

# MAJOR REVIEW

## Migraine-like Visual Aura Due to Focal Cerebral Lesions: Case Series and Review

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**Abstract.** Visual aura is a common presenting symptom of migraine to both neurologists and ophthalmologists. Features such as photopsia, fortification spectra, and the slow propagation of a scintillating scotoma across the visual field are usually considered diagnostic features of the visual aura of migraine. In the vast majority of cases, the diagnosis can be made without the need for further investigations. We present 9 patients and a further 31 cases from the literature who experienced visual aura fulfilling the diagnostic criteria for migraines but caused by focal occipital pathology. Key clinical features that could help to differentiate between the visual aura of migraine and those suggestive of a structural lesion are outlined. We review current scientific theories into the pathophysiology of visual aura, drawing on clinical and basic science research, including human functional imaging studies of migraine aura and advances in the genetic characterization of familial channelopathies, in order to explain the overlap which occurs in the clinical features of visual aura associated with migraine, cortical lesions, and epilepsy. We conclude that any disease process that is able to create a state of neuronal hyperexcitability can therefore increase an individual's susceptibility to the development of cortical spreading depression, the electrophysiological correlate of the visual aura. (*Surv Ophthalmol* 56:135–161, 2011. © 2011 Elsevier Inc. All rights reserved.)

**Key words.** cerebral lesions • epileptic aura • migraine visual aura • neuronal hyperexcitability • occipital lobe epilepsy • visual hallucinations

### I. Introduction

Ten percent (10%) of the general population are active migraineurs,<sup>94</sup> and a third of all migraine attacks are associated with aura.<sup>96</sup> Positive, episodic visual phenomena are the most common form of aura in migraine (99%);<sup>94</sup> may also be the first and only ictal manifestation of occipital lobe epilepsy<sup>75,104</sup> or seizures arising from any part of the visual pathway; and can occur in the context of focal cerebral pathology, in particular of the visual cortex. Notably, post-ictal headaches often indistinguishable from

migraine occur in over 50% of patients, even after brief visual seizures;<sup>84,85</sup> following a similar “asymptomatic interval” as seen in migraine.<sup>11</sup> Headache also occurs in more than 60% of patients with brain tumors over the course of their disease.<sup>100</sup>

### II. The Classic Visual Aura of Migraine

Most patients with typical migrainous visual aura experience a biphasic aura preceding the onset of headache that consists of a homonymous scotoma of shimmering lights (positive visual phenomena), in

most cases originating from the primary visual cortex, usually restricted to one half of the visual field. Typically the scotoma arises near to fixation and gradually enlarges in the form of an arc, with scintillating or sparkling zigzag lines at its leading edge. The arc gradually moves to the periphery of the affected hemifield with the size of the zigzag lines increasing with retinal eccentricity as predicted by the cortical magnification factor. Within minutes this is followed in the affected area by negative symptoms such as a blank scotoma or hemianopia. There are many variations on this theme: for example, some patients experience a visual disturbance which is akin to “heat-haze,” others fractured vision—as if looking in a broken mirror. The electrophysiological phenomenon thought to underlie the migraine visual aura is known as cortical spreading depression (CSD).<sup>56</sup> First hypothesized by the clinical observations of Milner<sup>69</sup> and Lashley,<sup>54</sup> and based on the experiments of Leão in the rabbit,<sup>58–60</sup> CSD is a slowly propagating wave of neuronal and glial depolarization, followed by long lasting suppression of cortical activity, that spreads across the cortex at a rate of 3 mm/minute, the same rate at which the scintillating scotoma propagates from the centre to the periphery of the visual field during a migraine aura.<sup>53</sup> This in turn can trigger the cascade of pathophysiological events, for example, activation of cells in the trigeminal nucleus caudalis in the medulla,<sup>12,34</sup> that lead to the headache and other autonomic disturbances of migraine.

### III. Typical Migraine-like Visual Aura Not Due to Migraine

The diagnostic criteria for typical migraine visual aura as defined by the International Classification of Headache Disorders (ICHD)<sup>43</sup> excludes any organic disease that may cause headache (Table 1). It is a commonly held view that the visual disturbances caused by cortical lesions do not conform to the time, pattern, appearance, or manner of spread of migraine scintillations.<sup>41</sup> Migraine-like visual aura otherwise fulfilling the ICHD criteria, however, have been reported to occur with a variety of cerebral lesions,<sup>7,16,17,25,27,36,42,45,48,50,52,63,64,74,79,88,98,101,105,110,113,114,121</sup> with or without associated headache.

Because the lifetime prevalence of migraine in the general population is approximately 18%,<sup>106</sup> it would not be unusual for a patient with a cerebral lesion, even one within the visual pathway, to have coincidental migraine and visual aura. Studies comparing the semiology of migraine-like visual aura and the visual phenomena of occipital lobe epilepsy have emphasised the duration and specific clinical features of the aura that could distinguish between the two conditions.<sup>83,84</sup>

Table 1

#### *Diagnostic Criteria for Typical Migraine Visual Aura*

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- A. At least two attacks fulfilling criteria B–D
  - B. Aura consisting of at least one of the following, but no motor weakness:
    1. Fully reversible visual symptoms including positive features (e.g., flickering lights, spots, or lines) and/or negative features (i.e., loss of vision)
    2. Fully reversible sensory symptoms including positive features (i.e., pins and needles) and/or negative features (i.e., numbness)
    3. Fully reversible dysphasic speech disturbance
  - C. At least two of the following:
    1. Homonymous visual symptoms and/or unilateral sensory symptoms
    2. At least one aura symptom develops gradually over  $\geq 5$  minutes and/or different aura symptoms occur in succession over  $\geq 5$  minutes
    3. Each symptom lasts  $\geq 5$  and  $\leq 60$  minutes
  - D. Headache begins during the aura or follows aura within 60 minutes
  - E. Not attributed to another disorder
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As defined by the International Classification of Headache Disorders (ICHD).<sup>43</sup>

### IV. Migraine-like Visual Aura: Migraine or Structural Intracranial Pathology? The Evidence

A third of migraineurs, or 1–3% of the general population, will present to their general practitioner, neurologist, or ophthalmologist complaining of visual aura. The occurrence of typical migraine-like visual aura as the result of a structural lesion, in the absence of other neurological signs or symptoms, is rare, yet knowing which patient requires neuroimaging is a common clinical problem.

In order to critically examine the true nature of visual aura secondary to structural lesions and compare them to those of migraine, we carried out a detailed prospective observational study of nine patients presenting with migraine-like visual aura caused by focal cerebral lesions seen in the practice of one neuro-ophthalmologist (GTP) at the National Hospital for Neurology and Neurosurgery and Moorfields Eye Hospital London between 1986 and 2009. The clinical histories were compiled using case notes and patient interviews. See the Appendix (Case histories) for a detailed description; Table 2 provides a summary of these nine cases. Table 3 is a compilation of a further thirty-one case histories from the world literature of patients with migraine-like visual aura secondary to cerebral lesions.<sup>7,16,17,25,27,36,42,45,48,50,52,63,64,74,79,88,98,101,105,110,113,114,121</sup>

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