Vision and Migraine

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Vision is intimately related to migraine
Vision is intimately related to migraine

- The vast majority of auras is visual in nature
- Visual aura symptoms in migraine are complex and diverse
- Non-aura visual symptoms are frequent, such as photophobia
Vision is intimately related to migraine

✓ The vast majority of auras is visual in nature

163 people (95 male and 68 female) who suffer from migraine with aura representative of the Danish population

Only visual auras were experienced in almost every attack (99%)

Seven subjects had exclusively visual aura without headache

158 people had gradually developed aura compatible with a contiguous spread of symptoms

When patients have multiple aura symptoms, usually visual abnormalities start first

Vision is intimately related to migraine

- The vast majority of auras is visual in nature
- Visual Aura symptoms in migraine are complex and diverse
- Non-aura visual symptoms are frequent, such as photophobia
Vision and migraine

✓ Visual Aura symptoms in migraine are complex and diverse

- Lilliputian (very small) and brobdingnagian (colossal sizes) hallucinations
- Zoom perception
- Misinterpretations of distances and velocity
- Mosaic vision
- Small fantastic little animals or creatures
- Splitting or misinterpretations of the body image
- Macro and microsomatoagnosia.

Vision and migraine

- Visual Aura symptoms in migraine are complex and diverse

Female, migraine with aura

1. Visual aura
2. Right arm paraesthesia
3. Right arm paresis
4. Right alien-hand syndrome

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- Visual Aura symptoms in migraine are complex and diverse

Vision is intimately related to migraine

☑ Visual Aura symptoms in migraine are complex and diverse

Male, migraine with aura

1. Dyschromatopsia
2. Prosopagnosia
3. Ideational apraxia
4. Paraesthesia
5. Aphasia

Vision and migraine

- Visual Aura symptoms in migraine are complex and diverse.


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1 cm

FFA - Fusiform Face Area
IOC - Inferior occipital cortex

- Aphasia
- Dyschromatopsia
- Prosopagnosia
- Ideational apraxia
- Paraesthesias
Vision is intimately related to migraine

✓ Visual Aura symptoms in migraine are complex and diverse

The visual cortex is crucial in migraine

Densities of $[^3]H$ sumatriptan-binding sites in postmortem human brain (fMOL/mg tissue)

- Frontal Cortex (IV-V)
- Temporal cortex (IV-V)
- Visual Cortex (II-III)
- Entorhinal cortex (III)
- Amygdala
- Globus pallidus, lateralis
- Periaqueductal gray

Vision and migraine

Vision is intimately related to migraine

✓ Visual Aura symptoms in migraine are complex and diverse

The visual cortex is crucial in migraine

SD in chick retina
Courtesy Professor Hiss Martins Ferreira, Biophysics Lab, UFRJ

Vision is intimately related to migraine

✔ Visual Aura symptoms in migraine are complex and diverse

The visual cortex is crucial in migraine

Typical textbook illustration: SD engulfing large parts of one hemisphere

Narrow band of excitation (red), refractory zone (yellow), disperse neurovascular feedback (green)

Localized SD wave in a full-scale attack

Dahlem MA. Migraine generator network and spreading depression dynamics as neuromodulation targets in episodic migraine Chaos. 2013 Dec;23(4):046101.
Vision is intimately related to migraine.

Visual Aura symptoms in migraine are complex and diverse.
Objective

Since the visual cortex is pivotal in the pathophysiology of migraine aura, the objective of our study was to investigate whether the phenotype of migraine-related visual phenomena would change in amaurotic patients.

Ethics Committee - Hospital Naval Marcílio Dias (HNMD), # 56/2010
Patients and methods

- 200 patients examined at Instituto Benjamin Constant, Rio de Janeiro

- 68 Amaurotic

- 132 with subnormal vision

Excluded:

- 2 gave up
- 1 did not meet necessary skills for protocol understanding
- 1 gave up
- 3 did not meet necessary skills for protocol understanding
- 1 presented a brain tumour
- 1 excluded because of cannabis use

Total subjects ........................................191
Patients and methods

Total subjects.................................191

- 100 males
- 91 females
- Blindness........................................ 63
- Severe visual impairment..............32
- Intermediate visual impairment......81
- Moderate visual impairment.........15

Subjects had to suffer from acquired or congenital amaurosis according to the 10th revision of the International Classification of Diseases (ICD-10) code H54, corresponding to vision impairment categories 3, 4 or 5 (WHO Study Group on the Prevention of Blindness, Geneva, 6-10 November 1972, WHO Technical Report Series No. 518, 1973)
Patients and methods

Total subjects...........................191

- Blindness................................. 63
- With headache............................. 35
- Without headache........................ 28
## Patients and methods

### Total subjects

- Blindness: 63
- With headache: 35

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migraine without aura</td>
<td>9</td>
</tr>
<tr>
<td>Migraine with typical aura</td>
<td>1</td>
</tr>
<tr>
<td>Migraine with typical aura</td>
<td>1</td>
</tr>
<tr>
<td>With migraine without aura not fulfilling criteria (photophobia)</td>
<td>2</td>
</tr>
<tr>
<td>Atypical aura (shape, colour, duration) with migrainous headache</td>
<td>2</td>
</tr>
<tr>
<td>Probable migraine with atypical aura</td>
<td>2</td>
</tr>
<tr>
<td>Atypical aura (auditory) with migrainous headache</td>
<td>1</td>
</tr>
<tr>
<td>Other headaches</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Patient</th>
<th>Aura phenotype</th>
<th>Aura duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scintillations and teichopsia</td>
<td>Minutes</td>
</tr>
<tr>
<td>2</td>
<td>Scintillations, photopsia, oval and round moveless forms, white and blue. Firework-like round lights. Before and during the pain.</td>
<td>1 minute</td>
</tr>
<tr>
<td>3</td>
<td>Scintillations, photopsia and teichopsia</td>
<td>Up to 2 hours</td>
</tr>
<tr>
<td>4</td>
<td>Scintillations</td>
<td>1 - 5 minutes</td>
</tr>
<tr>
<td>5</td>
<td>Scintillations, photopsia and teichopsia</td>
<td>5 - 60 minutes</td>
</tr>
<tr>
<td>6</td>
<td>Silver or blue Scintillations</td>
<td>1 - 5 minutes</td>
</tr>
<tr>
<td>7</td>
<td>Auditory perception (“noise”) during intense pain</td>
<td>Could not inform</td>
</tr>
<tr>
<td>8</td>
<td>Scintillations whiteout headache</td>
<td>5 - 10 minutes</td>
</tr>
</tbody>
</table>
Results

AJL, 25 y-o male patient
Optic nerve atrophy
Bilateral retinal detachment
Blind for the last 20 years

During adolescence: Throbbing paroxysmal headache, bilateral to the temporal region, lasting 4 - 24 hours, marked phonophobia (no photophobia) and nausea

During pain paroxysms: “noise” he can not clearly describe

No visual phenomena
Discussion

Seven visually impaired patents with visual aura:

5 became aura-less after blindness onset
2 presented aura after becoming blind

Visual input may be important for the aura phenotype
After blindness, only one patient continued to express aura as before. This suggests that normal visual input and processing is crucial for aura expression in migraine.

In one patient who became blind years before the migraine attacks, auditory rather than visual phenomena emerged.

Photophobia is clearly dependent on vision, as it is not present concomitantly with total blindness.

Visual input may be important for the aura phenotype.
Discussion

The visual deficiency changes the aura phenotype:

- Shorter
- Atypical

Visual input may be important for the aura phenotype
Discussion

Juggling induced grey matter changes

Discussion

✓ Plasticity is an intrinsic endowment of the brain

✓ Blindness induces substantial cerebral reorganization

✓ Blind individuals may compensate the lack of sight by developing hyper-effective non-visual senses.

✓ Although tactile input activates the visual cortex in sighted individuals, blinds activate their primary visual areas V1 and V2 during Braille reading as a compensatory cross-modal strategy.

✓ Blind subjects develop auditory abilities beyond controls and absolute pitch is more prevalent in blind musicians.

✓ Sightless people detect much more efficiently moving sounds and are able use sound encoding to create mental visual images.

✓ Odors may activate the occipital cortex in blinds too.
Discussion

- In theory, non-cortical blindness should not preclude CSD from occurring in a migraneous brain, as the cortex remains functional and is activated by various inputs.

- Since the occipital cortex may change from processing visual to other sensory modalities in sightlessness, we hypothesized that the lack of visual input would render the visual cortex less susceptible to typical visual auras.
Conclusions

Visual deficiency interferes with the clinical picture of migraine.

Brain plasticity and reorganization in blind subjects are probably responsible for changes in migraine phenotype.
Acknowledgments

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Hospital Naval Marcílio Dias

Thank you