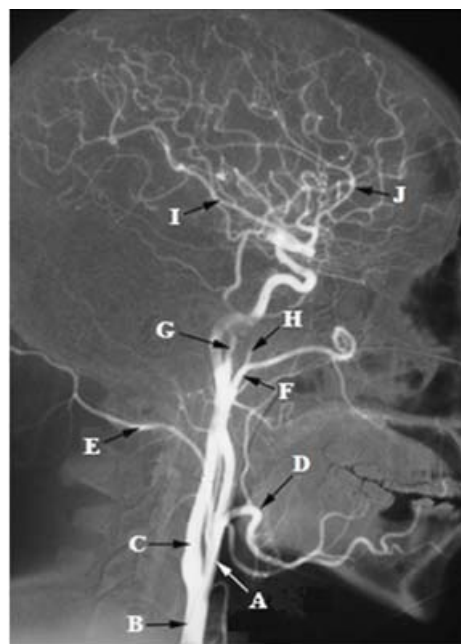
34.



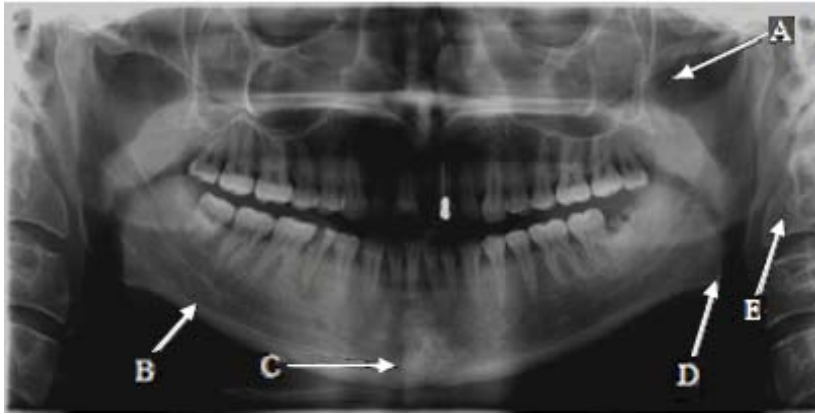
35.



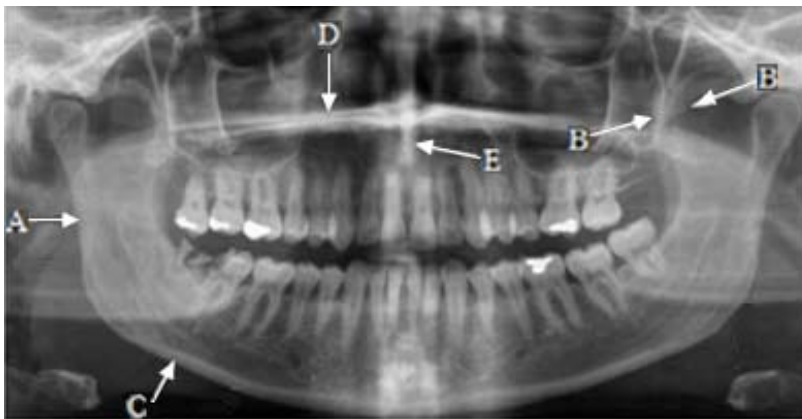
36.



37.



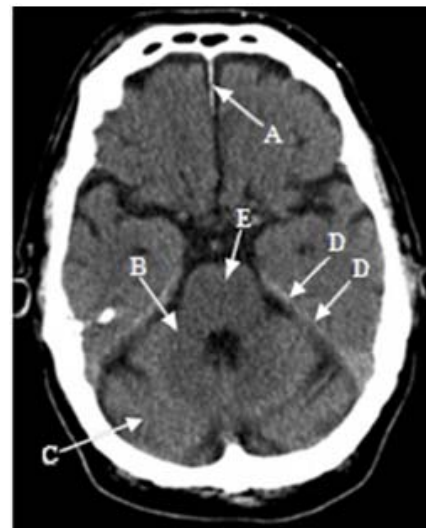
38.



39.



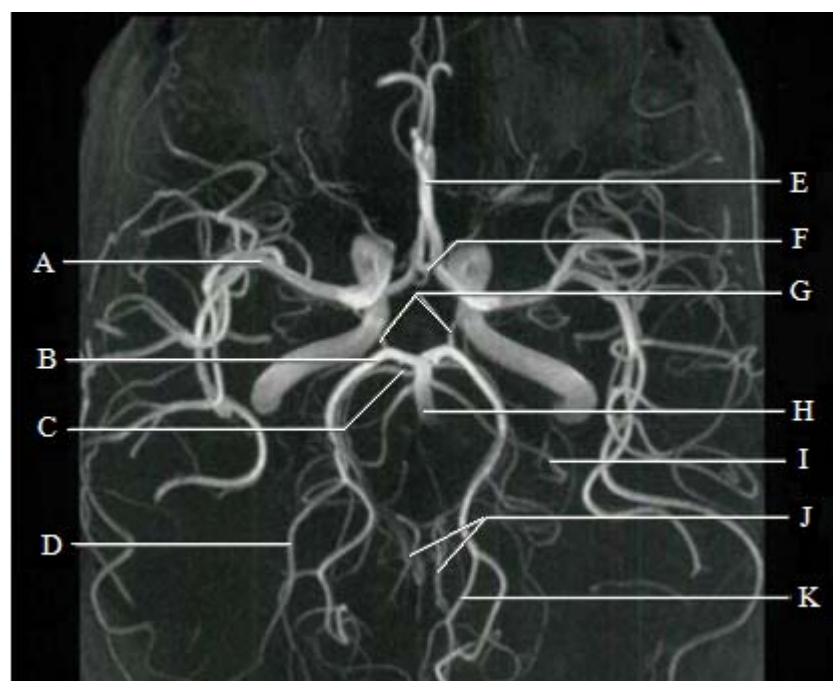
40.



41.

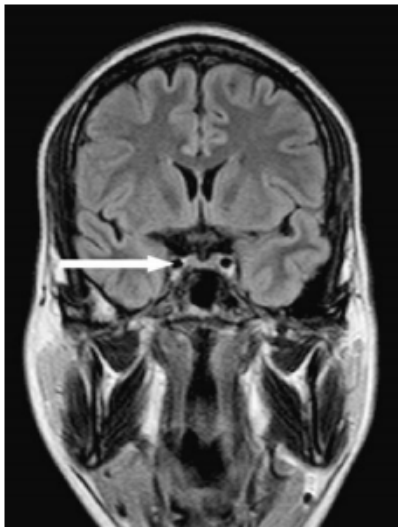
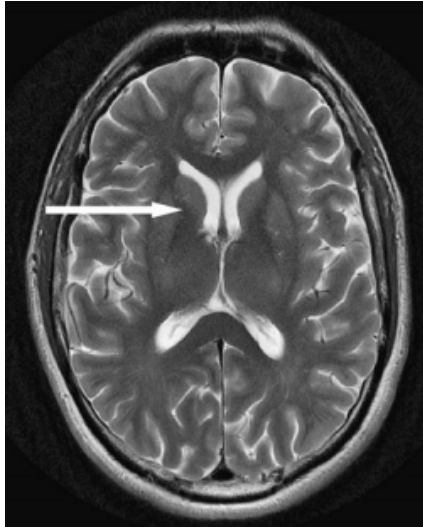
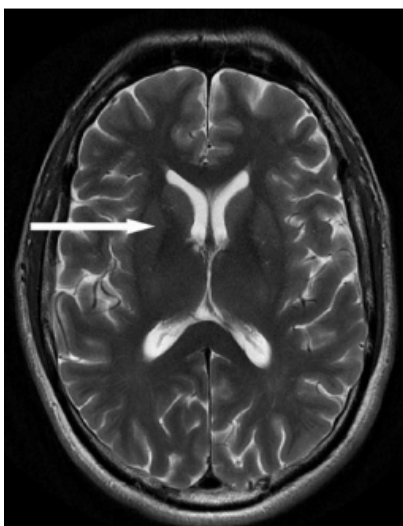
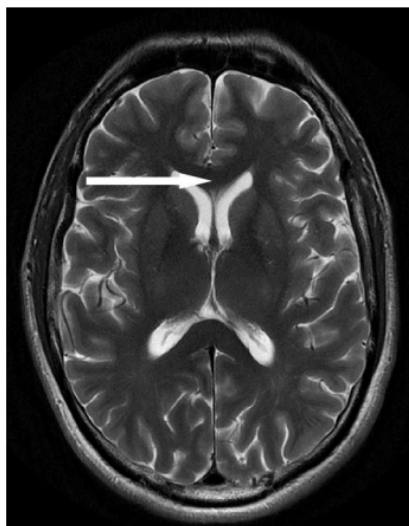
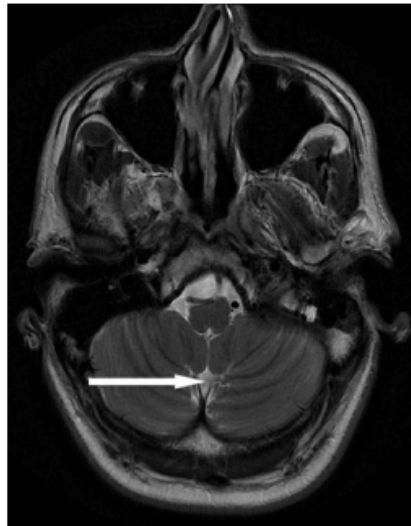
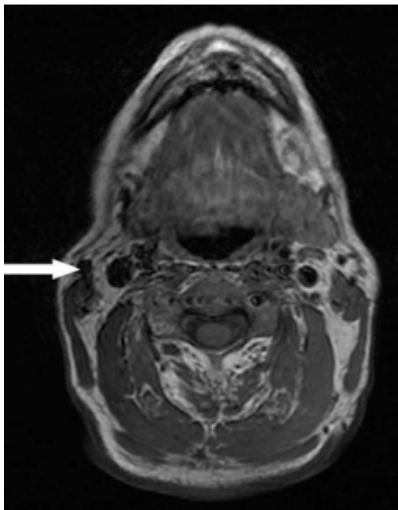


42.

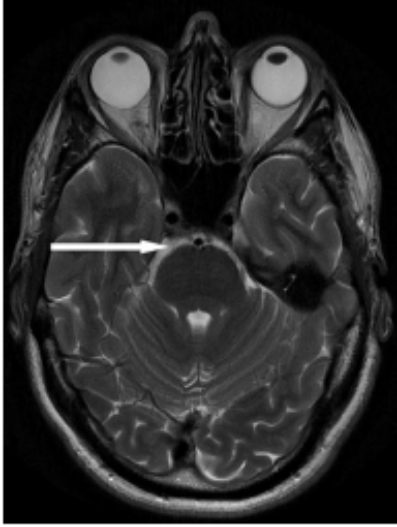


Нейроанатомия/Neuroanatomy. Часть II/ Part II

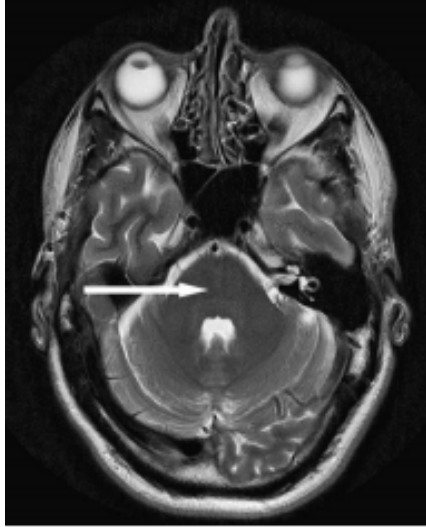
Назовите указанную стрелкой структуру / Name the arrowed structure:

1.**2.****3.****4.****5.****6.****7.****8.****9.**

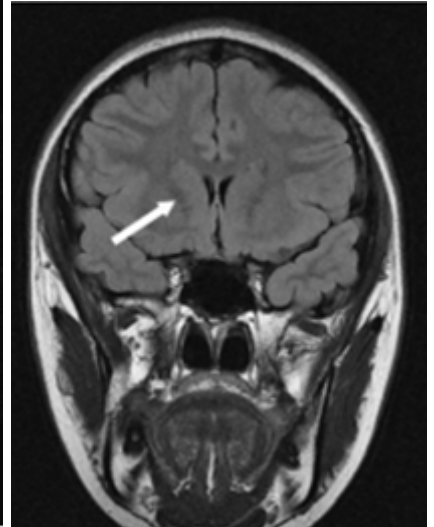
10.



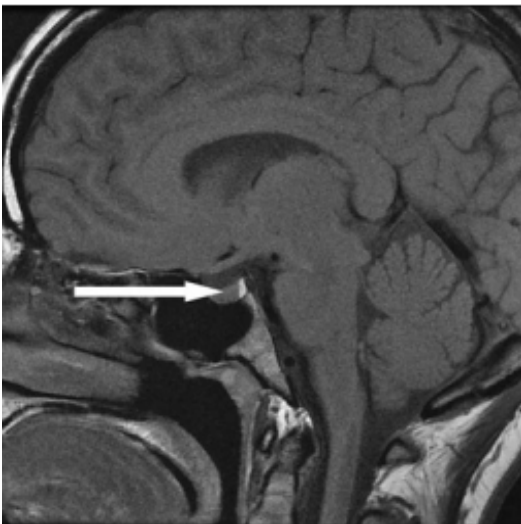
11.



12.



13.



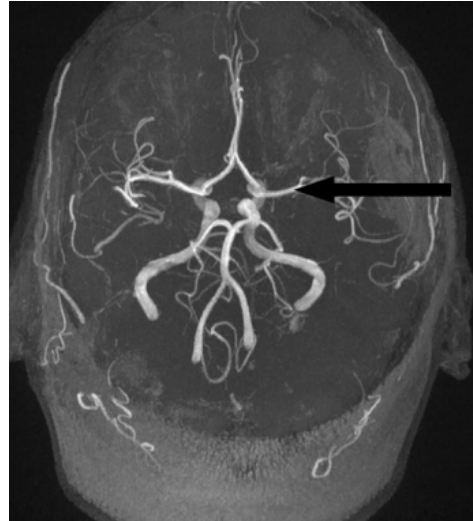
14.



15.



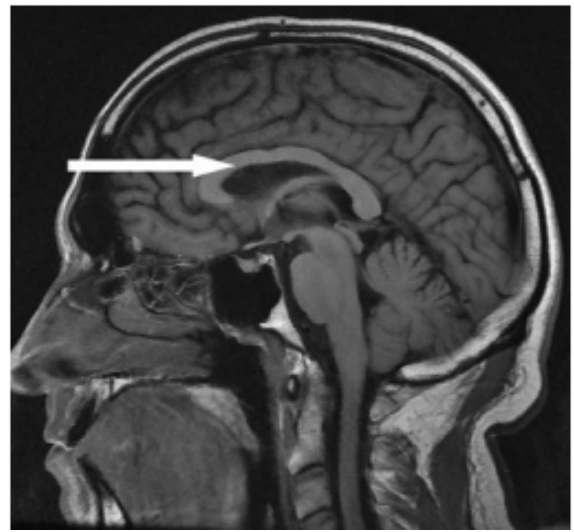
16.



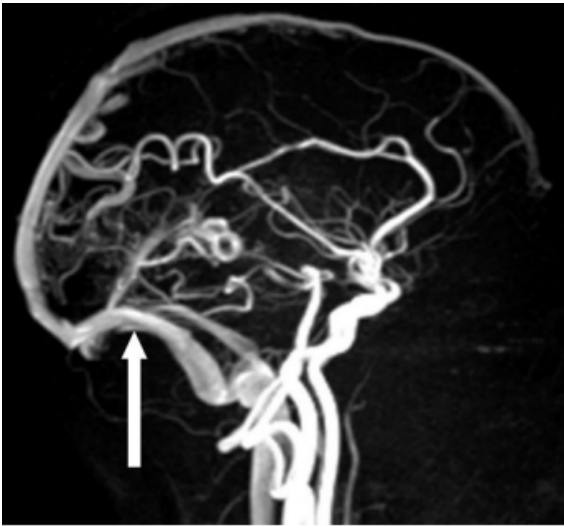
17.



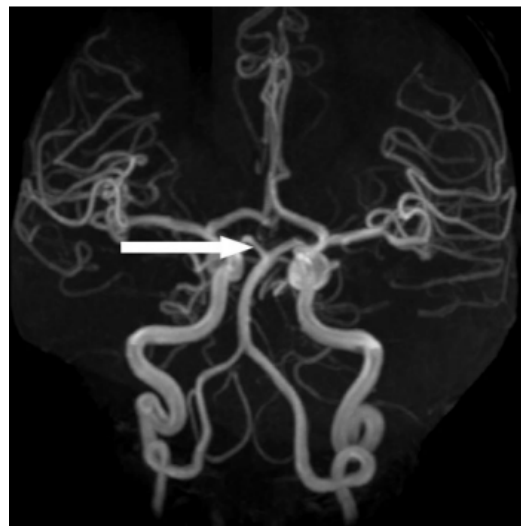
18.



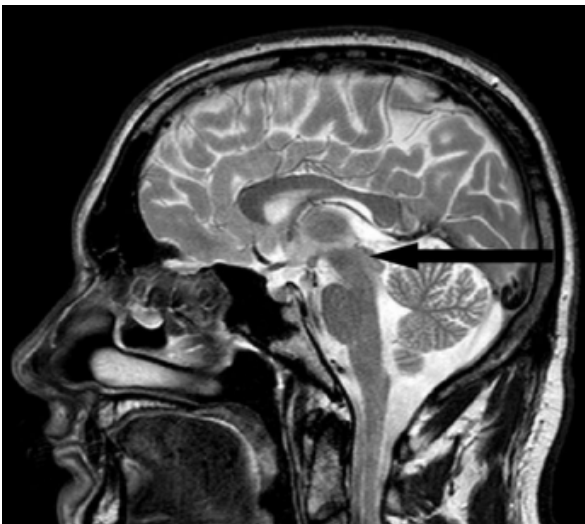
19.



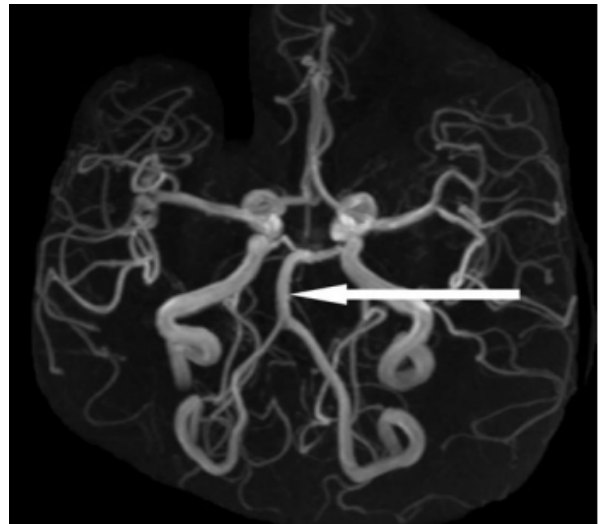
20.



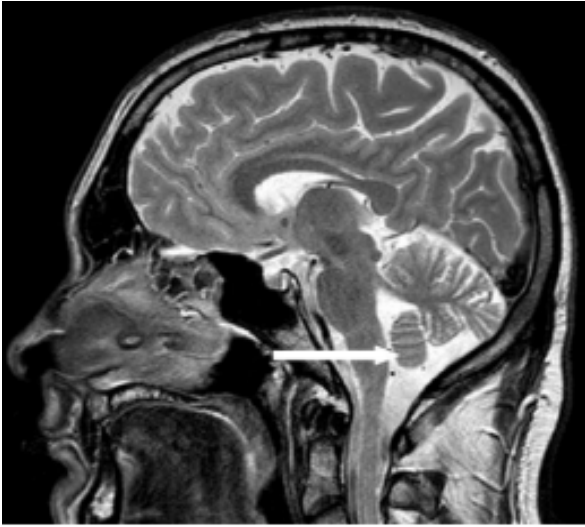
21.



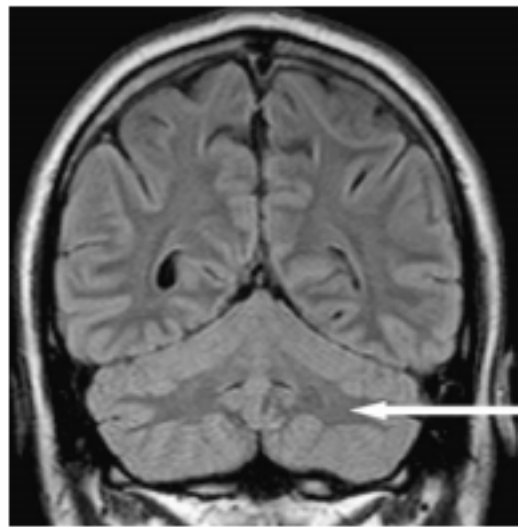
22.



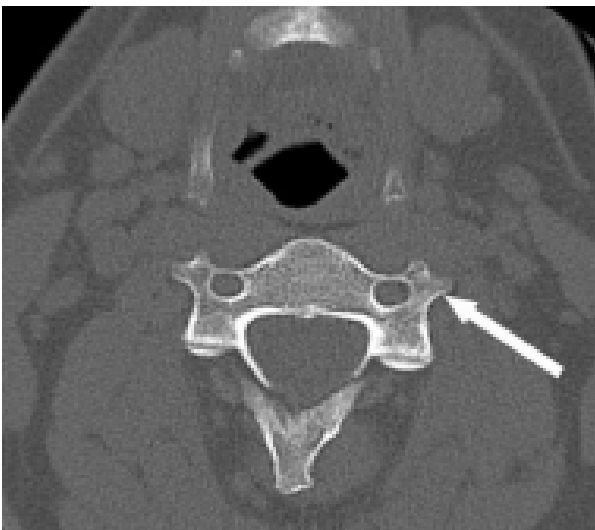
23.



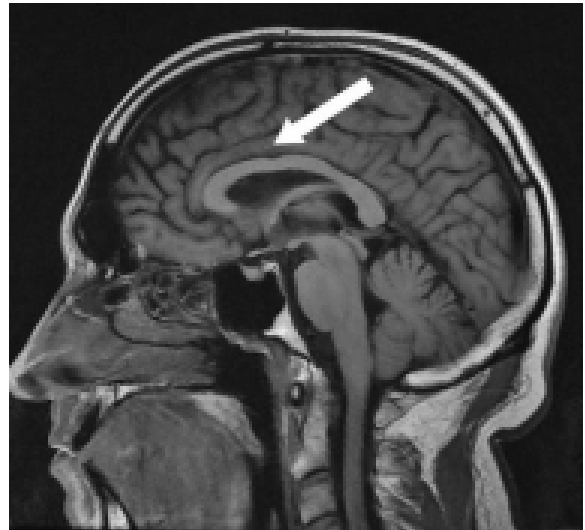
24.



25.



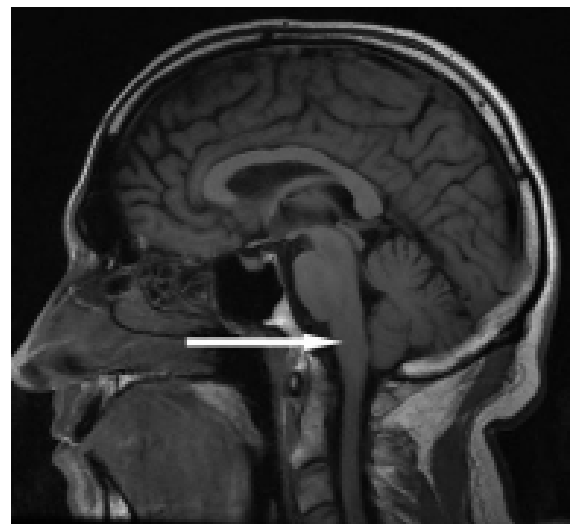
26.



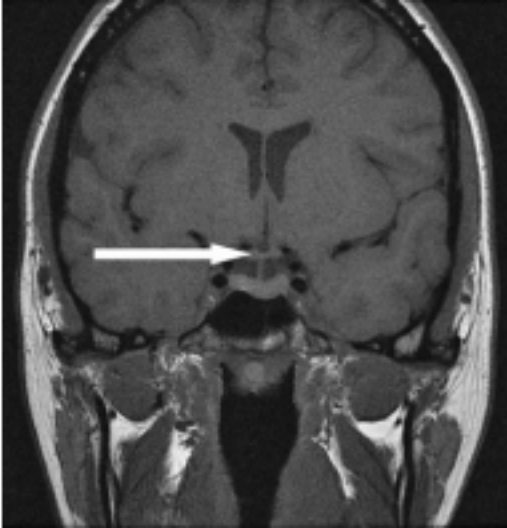
27.



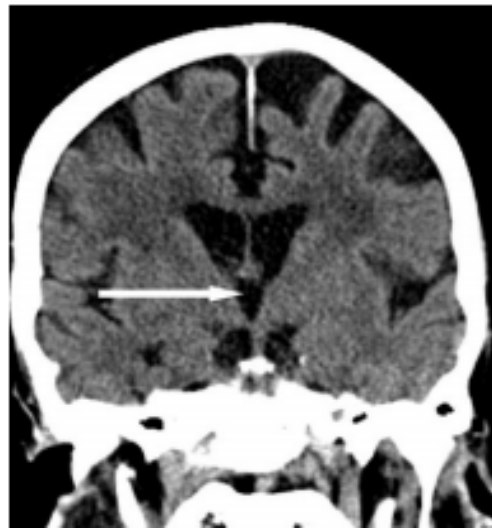
28.



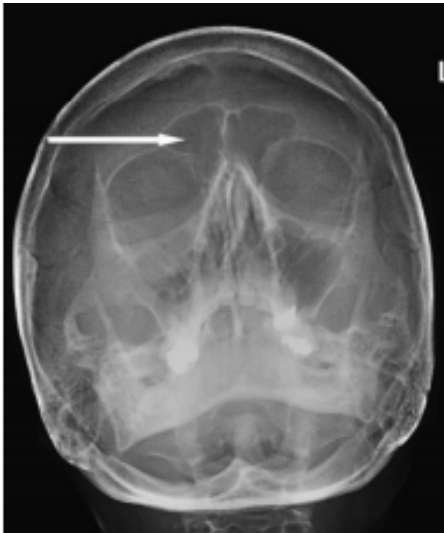
29.



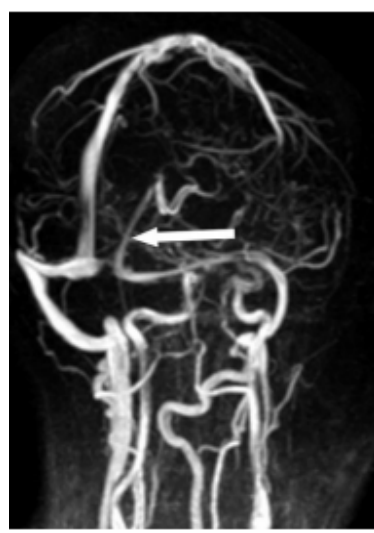
30.



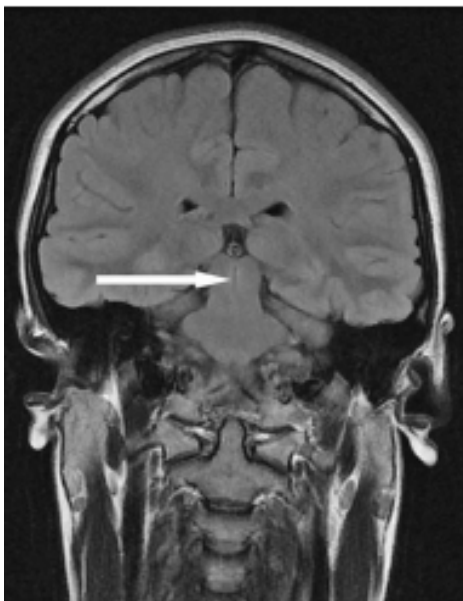
31.



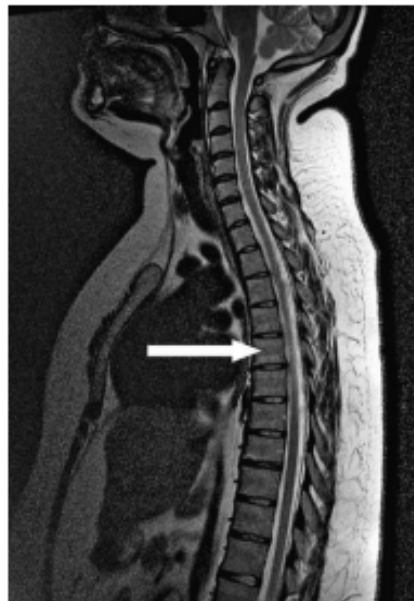
32.



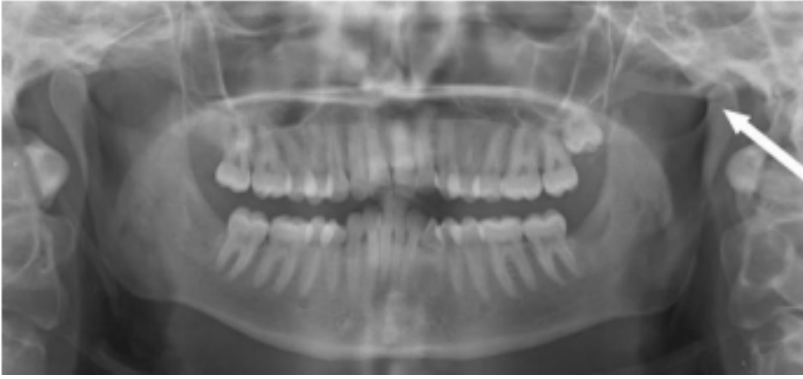
33.



34.



35.



36.



Нейроанатомия. Ответы.

Часть I

1.

- A. Колено мозолистого тела
- B. Супраселлярная цистерна
- C. Прямой синус
- D. Гипофиз
- E. Скат

2.

- A. Клиновидная пазуха
- B. Межножковая цистерна
- C. Водопровод большого мозга
- D. Сосудистое сплетение
- E. Цистерна четверохолмия

3.

- A. Левая лобная пазуха
- B. Петушинный гребень
- C. Правая безымянная линия
- D. Левая верхняя глазничная щель
- E. Правая ветвь нижней челюсти

4.

- A. Левая передняя мозговая артерия
- B. Правая средняя мозговая артерия
- C. Межножковая цистерна
- D. Левое красное ядро
- E. Цистерна четверохолмия

5.

- A. Сигмовидный синус
- B. Поперечный синус
- C. Синусный сток, слияние
- D. Прямой синус
- E. Верхний сагиттальный синус

6.

- A. Передняя дуга атланта
- B. Остистый отросток C2 позвонка
- C. Ножка C6 позвонка
- D. Фасеточный сустав C4/C5 позвонков
- E. Кольцо Харриса

7.

- A. Правая задняя мозговая артерия
- B. Правая внутренняя сонная артерия
- C. Верхний сагиттальный синус
- D. Левый поперечный синус
- E. Левый сигмовидный синус

8.

- A. Задний клиновидный отросток
- B. Турецкое седло
- C. Клиновидная пазуха
- D. Лобная пазуха
- E. Твердое небо

9.

- A. Левая передняя мозговая артерия
- B. Левая внутренняя сонная артерия
- C. Левая средняя мозговая артерия
- D. Развилка основной артерии
- E. Водопровод большого мозга

10.

- A. Сосочковое или сосцевидное тело
- B. IV желудочек
- C. Крыша (Tectum) среднего мозга
- D. Намет мозжечка
- E. Миндалины мозжечка

11.

- A. Правый боковой желудочек
- B. Стебель гипофиза
- C. Перекрест зрительных нервов, хиазма
- D. Гипофиз
- E. Правая внутренняя сонная артерия

12.

- A. Лобный отросток правой скуловой кости
- B. Правая верхнечелюстная пазуха
- C. Петушинный гребень
- D. Левое круглое отверстие
- E. Верхнечелюстной нерв (вторая ветвь тройничного нерва)

13.

- A. Колено мозолистого тела
- B. Головка хвостатое ядро
- C. Левое межжелудочковое отверстие
- D. Левый зрительный бугор, таламус
- E. Валик мозолистого тела

14.

- A. Внутренняя сонная артерия
- B. Передняя соединительная артерия
- C. Передняя мозговая артерия
- D. Средняя мозговая артерия
- E. Основная артерия
- F. Задняя соединительная артерия

15.

- A. Левая позвоночная артерия
- B. Основная артерия
- C. Левая задняя мозговая артерия
- D. Левая средняя мозговая артерия
- E. Передние мозговые артерии

16.

- F. Правая позвоночная артерия
- G. Правая передняя нижняя мозжечковая артерия
- H. Верхняя мозжечковая артерия
- I. Правая внутренняя сонная артерия
- J. Левая внутренняя сонная артерия

17.

- A. Левая задняя мозговая артерия
- B. Правая верхняя мозжечковая артерия
- C. Основная артерия
- D. Правая передняя нижняя мозжечковая артерия
- E. Левая позвоночная артерия

18.

- A. Правая передняя мозговая артерия
- B. Правая средняя мозговая артерия
- C. Правая внутренняя сонная артерия
- D. Правая позвоночная артерия
- E. Основная артерия

19.

- A. Правая средняя мозговая артерия
- B. Правая передняя нижняя мозжечковая артерия
- C. Верхняя мозжечковая артерия
- D. Основная артерия
- E. Левая задняя мозговая артерия

20.

- A. III желудочек
- B. Верхний сагиттальный синус
- C. Сильвиева борозда
- D. Левая височная доля
- E. Левая обводная цистерна

21.

- A. Межполушарная щель
- B. Ствол мозолистого тела
- C. Зрительный бугор (таламус) справа
- D. Варолиев мост
- E. Продолговатый мозг

22.

- A. Квадригеминальная цистерна
- B. Межталамическая спайка
- C. Пластинка четверохолмия
- D. Средний мозг
- E. Большая цистерна

23.

- A. Клюв мозолистого тела
- B. Колено мозолистого тела
- C. Ствол мозолистого тела
- D. Валик (splenium) мозолистого тела
- E. Твердое небо

24.

- A. Правый островок
- B. Левый свод
- C. Средний мозг
- D. Правая средняя ножка мозжечка
- E. Левый боковой желудочек

25.

- A. Правый нижний холмик
- B. Правая верхняя ножка мозжечка
- C. Правая нижняя ножка мозжечка
- D. IV желудочек
- E. Левая горизонтальная щель мозжечка

26.

- A. Правая наружная капсула
- B. Сосудистое сплетение правого бокового желудочка
- C. Валик мозолистого тела
- D. Левая головка хвостатого ядра
- E. Левое чечевичное ядро

27.

- A. Правая сильвиева борозда
- B. Правое хвостатое ядро
- C. Прозрачная перегородка
- D. Левая скорлупа (putamen)
- E. Правая латеральная масса C1 позвонка

28.

- A. Лобная пазуха
- B. Скуловой отросток лобной кости
- C. Лобный отросток скуловой кости
- D. Турецкое седло
- E. Задняя стенка верхнечелюстной пазухи

29.

- A. Основная артерия
- B. Левая общая сонная артерия
- C. Левая внутренняя сонная артерия
- D. Левая средняя мозговая артерия
- E. Правая позвоночная артерия

30.

- A. Твердое небо
- B. Варолиев мост
- C. Зубовидный отросток второго шейного позвонка
- D. Клиновидная пазуха
- E. Валик мозолистого тела

31.

- A. Клиновидная пазуха
- B. Пластинка четверохолмия
- C. Язык
- D. Передняя дуга атланта
- E. Миндалины мозжечка

32.

- A. Правая средняя ножка мозжечка
- B. Правая улитка
- C. Основная артерия
- D. Левый латеральный полукружный канал
- E. IV желудочек

33.

- A. Правая латеральная пластинка крыловидного отростка
- B. Правый нижнечелюстной мышцелок
- C. Левая внутренняя сонная артерия
- D. Левый шиловидный отросток
- E. Левая позвоночная артерия

34.

- A. Затылочная кость
- B. Правая латеральная масса атланта
- C. Зубовидный отросток второго шейного позвонка
- D. Передняя дуга атланта
- E. Сосцевидные ячейки левой височной кости

35.

- A. Правая внутренняя сонная артерия
- B. Основная артерия
- C. Левая надлопаточная артерия
- D. Левая подключичная артерия
- E. Безымянная артерия

36.

- A. Наружная сонная артерия
- B. Общая сонная артерия
- C. Внутренняя сонная артерия
- D. Лицевая артерия
- E. Затылочная артерия
- F. Верхнечелюстная артерия

- G. Поверхностная височная артерия
- H. Средняя оболочечная артерия
- I. Средняя мозговая артерия
- J. Передняя мозговая артерия

37. Ортопантограмма

- A. Левый венечный отросток нижней челюсти
- B. Тело нижней челюсти
- C. Подбородочный симфиз
- D. Левый угол нижней челюсти
- E. Тело C2 позвонка

38. Ортопантограмма

- A. Правая ветвь нижней челюсти
- B. Венечный отросток нижней челюсти
- C. Тело нижней челюсти
- D. Твердое небо
- E. Носовая перегородка

39.

- A. Левая сильвиева борозда
- B. Червь мозжечка
- C. Задняя ножка правой внутренней капсулы
- D. III желудочек
- E. Левое чечевичное ядро

40.

- A. Серповидный отросток, фалькс
- B. Правая средняя ножка мозжечка
- C. Правая гемисфера мозжечка
- D. Намёт мозжечка слева
- E. Варолиев мост

41.

- A. Передняя соединительная артерия
- B. Горизонтальный сегмент (A1) передней мозговой артерии
- C. Внутренняя сонная артерия
- D. Основная артерия
- E. A2 сегмент передней мозговой артерии
- F. Задняя соединительная артерия
- G. Горизонтальный сегмент (P1) задней мозговой артерии

42.

- A. Правая средняя мозговая артерия
- B. Задняя мозговая артерия
- C. Верхняя мозжечковая артерия
- D. Теменно-затылочная артерия
- E. Передние мозговые артерии
- F. Передняя соединительная артерия
- G. Задняя соединительная артерия
- H. Основная артерия
- I. Левая передняя нижняя мозжечковая артерия
- J. Верхние артерии червя мозжечка
- K. Шпорная артерия

Нейроанатомия. Ответы.

Часть II

1. Продолговатый мозг.
2. Внутренняя сонная артерия.
3. Передняя ножка правой внутренней капсулы.
4. Правая скорлупа (putamen).
5. Колено мозолистого тела.
6. Большая цистерна.
7. Правая наружная яремная вена.
8. Эпифиз, шишковидная железа.
9. Правое межжелудочковое отверстие Монро.
10. Предмостовая цистерна.
11. Варолиев мост.
12. Правая внутренняя капсула.
13. Передняя доля гипофиза.
14. Клиновидная пазуха.
15. Зубовидный отросток второго шейного позвонка.
16. Левая средняя мозговая артерия.
17. Ротовая часть глотки, ротоглотка.
18. Мозолистое тело.
19. Поперечный синус.
20. Правая задняя мозговая артерия.
21. Пластинка четверохолмия.
22. Основная артерия.
23. Миндалины мозжечка.

24. Левая гемисфера мозжечка.
25. Левый поперечный отросток первого шейного позвонка.
26. Поясная извилина.
27. Носоглотка.
28. Продолговатый мозг.
29. Хиазма.
30. III желудочек.
31. Правая лобная пазуха.
32. Прямой синус.
33. Водопровод большого мозга.
34. Тело пятого грудного позвонка.
35. Ортопантограмма. Левый нижнечелюстной мышцелок.
36. Нижний сагиттальный синус.

Neuroanatomy. Answers.

Part I

1.

- A. Genu of corpus callosum
- B. Suprasellar cistern
- C. Straight sinus
- D. Pituitary gland
- E. Clivus

2. MRI Brain.

- A. Sphenoidal sinus
- B. Interpeduncular cistern
- C. Aqueduct of Sylvius
- D. Choroid plexus in trigone of left lateral ventricle
- E. Quadrigeminal cisterna

The corpora quadrigemina is made up of the superior and inferior colliculi. The quadrigeminal cistern is the subarachnoid space posterior to it. It contains the confluence of veins which form the great cerebral vein of Galen.

3.

- A. Left frontal sinus
- B. Crista galli
- C. Right innominate line
- D. Left superior orbital fissure
- E. Right ramus of mandible

The innominate line is formed by the lateral greater wing of sphenoid. The superior orbital fissure transmits cranial nerves III, IV, V (ophthalmic division), VI and sympathetic nerves.

4.

- A. Left anterior cerebral artery
- B. Right middle cerebral artery
- C. Interpeduncular cistern
- D. Left red nucleus
- E. Quadrigeminal cistern

5. MRI venogram.

- A. Sigmoid sinus
- B. Transverse sinus
- C. Confluence of the sinuses or torcular herophili
- D. Straight sinus
- E. Superior sagittal sinus

The superior sagittal sinus runs from anterior to posterior of the brain, in the midline and between the two cerebral hemispheres, where it enters the confluence of the sinuses (torcular herophili) anterior to the internal occipital protuberance. The straight sinus is formed from the vein of Galen and the inferior sagittal sinus and is well demonstrated on this image, running from the centre of the brain where it drains into the confluence of the sinuses. The right and left transverse sinuses arise from the confluence and drain into respective tortuous sigmoid sinuses before draining into the internal jugular veins at the jugular foramen.

6. Lateral X-ray of the cervical spine.

- A. Anterior arch of C1
- B. Spinous process of C2
- C. Pedicle of C6
- D. Facet joint C4/C5
- E. Harris' ring.

C1, C2 and C7 are 'special' vertebrae because each differs from the normal structure of the remaining cervical vertebrae.

C1 (the atlas) has no vertebral body.

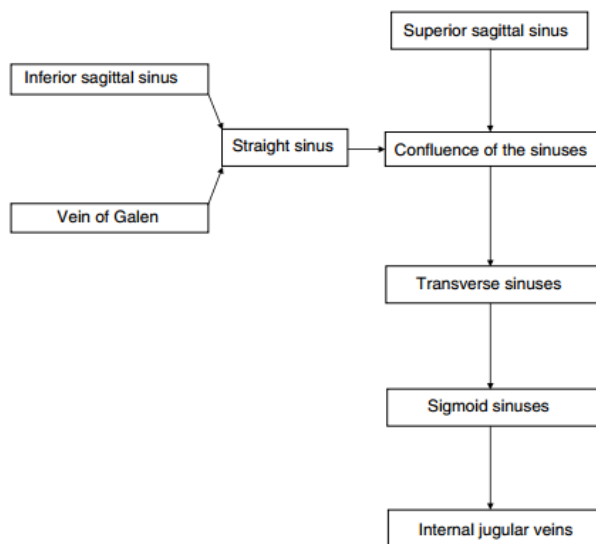
C2 (the axis) has an odontoid peg.

C7 (vertebra prominens) has a prominent longer spinous process than the other cervical vertebrae, which is why it is called the vertebra prominens.

7. MRV of the venous sinuses of the brain.

- A. Right posterior cerebral artery
- B. Right internal carotid artery
- C. Superior sagittal sinus
- D. Left transverse sinus
- E. Left sigmoid sinus

A diagram to aid remembering the sequence:



8. Lateral X-ray of the skull.

- A. Posterior clinoid process
- B. Sella turcica (pituitary fossa)
- C. Sphenoid sinus
- D. Frontal sinus
- E. Hard palate

The sella turcica is a depression within the sphenoid bone that houses the pituitary gland. The anterior border is formed by two small bony eminences called the anterior clinoid processes. The posterior border is formed by a flat square piece of bone called the dorsum sellae, from which two small bony eminences arise called the posterior clinoid processes. These not only deepen the sella but also form the attachment for the tentorium cerebelli. The sphenoid sinuses are paired sinuses within the body of

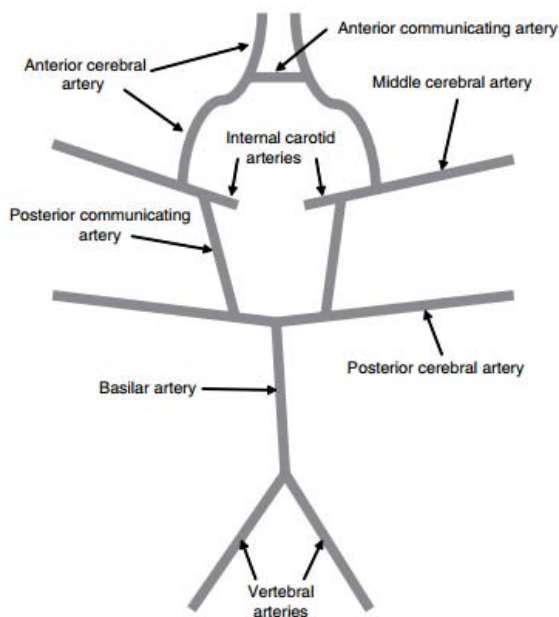
the sphenoid bone. The hard palate forms the anterior two-thirds of the roof of the mouth, separating the mouth from the nasal cavity.

9. Axial CT of the brain with IV contrast.

- A. Left anterior cerebral artery
- B. Left internal carotid artery
- C. Left middle cerebral artery
- D. Basilar artery tip
- E. Aqueduct of Sylvius

The circle of Willis is a circle of arteries that supplies the brain and includes:

- The anterior cerebral arteries.
- The anterior communicating artery.
- The internal carotid arteries.
- The posterior communicating arteries.
- The posterior cerebral arteries



10. Sagittal T1 MRI of the brain.

- A. Mammillary body
- B. Fourth ventricle
- C. Tectum of the midbrain
- D. Tentorium cerebelli
- E. Cerebellar tonsil

The mammillary bodies are a pair of rounded prominences at the anterior arches of the fornix. They are part of the limbic system. They can be damaged as a result of thiamine deficiency (Wernicke–Korsakoff syndrome). The fourth ventricle is the most inferior of the ventricular spaces and is diamond-shaped in cross section. It connects to the third ventricle via the aqueduct of Sylvius, and drains via the foramen of Luschka (two lateral tracts) and the foramen of Magendie (single midline tract). The tectum is located at the dorsal region of the midbrain and consists of superior (visual) and inferior (auditory) colliculi. There is a cerebellar tonsil on the undersurface of each cerebellar hemisphere in continuity with the uvula of the cerebellar vermis. It is helpful to assess these on sagittal section to look for elongation and descent of the cerebellar tonsils into the foramen magnum, which can be associated with raised intracranial pressure or congenital malformations (Chiari malformations).

11. Coronal T1 MRI of the brain with IV contrast.

- A. Right lateral ventricle
- B. Infundibulum (pituitary stalk)
- C. Optic chiasm
- D. Pituitary gland
- E. Right internal carotid artery

The pituitary gland lies within the sella turcica, which is covered by a dural fold called the diaphragma sellae. It is connected to the hypothalamus by a thin process called the infundibulum (or pituitary stalk). The pituitary gland is generally divided into two sections – anterior (adenohypophysis) and posterior (neurohypophysis). There is a further intermediate section, but this is only a few cells thick and is generally included with the anterior pituitary.

At birth, the pituitary gland is globular in shape and exhibits a generalized high signal on T1-weighted MRI. By six weeks of age this high signal has largely diminished in the anterior lobe, which returns an isointense signal similar to brain parenchyma.

The posterior pituitary continues to display a high signal on T1-weighted MRI, giving rise to the characteristic posterior pituitary bright spot. This normal finding is said to be related to the high neurophysin content of the posterior pituitary.

The adult pituitary gland is normally 3–8 mm in height, and is generally larger in females.

Anatomical relations to the pituitary gland:

- | | |
|-----------------|--|
| Superior | Optic chiasm (within suprasellar cistern) |
| Lateral | Cavernous sinuses (walls of the pituitary fossa) |
| Anteroposterior | Sphenoid sinus |

This image displays an incidental finding of a cavum septum pellucidum.

12. PA X-ray of the skull.

What nerve passes through D?

- A. Frontal process of the right zygomatic bone
- B. Right maxillary antrum
- C. Crista galli
- D. Left foramen rotundum
- E. Maxillary branch of the trigeminal nerve

The trigeminal nerve arises from the lateral surface of the pons and within millimeters enters the trigeminal ganglion, from which three major branches arise and exit the cranium through different foramina. The table below outlines the three divisions:

Division	Exit foramina of the skull	Sensory innervation
Ophthalmic division (V ¹)	Superior orbital fissure	Skin of the forehead and superior to the eye
Maxillary division (V ²)	Foramen rotundum, followed by infraorbital foramen	Skin inferior to the eye and superior to the mouth
Mandibular division (V ³)	Foramen ovale	Lower lip, teeth and gums, chin and jaw (also has motor innervation to the muscles of mastication)

The foramen rotundum is projected below the inferior rim of the orbit on facial radiographs and connects the middle cranial fossa with the pterygopalatine fossa. The crista galli is a ridge of bone that extends superiorly from the cribriform plate. It forms the anterior attachment for the falx cerebri. The anterior margin of the lateral orbital wall seen on facial bone radiographs is formed inferiorly by the orbital process of the zygomatic bone and the zygomatic process of the frontal bone superiorly. The junction of these two bones forms the zygomaticofrontal suture.

13. MRI Brain.

- A. Genu of corpus callosum
- B. Head of right caudate nucleus
- C. Left interventricular foramen of Monro
- D. Left thalamus
- E. Splenium of corpus callosum

14.

- A. Internal carotid artery
- B. Anterior communicating artery
- C. Anterior cerebral artery (ACA)
- D. Middle cerebral artery (MCA)
- E. Basilar artery
- F. Posterior communicating artery

15.

- A. Left vertebral artery
- B. Basilar artery
- C. Left posterior cerebral artery (PCA)
- D. Left middle cerebral artery (MCA)
- E. Anterior cerebral arteries

16.

- F. Right vertebral artery
- G. Right anterior inferior cerebellar artery (AICA)
- H. Superior cerebellar artery (SCA);
- I. Right internal carotid artery (ICA)
- J. Left internal carotid artery

17. This is an MR image (MIP) demonstrating the arterial supply to the brain – the circle of Willis.

- A. Left posterior cerebral artery
- B. Right superior cerebellar artery
- C. Basilar artery
- D. Right anterior inferior cerebellar artery
- E. Left vertebral artery

18. MR angiogram of the circle of Willis.

- A. Right anterior cerebral artery
- B. Right middle cerebral artery
- C. Right internal carotid artery
- D. Right vertebral artery
- E. Basilar artery

The circle of Willis is a pentagonal arterial circle and comprises of, from posterior to anterior:

- Posterior cerebral arteries, making the back wall.
- Posterior communicating arteries, making the posterior side walls.
- Internal carotid arteries, making the corners.
- Anterior cerebral arteries, making the anterior side walls.

- Anterior communicating artery, making the tip and connecting the anterior cerebral arteries.

The basilar artery, which is formed by the two vertebral arteries, divides into the posterior cerebral arteries and is not considered part of the circle.

19.

- A. Right middle cerebral artery (MCA)
- B. Right anterior inferior cerebellar artery (AICA)
- C. Superior cerebellar artery (SCA)
- D. Basilar artery
- E. Left posterior cerebral artery (PCA)

20. Coronal T1 MRI of the brain.

- A. Third ventricle
- B. Superior sagittal sinus
- C. Left sylvian fissure
- D. Left temporal lobe
- E. Left ambient cistern

The surface of the cerebral hemispheres is divided with fissures and sulci. Fissures involve the entire thickness of the cerebral wall, while sulci only affect the surface of the wall. The sylvian fissure lies superior to the temporal lobe and divides the frontal and parietal lobe. It is an important landmark when reviewing area on CT scans to look for evidence of subarachnoid hemorrhage.

Cisterns are cerebrospinal-fluid-filled subarachnoid spaces in the brain. Starting from inferiorly to superiorly these are:

Cisterna magna	Also known as the cerebellomedullary cistern The largest of the cisterns and located between the posterior surface of the medulla oblongata and the cerebellum
Prepontine cistern	Located anterior to the pons
Suprasellar cistern	The cistern located just superior to the pituitary fossa Continuous posteriorly with the interpeduncular cistern
Interpeduncular cistern	Located between the cerebral peduncles Continuous anteriorly with the suprasellar cistern and inferiorly with the prepontine cistern
Ambient cistern	Basically, a thin extension of the quadrigeminal cistern Extends laterally from the quadrigeminal cistern around the midbrain of the brainstem to connect to the interpeduncular cistern
Quadrigeminal cistern	Also known as the superior cistern or the cistern of the great cerebral vein as it contains the great cerebral vein Located between the superior surface of the cerebellum and the splenium of the corpus callosum
Cistern of the velum interpositum	Also known as the cavum velum interpositum A triangular space seen on axial CT Located just superior to the quadragminal cistern, with which it is continuous

21. Coronal T1 MRI of the brain.

- A. Interhemispheric fissure
- B. Body of the corpus callosum
- C. Right thalamus
- D. Pons
- E. Medulla

22. Sagittal T1 MRI of the brain.

- A. Quadrigeminal cistern
- B. Massa intermedia
- C. Tectum (quadrigeminal plate)
- D. Midbrain
- E. Cisterna magna

The thalami form the majority of the lateral walls of the third ventricle. In 70–80% of people there is a midline interthalamic adhesion known as the massa intermedia. It is made up of nerve cell bodies and a few nerve fibres. The exact function of this adhesion is not known and its absence does not cause any functional defects.

The cerebellum is also well demonstrated on this image. It is divided into two hemispheres, which are then further subdivided by the deep fissures into lobules. The

primary fissure (fissura prima) defines the anterior cerebellar lobe from the posterior lobe.

It is worth having a general understanding of the blood supply to the cerebellum.

There are three main arteries that supply it:

Superior cerebellar artery (SCA – branch of the distal basilar artery)	Superior surface of the cerebellar hemispheres down to the horizontal fissures Superior vermis Dentate nucleus Majority of the cerebellar white matter
Anterior inferior cerebellar artery (AICA – branch of the proximal basilar artery)	Middle cerebellar peduncle Flocculus Antero-inferior surface of the cerebellum
Posterior inferior cerebellar artery (PICA – branch of the distal vertebral arteries)	Postero-inferior cerebellar hemispheres to the horizontal fissure Inferior vermis

23. Sagittal T1 MRI of the brain.

- A. Rostrum of the corpus callosum
- B. Genu of the corpus callosum
- C. Body of the corpus callosum
- D. Splenium of the corpus callosum
- E. Hard palate

The corpus callosum is the largest white matter structure of the brain. It connects the cerebral hemispheres of the brain and allows communication between them.

The corpus callosum is divided into five parts:

Genu	Anterior portion of the corpus callosum Genu is Latin for knee: this part can be seen to resemble a bent knee
Splenium	Posterior part of the corpus callosum PoSterior for Splenium
Body	Lies between the genu and the splenium
Isthmus	Thin posterior part between the body and the splenium
Rostrum	Rostrum is Latin for rooster: the rostrum is supposed to resemble the crest on a rooster Extends inferiorly and posteriorly from the genu

24. Coronal T1 MRI of the brain.

- A. Right insula
- B. Left fornix
- C. Midbrain
- D. Right middle cerebellar peduncle
- E. Left lateral ventricle

The insula is an area of pronounced grey-white differentiation readily seen on CT and MRI. It is located between the sylvian fissure and external capsule, and is supplied by small perforating branches of the middle cerebral artery. Loss of the insular stripe is an early sign of middle cerebral artery (MCA) territory stroke. The fornix is a C-shaped bundle of white matter fibres that connects the hippocampus to the mammillary bodies and septal nuclei. The fibres at the hippocampus are known as the fimbria. The separate left and right sides are known as the crus of the fornix, and where they come together in the midline is called the body of the fornix.

25. Coronal T1 MRI of the brain.

- A. Right inferior colliculus
- B. Right superior cerebellar peduncle
- C. Right inferior cerebellar peduncle
- D. Fourth ventricle
- E. Left horizontal fissure of the cerebellum

There are four colliculi located on the anterior half of the midbrain – two superior and two inferior. Together they form part of the corpora quadrigemina. The superior colliculi are above the trochlear nerve and are visual processing centres. The inferior colliculi are involved in auditory processing.

26. Axial T2 FLAIR MRI of the brain.

- A. Right external capsule
- B. Choroid plexus in the right lateral ventricle
- C. Splenium of the corpus callosum
- D. Left caudate nucleus (head)
- E. Left lentiform nucleus

The external capsule is a collection of white matter tracts seen lateral to the lentiform nucleus of each hemisphere. The lentiform nucleus (named after its shape) consists of two parts – globus pallidus (medial) and putamen (lateral). The caudate nucleus is C-shaped and consists of a head, body and tail. The head of the caudate nucleus forms part of the floor and wall of the anterior horn of the lateral ventricle. The caudate nucleus is separated from the lentiform nucleus by the anterior limb of the internal capsule.

27. Coronal T1 MRI of the brain.

- A. Right sylvian fissure
- B. Right caudate nucleus
- C. Septum pellucidum
- D. Left putamen
- E. Right lateral mass of C1

The septum pellucidum is a thin membrane separating the anterior horns of the lateral ventricles. It consists of two layers of both white and grey matter, called the laminae septi pellucidi. During foetal development there is a space between these two laminae called the cavum septum pellucidum. This is fused in 85% of individuals by six months of age but can persist into adulthood as a normal variant.

28. Lateral X-ray of the facial bones.

- A. Frontal sinus
- B. Zygomatic process of the frontal bone
- C. Frontal process of the zygomatic bone
- D. Pituitary fossa
- E. Posterior wall of the maxillary sinus

The frontozygomatic suture lies in the region of the superolateral orbital margin. It is the point where the zygomatic process of the frontal bone meets the frontal process of the zygomatic bone.

29.

- A. Basilar artery
- B. Left common carotid artery
- C. Left internal carotid artery
- D. Left middle cerebral artery
- E. Right vertebral artery

30.

- A. Hard palate
- B. Pons
- C. Odontoid process of C2 (axis) vertebrae
- D. Sphenoid sinus
- E. Splenium of corpus callosum

The intracranial carotid artery has a very tortuous course; this may have a role in reducing the pulsating force to the brain. Its intracranial course has been divided into seven anatomical segments according to Bouthillier's classification.

31.

- A. Sphenoid sinus
- B. Quadrigeminal plate
- C. Tongue
- D. Anterior arch of atlas
- E. Cerebellar tonsil

32. Axial T2 MRI of the internal auditory meatus.

- A. Right middle cerebellar peduncle
- B. Right cochlea
- C. Basilar artery
- D. Left lateral semicircular canal
- E. Fourth ventricle

T2 imaging of the brain can be easily recognized by the high signal intensity of the cerebrospinal fluid. MRI has become a primary imaging modality for demonstrating the internal auditory meatus for pathology, such as acoustic neuromas. The seventh and eighth cranial nerves enter the internal acoustic meatus. The cochlea can be recognized as it is fluid filled and therefore has a high signal.

The basilar artery lies anterior to the pons in the prepontine cistern and appears black on T2-weighted imaging owing to signal flow void. The cerebellum communicates with the brainstem via the cerebellar peduncles. The fourth ventricle is bounded anteriorly by the pons and upper half of the medulla, posteriorly by the cerebellum and laterally by the cerebellar peduncles. It is continuous with the aqueduct of Sylvius superiorly and the central canal of the spinal cord inferiorly.

33. Axial CT of the upper neck with IV contrast.

- A. Right lateral pterygoid plate
- B. Right mandibular condyle
- C. Left internal carotid artery
- D. Left styloid process
- E. Left vertebral artery

34. X-ray of the odontoid peg

- A. Occipital bone
- B. Right lateral mass of C1
- C. Odontoid peg
- D. Anterior arch of C1
- E. Left mastoid air cells

The odontoid peg (dens) is a bony projection from the body of C2 (axis). The peg articulates with the posterior surface of the anterior arch of the atlas and has ligamentous attachments to the atlas and occipital bone. Fractures of the peg are classified into three different types:

- Type I Fracture through the tip
- Type II Fracture through the base (most common)
- Type III Fracture through the body of C2

35. Coronal MR angiogram of the neck.

- A. Right internal carotid artery
- B. Basilar artery
- C. Left suprascapular artery
- D. Left subclavian artery
- E. Brachiocephalic artery

The common carotid arteries bifurcate into the internal and external carotid arteries at approximately the C3 or C4 level. The internal carotid artery has no branches in the neck. The basilar artery supplies blood to the posterior part of the circle of Willis and arises from the confluence of the two vertebral arteries. The left subclavian artery is usually the third aortic arch branch (excluding the coronary arteries). The brachiocephalic artery is the first aortic arch branch.

36.

- A. External carotid artery
- B. Common carotid artery
- C. Internal carotid artery
- D. Facial artery
- E. Occipital artery
- F. Maxillary artery
- G. Superficial temporal artery
- H. Middle meningeal artery
- I. Middle cerebral artery
- J. Anterior cerebral artery

37. Orthopantomogram (OPG).

- A. Left coronoid process of mandible
- B. Right body of mandible
- C. Symphysis menti
- D. Left angle of mandible
- E. C2 vertebral body

38. Orthopantomogram (OPG).

- A. Right ramus of mandible
- B. Coronoid process of left mandible
- C. Body of right mandible
- D. Hard palate
- E. Nasal septum

The OPG is a panoramic dental X-ray view of the upper and lower jaw displaying the upper and lower teeth and includes the temporomandibular joints on either side. The nature of the panoramic view demonstrates the hard palate as a straight line. The hyoid bone can also be seen in the bottom corners of the image. The mandible is made up of two halves, each half consisting of a body, an angle, a ramus, a coronoid process and a condylar neck and process.

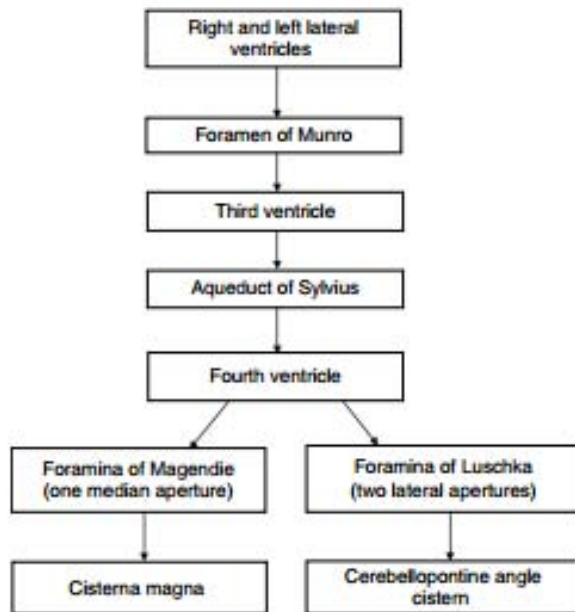
39. Axial CT of the brain.

- A. Left sylvian fissure
- B. Cerebellar vermis
- C. Posterior limb of the right internal capsule
- D. Third ventricle
- E. Left lentiform nucleus

On brain CT the white matter appears darker than the cortical grey matter. The internal and external capsules are white matter tracts and can therefore be visualized as low attenuation lines adjacent to the basal ganglia. The external capsule is lateral to the lentiform nucleus and medial to the insular cortex. Cerebrospinal fluid spaces within the brain can be readily identified by their fluid attenuation and appear almost black.

The ventricular system of the brain is continuous with the central canal of the spinal cord. There are four ventricles – the right and left lateral ventricles, the third ventricle and the fourth ventricle. The lateral ventricles are large C-shaped structures, which

have frontal, temporal and occipital horns. The third ventricle lies within the midline between the thalami and the fourth ventricle which lies within the hindbrain. They all communicate via different foramina. The following flow diagram depicts the ventricular system and the foramina:



40. Axial CT of the brain.

- A. Falx cerebri
- B. Right middle cerebellar peduncle
- C. Right cerebellar hemisphere
- D. Left tentorium cerebelli
- E. Pons

The falx cerebri is a scythe-shaped fold of dura mater in the longitudinal fissure between the two cerebral hemispheres. It attaches anteriorly to the crista galli of the ethmoid and posteriorly to the upper surface of the tentorium cerebelli. The tentorium cerebelli is a tent of dura that separates the cerebellum from the inferior portion of the occipital lobe, thus defining the supratentorial and infratentorial spaces.

The cerebellum is connected to the rest of the central nervous system by three pairs of nerve tracts known as cerebellar peduncles. The inferior cerebellar peduncles connect the medulla spinalis and medulla oblongata with the cerebellum. They form a thick strand between the lower part of the fourth ventricle and the roots of the ninth and tenth cranial nerves. The middle cerebellar peduncles connect the pontine nuclei to the contralateral cerebellum. Their fibres are arranged in three fasciculi – superior, inferior and deep. The superior cerebellar peduncles connect the cerebellum to the midbrain. They form the upper lateral boundaries of the fourth ventricle. The anterior medullary velum connects the superior cerebellar peduncles, and between them they also form the roof the fourth ventricle.

41.

- A. Anterior communicating artery
- B. Horizontal (A1) ACA
- C. Internal carotid artery
- D. Basilar artery
- E. A2 ACA segment
- F. Posterior communicating artery
- G. Horizontal (P1) PCA segments

42.

- A. Right middle cerebral artery
- B. Posterior cerebral artery
- C. Superior cerebellar artery
- D. Parieto-occipital artery
- E. Anterior cerebral arteries
- F. Anterior communicating artery
- G. Posterior communicating artery
- H. Basilar artery
- I. Left anterior inferior cerebellar artery
- J. Superior vermian arteries (branches of SCA)
- K. Calcarine artery

Neuroanatomy. Answers.

Part II

1. Axial T2-weighted MRI of the brain.

Answer: Medulla oblongata.

On axial images, it can be difficult to determine the level of the brainstem on a single slice. The key is to look at the shape of the section of brainstem and also the surrounding anatomy.

The medulla is the most inferior portion of the brainstem. Some of the surrounding structures to take note of are the maxillary antra and the mandibular condyles, which indicate the inferior position in the skull. The medulla connects to the pons (superiorly) and to the spinal cord (inferiorly) at the level of the foramen magnum. It lies anterior to the fourth ventricle. It has connections to the cerebellum via the inferior cerebellar peduncles (pictured). Its ventral surface is made up of the pyramids (anteromedially) and the olives (posterolaterally).

2. Coronal MRI of the brain.

Answer: Right internal carotid artery.

The internal carotid artery lies lateral to the optic chiasm and superior to the sphenoid sinuses.

It is divided into four segments:

- Cervical: arises posterolaterally from the bifurcation of the common carotid artery at the level of C4 and has no branches
- Petrous: through the foramen lacerum
- Cavernous: through the cavernous sinus
- Supraclinoid

3. Axial T2-weighted MRI of the brain.

Answer: Anterior limb of the right internal capsule.

This is a white matter tract that separates the caudate (medially) from the lentiform nucleus (laterally). It returns a lower signal on T2-weighted imaging relative to the lentiform nucleus.

4. Axial T2-weighted MRI of the brain.

Answer: Right putamen.

The putamen lies lateral to the anterior limb of the internal capsule and anterolateral to the globus pallidus.

Putamen + caudate nucleus = striatum

Putamen + globus pallidus = lentiform nucleus

5. Axial T2-weighted MRI of the brain.

Answer: Genu of corpus callosum.

The genu is the anterior pole of the corpus callosum.

Genu is Latin for 'knee'. Notice its shape when viewed in the sagittal plane.

6. Axial T2-weighted MRI of the brain.

Answer: Cisterna magna.

The cisterna magna is a cerebrospinal fluid-filled arachnoid space in the posterior fossa. It is situated between the cerebellar hemispheres and posterior to the inferior aspect of the medulla. It is connected to the fourth ventricle via the foramina of Luschka and Magendie.

7. Axial T1-weighted MRI of the neck.

Answer: Right external jugular vein.

At the level of the mandible, the posterior branch of the retromandibular vein and the posterior auricular vein join to form the external jugular vein. It is superficial to the sternocleidomastoid muscle. It terminates above the midpoint of the clavicle where it joins the subclavian vein. The external jugular vein drains the scalp and face.

8. Axial CT of the brain.

Answer: Pineal gland.

The pineal gland is a small (< 1 cm) endocrine gland that is shaped like a pine cone, hence its name. It is found in the midline, posterior to the third ventricle, and between the left and right thalami. It is calcified in approximately 50% of the population by the age of 20 (as shown in the image).

9. Axial CT of the brain.

Answer: Right interventricular foramen of Monro.

The foramen of Monro is a paired structure that connects the left and right lateral ventricles to the third ventricle. It forms the anterior border of the third ventricle.

10. Axial T2-weighted MRI of the brain.

Answer: Prepontine cistern.

The prepontine cistern is a cerebrospinal fluid-filled space that lies anterior to the pons. It contains the basilar artery and two of its paired branches: the anterior inferior cerebellar artery and superior cerebellar arteries. The abducens nerve (CN VI) traverses it.

11. Axial T2-weighted MRI of the brain.

Answer: Pons.

The pons is the mid-portion of the brainstem and connects the midbrain (superiorly) and the medulla (inferiorly). It lies posterior to the prepontine cistern and anterior to the fourth ventricle. It is located between the two temporal lobes. The pons is connected to the cerebellar hemispheres posteriorly via the middle cerebellar peduncles (pictured) and the inferior cerebellar peduncles.

12. Coronal MRI of the brain.

Answer: Right internal capsule.

The internal capsule separates the caudate (medially) and the lentiform nucleus (laterally). It returns a lower signal on T2-weighted image relative to the lentiform nucleus.

13. Sagittal T1-weighted MRI of the brain.

Answer: Anterior pituitary gland.

The pituitary gland is located in the sella turcica (Latin for ‘Turkish saddle’), inferior to the optic chiasm. It is connected to the hypothalamus via the infundibulum (stalk). It demonstrates strong contrast enhancement because it is not contained within the blood–brain barrier. The posterior pituitary gland is bright on a T1-weighted (unenhanced) scan.

14. T1-weighted sagittal MRI of the head.

Answer: Sphenoid sinus.

At first glance, this structure may seem difficult to identify, but it is easy to work out. The image shows a midline sagittal slice with the arrow pointing to a very low signal intensity structure similar to that outside the patient—that is, air. The only midline air-filled structures are the frontal (also pictured) and sphenoid sinuses. The ethmoid sinuses are paramidline and consist of many small air cells.

15. Lateral radiograph of the cervical spine.

Answer: Dens/odontoid process/odontoid peg.

The second cervical vertebra (axis/C2) is characterised by the dens—a bony projection that arises perpendicularly from the vertebral body. Lying immediately anterior to the dens is the anterior arch of the first cervical vertebra (atlas/C1).

There is a pivot articulation between the dens and the ring formed anteriorly by the anterior arch, and posteriorly by the transverse ligament of C1. This articulation is part of the atlantoaxial joint that allows C1 to rotate on C2.

16. MR angiogram of the circle of Willis (MIP image).

Answer: Left middle cerebral artery.

The middle cerebral artery (MCA) is the largest branch of the internal carotid artery. It does not actually form one of the sides of the pentagon that is the circle of Willis. Instead, it branches from the internal carotid artery and travels laterally into the insula toward the cortex where it terminates.

The MCA and its branches supply the basal ganglia, the anterior part of the internal capsule, the lateral cerebral cortex, the anterior temporal lobe, and the insular cortex. The segment from the origin to the bifurcation/trifurcation is referred to as the M1 segment (as shown in the image).

17. Sagittal T2-weighted MRI of the neck.

Answer: Oropharynx.

The oropharynx is the part of the pharynx that lies between the nasopharynx (superior) and laryngopharynx (inferior). It extends from the free edge of the soft palate to the superior border of the epiglottis. The posterior third of the tongue forms the anterior wall of the oropharynx. Note the fracture-dislocation at C4/5.

18. Sagittal T1-weighted MRI of the brain.

Answer: Corpus callosum.

The corpus callosum is a midline C-shaped structure that is composed of a flat bundle of nerve fibres.

19. MR venogram (MIP image).

Answer: Transverse sinus.

The left and right transverse sinuses emerge from the confluence of the sinuses. The right is usually a continuation of the superior sagittal sinus, whereas the left is usually continuous with the straight sinus. It is not possible to determine whether this is the left or the right transverse sinus in the image. Where the sinus takes a downward turn in the mastoid bone is referred to as the sigmoid sinus. Once the sigmoid sinus has passed through the jugular foramen, it becomes the internal jugular vein.

20. MRA of the circle of Willis (MIP image).

Answer: Right posterior cerebral artery.

The posterior cerebral arteries (PCAs) are terminal branches of the basilar artery. The PCAs complete the circle of Willis by joining the internal carotid arteries via the posterior communicating arteries. The PCA supplies the inferior occipital and temporal lobes.

21. Sagittal T2-weighted MRI of the brain.

Answer: Quadrigeminal (tectal) plate.

The quadrigeminal plate is the dorsal portion of the midbrain. It is made up of the paired superior and inferior colliculi. It is responsible for visual and auditory reflexes. The quadrigeminal plate is located within the quadrigeminal cistern.

22. MR angiogram with MIP image of the circle of Willis.

Answer: Basilar artery.

It is vital to memorise the components that form the circle of Willis because it is a common examination question. The basilar artery is an unpaired vessel that is formed by the union of the two vertebral arteries. It lies close to the midline in most people but can deviate to one side away from the dominant vertebral artery. It terminates by dividing into the left and right posterior cerebral arteries.

23. Sagittal T2-weighted MRI of the brain.

Answer: Cerebellar tonsil.

The cerebellar tonsil is the most inferior lobule of the cerebellar hemisphere. It lies posterior to the medulla. Its inferior tip lies above or at the level of the foramen magnum.

24. Coronal FLAIR MRI of the brain.

Answer: Left cerebellar hemisphere.

The cerebellum is an infratentorial structure in the posterior fossa.

It is separated by the median cerebellar vermis into the right and left cerebellar hemispheres.

The cerebellar hemispheres are separated into lobules by fissures (folia).

The cerebellum is connected to the brainstem via three cerebellar peduncles:

- Superior peduncle connects to the midbrain
- Middle peduncle connects to the pons
- Inferior peduncle connects to the base of the pons

25. Axial CT of the neck.

Answer: Left transverse process of atlas (C1).

The atlas is unique in its structure and readily identifiable on a single axial image.

The anterior and posterior tubercles typical of C3-C7 vertebrae are fused in the atlas to form a relatively large process that projects laterally and inferiorly from the lateral mass. Each transverse process contains the foramen transversarium, which transmits the vertebral artery, vertebral vein, and nerves.

26. Sagittal T2-weighted MRI of the brain.

Answer: Cingulate gyrus.

The cingulate gyrus is a midline curved structure that lies inferior to the frontal lobes and superior to the corpus callosum. It is separated from the corpus callosum by the cingulate sulcus. The cingulate gyrus forms part of the limbic system.

27. Sagittal T1-weighted MRI of the brain.

Answer: Nasopharynx.

The nasopharynx is the most superior portion of the pharynx.

It extends from the skull base to the soft palate and is connected to the nasal cavities.

It lies anterior to the pharyngeal tonsils (most prominent in childhood).

28. Sagittal MRI of the brain.

Answer: Medulla.

The medulla is the most inferior portion of the brainstem. It connects the pons (superiorly) to the spinal cord (inferiorly at the level of the foramen magnum).

It lies anterior to the fourth ventricle. Its ventral surface is made up of the pyramids (anteromedial) and the olives (posterolaterally). Its posterior portion contains the nucleus gracilis (medial) and nucleus cuneatus (lateral).

29. Coronal T1-weighted MRI of the brain.

Answer: Optic chiasm.

The optic chiasm is located in the suprasellar cistern.

It lies superior to the pituitary gland and anterior to the pituitary stalk (infundibulum).

30. Coronal CT of the brain.

Answer: Third ventricle.

- The third ventricle is a slitlike structure in the midline.
- The third ventricle is connected to the fourth ventricle via the aqueduct of Sylvius.
- The borders of the third ventricle are:
 - Anterior: columns of fornix, foramina of Monro, anterior commissure, optic chiasm, optic recess, and lamina terminalis
 - Lateral: thalamus (superiorly) and hypothalamus (inferiorly)
 - Roof: body of fornix (medially), choroid fissure, thalamus, and stria medullaris (laterally)
 - Floor: optic chiasm, infundibulum, tuber cinereum, and mamillary bodies

- Its anatomic recesses include the optic recess, infundibular recess, pineal recess, suprapineal recess, and interthalamic adhesion (massa intermedia).

31. Occipitomenal radiograph of the face.

Answer: Right frontal sinus.

The frontal sinuses are mucosa-lined airspaces in the frontal bone.

They are located above the orbits and form part of the paranasal sinuses.

They vary in shape and are usually paired.

32. MR venogram.

Answer: Straight sinus.

The straight sinus is situated at the junction of the falx cerebri and the tentorium cerebelli. It receives blood from the inferior sagittal sinus and the great cerebral vein of Galen. In this example, the straight sinus is draining into the left transverse sinus, but it can also drain into the confluence of the sinuses or the right transverse sinus.

33. Coronal MRI of the brain.

Answer: Aqueduct of Sylvius (cerebral aqueduct).

The aqueduct of Sylvius is a thin, midline tube that connects the third ventricle to the fourth ventricle. It is located in the midbrain between the pons (anterior) and the cerebellum (posterior). It is filled with cerebrospinal fluid.

34. Sagittal MRI of the cervicothoracic spine.

Answer: T5 vertebral body.

You can determine the number of the vertebrae by counting down from the odontoid process of C2.

There are 24 articulating vertebrae within the vertebral column: 7 cervical, 12 thoracic, and 5 lumbar. There are five sacral and four coccygeal bones that are not separated by intervertebral discs and are fused.

35. Orthopantomogram.

Answer: Left mandibular condyle.

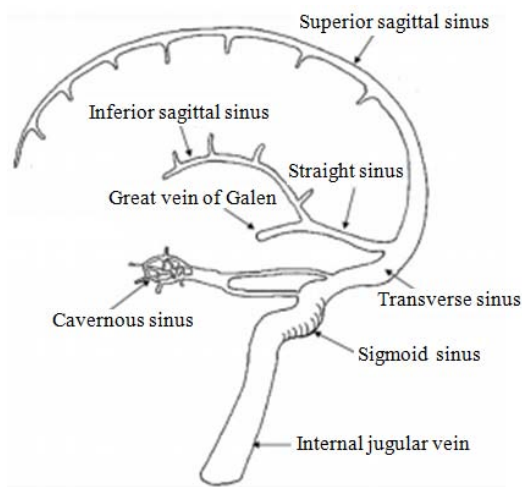
The mandibular condyle articulates with the mandibular fossa of the temporal bone to make the Temporomandibular joint. Do not confuse them with the coronoid

processes, which are seen medial to the mandibular condyles on the orthopantomogram.

36. MR venogram.

Answer: Inferior sagittal sinus.

The inferior sagittal sinus runs along the inferior border of the falx cerebri. It drains into the straight sinus, as does the great cerebral vein of Galen. It can be distinguished from the great vein by the fact that it parallels the course of the superior sagittal sinus. The figure below shows the main dural venous sinuses.



References

1. Niall Moore, Yu-Yul Bashir, Hassan Elhassan, Jean Lee, Heiko Peschl, Matt Smedley. Passing the FRCR Part 1: Cracking Anatomy. Thieme Medical Publishers, New York, 2014
2. Mark R. Shaya, Remi Nader, Jonathan S. Citow, Hamad I. Farhat, Abdulrahman J. Sabbagh. Neurosurgery Rounds. Questions and Answers. Thieme Medical Publisher, New York, 2011.
3. Aidan Shaw, Benjamin Smith, David C. Howlett. FRCR Part 1 Anatomy Mock Examinations. Cambridge University Press, UK, 2011
4. Kiat Tsong Tan, John Curtis, Jessie Aw. Final FRCR 2B Viva. A Survival Guide. Cambridge University Press, UK, 2012
5. Jessie Aw, John Curtis. Final FRCR 2B Long Cases. A Survival Guide. Cambridge University Press, UK, 2010