

HEMIANOPSIA

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Abstract: Hemianopsia, sometimes called Hemianopia, is blindness in one half of the visual field. This loss can be caused by a variety of medical conditions, of which stroke is among the most commonly experienced. Hemianopsia is a functional defect which can affect the right or left side. Stroke patients with weakness of, for example, the right arm and leg have right sided poor vision. Some people lose sight mostly in the upper or lower part of the affected side, whereas others lose sight completely on all of the affected side. Where the stroke has affected the right arm and leg, right sided vision can be affected. **Heteronymous hemianopsia** affecting the nasal or the temporal half of the field of vision of each eye. **Homonymous hemianopsia** affecting the right halves or the left halves of the visual fields of the two eyes. **Scotoma** - an area of lost or depressed vision within the visual field, surrounded by an area of less depressed or of normal vision.

Keywords: Homonymous hemianopsia, Heteronymous hemianopsia, Scotoma, Visual field.

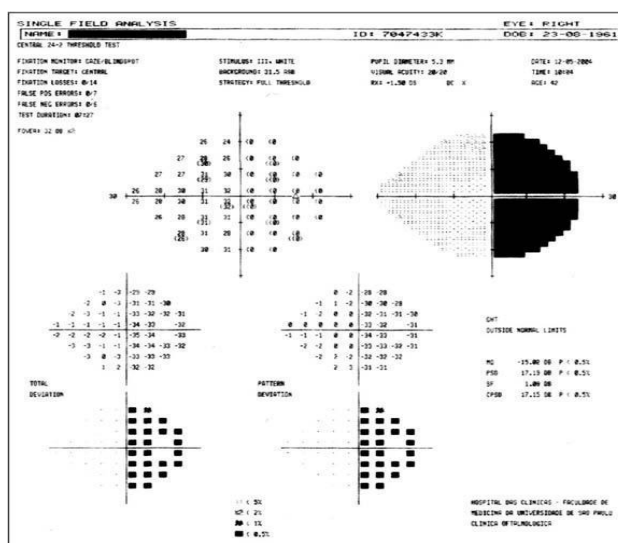
Rezumat: Hemianopsia, numită uneori și hemianopie, este orbirea într-o jumătate a câmpului vizual. Această pierdere poate fi cauzată de o varietate de condiții medicale, dintre care atacul vascular cerebral este printre cele mai obișnuite cauze. Hemianopsia este un defect funcțional care poate afecta partea dreaptă sau stângă. Pacienții care au suferit un atac vascular cerebral cu slăbiciune, de exemplu, a brațului și piciorului drept, au vedere slăbită pe partea dreaptă. Unii oameni își pierd vederea în general în partea de sus sau de jos a zonei afectate, în timp ce alții își pierd vederea complet în toată zona afectată. **Hemianopsia heteronimă** afectează jumătatea nazală sau temporală a câmpului vizual al fiecărui ochi. **Hemianopsia homonimă** afectează jumătățile drepte sau stângi ale câmpurilor vizuale ale ambilor ochi. **Scotomul hemianopsic**-o arie de pierdere sau depresie a vederii în interiorul câmpului vizual, înconjurat de o arie de mai mică depresie sau de vedere normală.

Cuvinte cheie: Hemianopsia homonimă, Hemianopsia heteronimă, Scotomul, Câmp vizual

Workbook. Terence R. Anthony – „Patterns and priorities in Neuromatological diagnosis”)

Before examining the effects of lesions in the visual afferent system, we will need to introduce the concept of **visual field**. If you shut your right eye and look straight ahead with the left, what you see is in the visual field of your left eye. Although the objects you see with your left eye are all represented on your left retina, their positions are different. Imagine that you divide the visual field of your left eye into quadrants--upper temporal, lower temporal, upper nasal, and lower nasal. Light from an object above your head and to your far left (i.e., in the upper temporal quadrant of the visual field), as it travels toward your left eye, is aimed at and will be focused on the lower nasal quadrant of the retina. Similarly, light from an object in the lower temporal quadrant of the visual field is focused on the upper nasal retina; etc. In other words, the retinal representation of the visual field is upside down and reversed from left to right, just as if the entire visual field had been rotated 180 degrees. The same is true for the visual field of your right eye. When you look right at an object, as when reading, the light from the object is aimed at and becomes focused on the midpoint of each retina, which is called the macula.

Picture no. 1: Complete temporal hemianopsia in computerized perimetry



Hemianopsia temporală completă la perimetria computerizată

GENERAL CONSIDERATIONS

Hemianopsia represents the loss of the vision in a half of the visual field, a bilateral deficiency, characteristic for certain lesions of the optic way. (A.

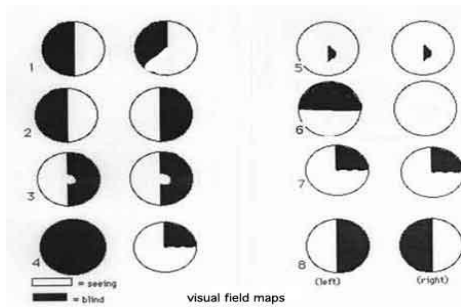
Two aspects of visual function are mentioned, tested routinely--acuity and visual fields. From what has just been discussed, it should be clear that acuity tests are essentially tests of central or macular vision; whereas visual field testing examines the intactness of peripheral vision in all directions. The spatial transformation of information from visual field to retina is important to remember, for the cell bodies and axons in the rest of the visual afferent pathways are organized retinotopically, with those carrying information from the upper retina remaining superior to those from the lower retina. Similarly, cell bodies and axons carrying information from the left half of each retina go to the left cerebral hemisphere; while those from the right half of each retina go to the right hemisphere. For this latter segregation to occur, the axons from ganglion cells in the nasal half of each retina must cross the midline, and they do--in the optic chiasm. [A. Workbook; Terence R. Anthonyey-„Patterns and priorities in Neuroanatomical diagnosis“.] Now we can discuss the localizing value of lesions in the afferent visual system. To begin with, it should be clear that deficits in acuity or visual fields due to a neural lesion already narrow the possible locations down to the retina, optic nerve, optic chiasm, optic tract, or cerebrum. Imagine you examine a patient and find that she cannot see objects placed to the left of her point of focus when using only her left eye. Where might her lesion be (assuming that non-neural possibilities have been ruled out)? Could it be in the left retina or left optic nerve? Yes, of course. If so, would you expect any deficit in the visual field of her right eye? No, as fibers from the right retina do not enter the left optic nerve. How about the optic chiasm? Yes, this would be a possibility. The patient's deficit is in the temporal half of her left visual field, which projects onto the nasal half of the left retina; and it is axons from the nasal half of each retina that cross in the optic chiasm. If the lesion were in the optic chiasm, would you expect any deficit in the visual field of her right eye? Yes, you would. What would the deficit be? An absence of the temporal half, right? In other words, the patient would be unable to see objects out to either side of her line of sight. She would have bilateral (i.e., affects visual fields of both eyes) temporal hemianopsia (hemi = half, an = without, opsis = sight). Could the lesion be in the left optic tract, left LGB, or beyond? No, it couldn't, because the axons from the nasal left retina crossed, so are found exclusively in the right optic tract and right hemisphere. If the lesion were in the right optic tract, right LGB, right optic radiations, or right primary visual cortex, would you expect any deficit in the visual field of her right eye? Yes, you would, for axons from ganglion cells in the temporal half of the right retina also travel in the right optic tract. Where then, would the deficit in the visual field of the right eye be located? In the temporal half? No, of course not, for that portion of the visual field would project to the nasal retina. The deficit would be in the nasal half of the visual field. In other words, the patient would be unable to see anything to the left of her line of sight with either eye. She would have a left (the deficient half of each visual field) homonymous (homo = same, having the same distribution in the two visual fields) hemianopsia. [Be aware that the phrase "left visual field" can be used in two

different ways, which are differentiated by context for a person "in the know," but can confuse the beginning student. Basically, "left visual field" means the visual field of the left eye. However, "left visual field of each eye" is sometimes used as a short-hand for the left half of the visual field of each eye. Thus, a patient with left homonymous hemianopsia may be said to have deficits in the left visual fields. It is probably best to avoid the latter usage yourself, but you'll probably come across it. Obviously, the phrase "right visual field" has the same potential ambiguity.

It is interesting to take into consideration the relationships between the part of the visual fields from which a cerebral hemisphere receives information, the part of the body from which it receives somatosensory information, and the part of the body whose voluntary movements it directs. As you look straight ahead, movements performed by your right arm and leg will tend to occur primarily in the right half of your visual fields. Information from those halves of your visual fields is transmitted to your left cerebral hemisphere, which is the same hemisphere that directs the voluntary movements being visually observed and receives information regarding the positions and movements of those limbs. Also, objects that may touch the right half of the body, causing such sensations as touch, heat, pain, and pressure, will also tend to appear in the right halves of the visual fields. Again, both the visual and somatosensory information is transmitted to the same hemisphere--the left. Thus, one can see how visual, somatosensory, and motor functions for one side of the body could be integrated within a single (the contralateral) hemisphere. Even if these relationships are coincidental, they may help you to remember some of the anatomy involved.

When considering a patient with a visual field deficit, the reasoning given above for distinguishing among lesions in an optic nerve (or retina), the optic chiasm, or in an optic tract (or beyond) is valid, whether the deficit involves entire temporal or nasal halves of visual fields or just portions of the halves. Thus, for example, a patient with deficits confined to the upper right quadrant of each visual field has partial destruction of either the left optic tract, left LGB, left visual radiations, or left primary visual cortex. Be sure that you understand why. In homonymous hemianopsias, there is often "sparing" of macular vision. This sparing is apparently due mainly to the disproportionately large percentage (about 90%) of the visual afferent pathways devoted to macular vision, so that most incomplete lesions miss some of these macular neurons. In summary, a monocular deficit points to a lesion anterior to the optic chiasm, a heteronymous (e.g., bilateral temporal) deficit suggests a chiasmal problem, and a homonymous deficit accompanies lesions of the contralateral optic tract, LGB, optic radiations, or primary visual cortex.

Hemianopsia is either heteronymous or anonymous



(<http://www.indiana.edu/~pietsch/hemianopsia.html>)

1. Incomplete left homonymous incongruous hemianopsia with the loss of macula;
2. Heteronymous bitemporal hemianopsia;
3. Right homonymous hemianopsia with the maintenance of the macular sight;
4. Compound hemianopsia – left total ocular cecity + right upper-temporal cvadranopsia;
5. Congruous homonymous central scotoma;
6. Left altitudinal hemianopsia;
7. Congruous, upper-temporal right cvadranopsia;
8. Heteronymous binasal hemianopsia.

Heteronymous hemianopsia presents the following aspects:

- Bitemporal hemianopsia – is caused by carotid aneurysms or of the anterior cerebral artery.
- Binasal hemianopsia – is caused by carotids atheromasia, aneurysms of the interior carotid, progressive atheromatous sclerosis of the interior carotid C.I.
- Superior or inferior horizontal hemianopsia (altitudinal). Those superior may be produced by the ectasia of the interior carotid or by symmetrical lesions of the external geniculate bodies. Those inferior may be produced by lesions of the upper edge of chiasm or of the upper branch of the calcarine fissure.

Diagonal deficiencies:

- they are partial and intersect only a part of the quadrant;
- occur in lateral chismatic lesions.

Homonymous hemianopsia (Neuroophthalmology – C. Arseni, M. David, M. Chiliman, I.I.Glăvan).

The explanation of the occurrence of the homonymous hemianopsia has at its basis the following considerations: at the level of the optic chiasm, the optic fibres spreading from the nasal halves of retina of both eyes cross themselves on the median line, in order to pass into the optic bands from the opposite side, together with the uncrossed direct fibres, which come from the temporal halves of retina.

Thus, the left band corresponds to the left halves of both retinas and the right band to the right halves.

Within the external geniculate bodies, the fibres of the band are articulated with the optic radiations which lead to the visual impressions brought by the lesions of the retrochiasmatic optic fibres or of the cortical centre of the

vision. If the lesion is placed on the right side, hemianopsia occurs in the left and opposite lateral field.

The visual acuity is intact by observing the central visual field.

Pupilar disorders. Wernicke hemianopsic pupillary reaction is important for the diagnosis; they only occur if the lesion is at band level, because the pupilomotor reflex arc passes through the optic nerve and band

The perimetric curve is congruent in case the deficit areas of both eyes superpose and is incongruent when there are differences between the nasal visual field and the temporary field.

Lateral homonymous hemianopsia (Tratat de Oftalmologie (Treatise on ophthalmology– Cernea) occurs in retrochiasmatic lesions after the crossing of the nasal fibres. Congruent lateral homonymous hemianopsia is produced by the posterior lesions of the bands, CGL lesion and of the optic radiations. Incongruent lateral anterior hemianopsia occurs in the anterior lesions of the bands.

The anterior homonymous hemianopsia is produced by a lesion of the optic bands and is accompanied by optic atrophy, vision lowering, Wernicke hemianopsic reaction, disorders of the pupilar reflexes. It may be associated with Foster Kennedy syndrome. It is presented in the aneurysm of the interior carotid, in the lesions of the anterior carotid artery.

The posterior homonymous hemianopsia occurs in the retroganglionar lesions, of the optic radiations, of the occipital cortex and evolves without optic lesions and popular disorders. It usually occurs in the vascular affections, in the lesions of the sylvian artery, of the posterior cerebral artery. Double hemianopsia is the state in which right or left homonymous hemianopsia is completed by a new hemianopsia.

The visual deficit with the quadrant (quadrantanopsia) is characterised by the loss of the sight in the superior or inferior homonymous quadrants. It usually corresponds to certain lesions of the optic radiations or of a mouth of the calcarine fissure, consecutively to certain vascular lesions. The half-moon syndrome occurs due to the lesion, which intersects internal and anterior optic radiations.

Relative hemianopsia can be found in occipital or occipital-parietal lesions. Allen calls this “unilateral visual intension” and Duke – Elder refers to as “visual extinction”.

Hemianopsic scotoma consists in the presence of certain areas without vision, placed in one of the quadrants of the visual field, having different forms or sizes. Hemianopsic scotomas may be due to certain lesions placed at the level of the optic paths, radiations or bands.

Topographic diagnosis of a retrochiasmatic lesion allows being distinguished (Tratat de Neurologie (Treatise on Neurology) C. Arseni, V. Voiculescu):

1. The lesion of the optic tract represents a rare localisation. The following elements of differential diagnosis are allowed, regarding the retrogenicular localisation:

a) Regarding the optic tract, the visual deficit intersects both the peripheral vision and the central one. Within the

posterior lesions of the geniculate body, the central vision is generally preserved.

b) Within the optic tract lesions, important attention was paid on Wernicke pupillary hemianopsic reaction.

c) Regarding the lesions of the optic tract, a pupillary inequality can be sometimes observed, the largest pupil being on the lesion side.

d) Generally, within the lesion of the optic tract, an incongruence of the deficiencies of the visual field could be accepted. This symptom cannot be considered as constant unless in the case of an incomplete tract lesion.

2. Hemianopsia due to the lesion of the lateral geniculate body is difficult to be diagnosed, with the exception of those cases in which it is accompanied by signs of thalamic lesion (thalamic pains, disorders of objective sensitivity in the half of the body corresponding to hemianopsia). The lesions interesting the medial part of the right geniculate body will produce inferior left cvadranopsia and the lesions of the lateral parts of the right geniculate will produce superior left quadrantanopsia.

3. Hemianopsia due to the lesions of the optic radiations – are usually incongruent with the exception of those cases, in which the radiation lesion is total. The hemianopsic deficit does not intersect the macular vision.

Optic radiations may be interrupted by different lesional localisations: on the posterior part of the internal capsule, on the temporal lobe, on the parietal lobe, on the occipital lobe. The capsular lesions and those of the occipital lobe have in general vascular origin. Regarding the lesions interesting the most anterior part of the temporal lobe, the visual field may be intact. The more posterior the lesion is placed in the temporal lobe, the more frequent total congruent hemianopsia is. The appearance of a homonymous deficit in the superior quadrant represents a value indication for the temporal localisation.

The inferior parietal localisations regarding the superior fibres of radiation bring about homonymous deficiencies in the superior quadrant. Sometimes other parietal symptoms are associated: sensitive focal crises, paraesthesia, asternognosia, hypotonia, ataxia, the absence of the optokinetic mistangmus.

The occipital lesions interest both the optic radiations and the visual cortex. Usually, it is about congruent complete hemianopsia.

When the deficit is incomplete, it prefers the inferior quadrants. In the case of certain small lesions of the visual cortex, limited deficiencies of the visual field may occur – scotomas – which are congruent, a characteristic for the occipital localisation (Tratat de Neurologie -Treatise on Neurology – Arseni, Voiculescu).

From the **etiologic** point of view, **homonymous lateral hemianopsia**, could be found in:

Vascular cerebral lesions. The anterior choroidal artery irrigates the optic tract by their passing through the retrolenticular segment of the internal capsule. Theoretically, the occlusion of the anterior choroidal occlusion determines a hemianopsia associated with a passing hemiparesis and a hemianopsia. The existence of this syndrome was not sufficiently researched from the anatomo-clinical point of view. The median cerebral

artery irrigates the largest part of the optic radiations through their posterior branches. The posterior cerebral artery irrigates the calcarine cortex and together with the anterior choroidal, it participates in the irrigation of the lateral geniculate body.

a) Temporal tumours

b) Temporal lobe abscess

c) A temporary hemianopsia can be found in the headache abscess

d) Hypertensive encephalopathy

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