Excerpts
Bare Minimum Neurology and Neuroanatomy
Visual Field Defects
LESIONS OF THE VISUAL PATHWAY

Normally damage to the brain cortex causes contralateral deficits in the extremities. This is not, however, true of the visual system. Unilateral damage to the visual cortex is manifested by characteristic partial loss of vision in both eyes. Neither of the eyes is able to see the contralateral visual field with respect to the location of lesions. As we will see later this unique pattern also holds true for the oculomotor muscles. In this case either of the eyes will have difficulty in moving to the contralateral position.

The next drawing illustrates the visual field (field of view) through the left and right eyes. To better understand the diagram and concepts that will follow hereafter it would be helpful to suppose that you are looking over the head of the perceiver and through his/her eyes. The visual field would then be what the perceiver actually would be able to see in front of him or her.

Following diagram depicts report of the patient to her physician about how she sees the world (i.e. visual field) through her right eye.

- This tumor most frequently occurs in the convexities of the cerebral hemisphere, parasagittal/falx-cerebri, olfactory area, and supra-sellar region. It arises from the arachnoid's layer. It is more common in woman (3:2 female:male ratio); and often happens between ages 20 to 60.
- It is the second most common primary brain tumor. It is benign and grows slowly. Histologically it is characterized by uniform whorling pattern and calcified psammoma bodies.
- Surgical removal is quite successful.
- Associated with bitemporal heteronymous hemianopia.
- This tumor is ________________

Note: Suprasellar means above the sella turcica (literally Turkish Saddle). It is the saddle-shaped depression in the sphenoid bone that houses pituitary gland.
**About Calcarine Fissure**

The calcarine fissure (or calcarine sulcus) is an anatomical landmark located at the caudal and medial surface of the occipital lobe and divides the visual cortex into upper and lower parts. Visual information that originates on the upper retina is projected to the visual cortex above the calcarine, and those that originate in the inferior retina, to the inferior part of the calcarine fissure.

**Common Primary Brain Tumors**

1. The most common primary brain tumor is:
   ___________________________________________

2. The second most common primary brain tumor is:
   ___________________________________________

3. The third most common primary brain tumor is:
   ___________________________________________

4. Gliomas are tumors that originate in the brain or spine. They are named according to the types of cells that they originate from. What are the three main cell types of gliomas?
   ___________________________________________
   ___________________________________________

5. What is the most common astrocytoma?
   ___________________________________________

6. Name the two most important nerve sheath tumors?
   ___________________________________________

7. In the diagram below the exaggerated (caricature) crescent structure (labeled “?”) is a fold of dura mater forming a roof over the posterior cranial fossa, and separating the cerebellum from the basal surface of the occipital and temporal lobes of the cerebral cortex. What is the term that correctly describes this structure?
   ___________________________________________

8. In the above diagram, circular structures that are labeled “A” and “B” represent tumors of the brain. One of the two tumors belongs to a 5-year-old child and the other to the 70-year-old man. Which one is which?
   ___________________________________________

9. Also called “Blue Cell Tumor”, this brain tumor commonly occurs in children. The most common location for it is the midline of cerebellum. It may spread into the CSF. What is this tumor?
   ___________________________________________

**About Psammoma Bodies**

- AKA. Sand bodies
- Mineralized (calcium deposit) bodies composed usually of a central capillary surrounded by concentric whorls
- They can occur in benign and malignant epithelial tumors (such as papillary ovarian or thyroid carcinoma, and meningiomas)

- Papillary carcinoma of the thyroid
- Serous ovarian cystadenocarcinoma
- Adenocarcinoma of ovary
- Meningioma
- Mesothelioma
10. Name the term used to describe the above visual finding in lesions of chiasm? __________________________________________

11. What are a few major causes of the above finding? __________________________________________

12. This patient has a tumor that has severed the temporal retinal pathways on the right-side and has spared the decussating fibers. Name and draw the visual defect of the patient. __________________________________________

13. In the following diagram there are two lesions (severance of pathways); one before, and the other after the lateral geniculate body. In either condition the patient reports similar visual field deficits. What is the descriptive term for this condition, and how would you illustrate it by filling out the diagram below? __________________________________________
14. A patient with pituitary adenoma has lesions of the visual pathway at the level of chiasm that has uniquely spared the decussating fibers. Name and draw the visual defect of the patient.

[Diagram]

15. What lesions cause homonymous defects?

[Blank]

16. What is the distinctive difference between severing all pathways at the position (A) and severing them after the lateral geniculate (B)?

[Diagram]

17. A patient has been diagnosed with metastatic brain tumors. The tumors have severed his visual pathways as it is shown in the diagram. Name and draw his visual field defect?

[Diagram]

Note: As general rule lesions that are located farther away from the lateral geniculate bodies and closer to the visual cortex are presented with a more prominent macular sparing.

18. A patient with recent history of deep vein thrombosis presents with thrombosis of the basilar artery at the bifurcation of the two posterior cerebral circulations. As a result he has bilateral damage to his visual cortex (as it is shown in the diagram). Name and draw his visual field defect?

[Diagram]

Note: Patients with end stage glaucoma in one or both eyes may present with unilateral or bilateral macular sparing.

19. What is the following picture all about?

[Diagram]
Superior and Inferior Visual Fields

- Superior visual field information is projected onto the inferior retina, and the inferior field information onto the superior retina.
- The neurons that originate in the superior or inferior retina maintain their topographic positions throughout the visual pathway until they reach the visual cortex.
- Superior retinal neurons pass through the parietal lobes and end on the superior aspects of the calcarine fissure.
- Inferior retinal neurons pass through the temporal lobes and end on the inferior aspect of the calcarine fissure.
- From retina through the lateral geniculate bodies the superiorly and inferiorly located neurons are so close to each other that a lesion will sever both of them together.
- Past the lateral geniculate, the optic radiations through the parietal or temporal lobes are spatially apart from each other. As a result a lesion may selectively sever one of the two radiations and spare the other.

20. You are evaluating a patient with lesion of the left temporal lobe due to vascular thrombosis. What is the name of the characteristic visual field defect of the patient, and how would you draw it?

21. We have talked so many times about lateral geniculate nucleus or body (LGN). What is this organ; what is its function and where is it located?

22. Draw and name the visual defect that results from severance of the temporal radiations in this picture.

23. Draw and name the visual defect that results from bilateral severance of the parietal lobe radiations in this picture.

24. What type of cerebral lesions will cause the following visual field finding?
25. Using the following diagram and lesions draw and name the visual defect of the following patient?

![Diagram of visual field defects]

26. What lesions of the visual pathways cause homonymous defects?

Use the word “hetero” if the defect seen by the left and right eyes are not to the same side of the visual field (i.e. one is to the left and one to the right). Use the word “homo” if the visual field defects of the left and right eyes are to the same side (i.e. either on the left or right).

27. Which of these two findings is a heteronymous and which one a homonymous defect?

28. This picture is the left eye report of a 25-year-old female patient during her ophthalmologic examination. Name the visual defect and the most likely disease that she is suffering from?

29. What is the mechanism of macular sparing?

30. A patient is presented with the following visual field defect pattern. Which of the following options better explains this finding?

A. Right eye blindness and bitemporal heteronymous hemianopia
B. Bitemporal heteronymous hemianopia and left homonymous hemianopia
C. Neither of the above
D. Both of the above
1. The top most common Glioblastoma multiforme
2. The second most common: Meningioma
3. The 3rd most common: schwannoma.
4. The four main cells types and tumors are ependymomas (ependymal cells), astrocytomas (astrocytes), oligodendrogliomas (oligodendrocytes) and nerve sheath tumors.
5. The most common (and most aggressive) astrocytoma is glioblastoma multiforme.
6. The two major nerve sheath tumors are neu rofibromas and schwannoma
7. The crescent structure is tentorium cerebelli
8. Adult tumors are often supra-tentorial (i.e. “A”) whereas children tumors are often infra-tentorial (i.e. "B”).
10. Bitemporal heteronymous hemianopia!
11. Pituitary Adenomas, craniopharyngiomas, and meningiomas.
12. Right nasal heteronymous hemianopia. Common causes are calcified right internal carotid arteries and compression of the chiasm.
13. Left homonymous hemianopia
14. Binasal heteronymous hemianopsia
15. Lesions after the chiasm (and excluding chiasm cause homonymous defects. Lesions before the chiasm cause heteronymous defects
16. Both lesions cause right homonymous hemianopia. However, the lesion in “B” causes right homonymous hemianopia with macular sparing.
17. He has bilateral macular sparing (AKA. bilateral homonymous macular sparing).
18. The patient with bilateral damage to visual cortex due to lack of circulation presents with has bilateral macular sparing (AKA. bilateral homonymous hemianopia with macular sparing)
19. “This is the picture of a pie in the sky!”
20. Right superior (upper) quadrantanopia. Pie in the sky!
21. The left and right lateral geniculate nuclei (LGN) are within the thalamus and they are the primary relay centers for visual information from the retina. Each LGN receives information from one half of the visual field. For example, the left LGN receives information from ganglion cells of the temporal retina of the left eye plus information from the nasal retina of contralateral (right) eye. The nerves that originate in the retina have long axons that extend, uninterrupted, through the optic nerve, chiasm and optic tract and reach to the LGN. In the LGN they synapse with the second set of neurons that extend to the visual cortex.
22. Bilateral superior hemianopia or superior homonymous hemianopia. Of course, there may also be a macular sparing.
23. Inferior (Lower) (Homonymous) hemianopia
24. Vascular damage to the occipital visual cortex (example bilateral occlusion of the posterior cerebral circulation)
25. Right inferior (homonymous) quadrantanopia and left superior quadrantanopia.
26. Lesions anywhere behind the chiasm; optic tract, lateral geniculate, optic radiations, and visual cortex cause homonymous defects.

27. This condition, often unilateral, is called central scotoma seen in optic neuritis and it may also result from optic disc swelling. It is commonly associated with multiple sclerosis.

29. Due to the large size of foveal representations in the cortex, the areas that are devoted to central vision (central parts of the visual field) are less likely to be affected. Additionally, it is shown that the occipital lobe receives a dual blood supply. Even though the posterior cerebral artery is the main supply, a branch of middle cerebral artery also supplements the occipital pole areas that are topographically represented by the macula.

30. The best option is “D”. When you superimpose the following two diagrams you will generate the picture that is shown in the tested item.