Migrainous Visual Accompaniments Are Not Rare in Late Life
The Framingham Study
Christine A.C. Wijman, MD; Philip A. Wolf, MD; Carlos S. Kase, MD; Margaret Kelly-Hayes, EdD, RN; Alexa S. Beiser, PhD

Background and Purpose—Questionnaires to elicit symptoms of transient ischemic attacks (TIAs) may detect late-life transient visual symptoms similar to the visual aura of migraine, often without headache. We determined the frequency, characteristics, and stroke outcome of these symptoms in the Framingham Study.

Methods—During 1971–1989, at biennial examinations, 2110 subjects of the Framingham cohort were systematically queried about the occurrence of sudden visual symptoms.

Results—Visual migrainous symptoms were reported by 1.23% (26/2110) of subjects (1.33% of women and 1.08% of men). In 65% of subjects the episodes were stereotyped, and they began after age 50 years in 77%. Mean±SD age at onset of the episodes was 56.2±18.7 years. In 58% of subjects the episodes were never accompanied by headaches, and 42% had no headache history. The number of episodes ranged from 1 to 500 and was 10 or more in 69% of subjects. The episodes lasted 15 to 60 minutes in 50% of subjects. Sixty-five percent of the subjects were examined by a study neurologist, and only 19% of them met the criteria of the International Headache Society. Twelve percent of subjects sustained a stroke after the onset of migrainous visual symptoms: a subarachnoid hemorrhage 1 year later, an atherothrombotic brain stem infarct 3 years later, and a cardioembolic stroke 27 years later. In contrast, of 87 subjects with TIAs in the same cohort, 33% developed a stroke (P=0.030), two thirds within 6 months of TIA onset.

Conclusions—Late-life-onset transient visual phenomena similar to the visual aura of migraine are not rare and often occur in the absence of headache. These symptoms appear not to be associated with an increased risk of stroke, and invasive diagnostic procedures or therapeutic measures are generally not indicated. (Stroke. 1998;29:1539-1543.)

Key Words: epidemiology n migraine n vision disorders

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migraine accompaniments occur is presently unknown. Since data on migraine accompaniments derived from population-based studies are sparse, this study was undertaken to further clarify the prevalence, characteristics, and outcome of visual migrainous symptoms in the Framingham Study population.

**Subjects and Methods**

The Framingham cohort of 5070 men and women between 30 and 62 years of age and free of cardiovascular disease, including TIA and stroke at entry, has been followed by means of routine examinations every 2 years from 1950 until the present. Conduction of the study has been approved by the Institutional Review Board of Boston University, and all participants have given informed consent for their participation in the study. Details of the study design, implementation, and diagnosis criteria have been published previously. At each biennial examination, subjects have been systematically queried about the occurrence of symptoms of TIA and stroke. Since 1968 all subjects were specifically asked about the following symptoms: unconsciousness, sudden difficulty with speech, sudden muscular weakness, numbness or tingling, double vision, loss of vision in one eye, and other sudden visual symptoms. The records of subjects responding affirmatively to any of these questions and with suspected symptoms of stroke or TIA were reviewed by a panel of investigators including a neurologist, and a diagnosis was established on the basis of detailed clinical, laboratory, and radiological data. Whenever symptoms were atypical or the available clinical information was insufficient to make a diagnosis with certainty, subjects were interviewed and examined by one of the study neurologists. In addition, stroke surveillance was maintained by daily monitoring of hospital admissions to the only general hospital in town, and since 1968, whenever possible, a study neurologist has examined subjects.

For the present study the nature of all first-ever episodes of sudden visual defect (SVD) reported at biennial examinations during 1971–1989 (examinations 12 through 20) was determined by a neurologist based on the available notes of the biennial examination, neurology clinic notes, records from hospitalizations and office visits, and previous reviews of study investigators (described above). Whenever the clinical features of the SVD corresponded to the characteristics of the visual aura of migraine headaches, a number of variables were systematically recorded, including details on the character and number of episodes, their duration and mode of onset, accompanying headache, associated symptoms (neurological and nonneurological), and family history. In addition, it was determined whether the episodes fulfilled IHS criteria for migraine with aura or migraine aura without headache.

Prevalence of visual migraine accompaniments was determined in all subjects who attended at least six of the nine biennial examinations during 1971–1989. Thus, each subject was queried on at least six different occasions about the occurrence of sudden visual symptoms over an 18-year period. Stroke incidence rates between two groups with and without SVD were compared with the χ² test. All testing was performed at a 5% significance level.

**Results**

Among the 2110 original cohort members who attended at least six biennial examinations during 1971–1989, 186 reported a first-ever SVD. Thus, the incidence of SVD in this population sample was 8.8%. With the use of all available information, a judgment was made about the cause of the SVDs in these 186 subjects (Table 1).

Ocular diseases resulted in SVD in 17% (32/186) of subjects, who typically presented with loss of vision, often persistent, affecting one eye. According to the report of the subject, subsequent ophthalmologic evaluation had identified an ocular cause such as retinal hemorrhage, retinal detachment, central retinal artery occlusion, and acute glaucoma.

The largest single category of SVDs was due to stroke, TIA, or transient monocular blindness, which occurred in 34% (64/186) of subjects. SVD resulting from “other” causes included diagnoses such as presyncope, seizures, and temporal arteritis and occurred in 12% of subjects. Visual symptoms in this group varied widely and usually were associated with a number of other (nonvisual) symptoms or signs suggestive for the diagnosis. No definite cause for the reported SVD was found in 22% of subjects. These subjects frequently reported nonspecific visual symptoms such as blurring of vision affecting one or both eyes for which no cause was found.

Visual symptoms that corresponded to the visual aura of migraine were reported by 26 of 186 subjects (14%). The pattern of visual manifestations varied widely among subjects, and some of the more detailed descriptions are shown in Table 2. The prevalence of migrainous visual symptoms in this general population was 1.23% overall (1.33% in women and 1.08% in men). The prevalence of episodes of migrainous


<table>
<thead>
<tr>
<th>Cause of SVD</th>
<th>No. of Subjects</th>
<th>Percentage of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocular disease</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Stroke</td>
<td>34</td>
<td>18</td>
</tr>
<tr>
<td>TIA</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Transient monocular blindness</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Unknown</td>
<td>41</td>
<td>22</td>
</tr>
<tr>
<td>Other causes</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>Migrainous visual symptoms</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Total number of SVDs</td>
<td>186</td>
<td>99*</td>
</tr>
</tbody>
</table>

*Cumulative percentage is 99% because of rounding.

**TABLE 2. Some of the Patterns of Migrainous Visual Disturbances Described by Subjects in This Study**

- Heat rising off the ground and things jumping in front of both eyes followed by poor vision
- Loss of vision on the right associated with zigzag lines, moving visual phenomena, and a halo around the area
- Disco lights in front of both eyes and a bright silvery shape in the form of an eyebrow to the right of visual field
- Vision like looking through a kaleidoscope
- Bright lines in half of the visual field of both eyes interfering with ability to read
- Geometric figures consisting of squares with circles in them
- Bright wiggling lines in inferior left visual field advancing superiorly followed by left homonymous hemianopia
- Wavy vision as on television when the picture is not focused
- Vision is jumping like a film in an old film projector
- Dancing spots off to one side followed by blurring of vision and hemianopia on the same side
- Periphery of vision gets black and vision becomes as if looking through a pinhole followed by dancing black and white spots in front of both eyes
- Sudden white sheet descending in front of both eyes
TABLE 3. Characteristics of 26 Subjects Who Reported Episodes Corresponding to Migrainous Visual Symptoms

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%) of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>17 (65)</td>
</tr>
<tr>
<td>Age of onset &gt;50 y</td>
<td>20 (77)*</td>
</tr>
<tr>
<td>Number of spells ≥10</td>
<td>18 (69)</td>
</tr>
<tr>
<td>Duration of spells is consistent</td>
<td>15 (58)†</td>
</tr>
<tr>
<td>Character of spells is stereotyped</td>
<td>17 (65)*</td>
</tr>
<tr>
<td>Spell is of sudden onset</td>
<td>9 (35)‡</td>
</tr>
<tr>
<td>Both eyes are involved</td>
<td>19 (73)†</td>
</tr>
<tr>
<td>Positive visual phenomena are present</td>
<td>20 (77)§</td>
</tr>
<tr>
<td>Associated neurological symptoms</td>
<td>5 (19)</td>
</tr>
<tr>
<td>Associated nonneurological symptoms</td>
<td>5 (19)</td>
</tr>
<tr>
<td>Spells never occur with headache</td>
<td>15 (58)</td>
</tr>
<tr>
<td>History of recurrent headaches</td>
<td>14 (54)*</td>
</tr>
<tr>
<td>Family history of migraine headaches</td>
<td>8 (31)¶</td>
</tr>
<tr>
<td>Subject evaluated by panel of investigators</td>
<td>21 (81)</td>
</tr>
<tr>
<td>Subject examined by a neurologist</td>
<td>17 (65)</td>
</tr>
<tr>
<td>Spells fulfill IHS criteria for migraine</td>
<td>5 (19)</td>
</tr>
<tr>
<td>Duration of spells‡</td>
<td></td>
</tr>
<tr>
<td>&gt;1 and &lt;15 min</td>
<td>7 (27)</td>
</tr>
<tr>
<td>15 to 60 min</td>
<td>13 (50)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Visual field loss§</td>
<td></td>
</tr>
<tr>
<td>Hemianopia</td>
<td>7 (27)</td>
</tr>
<tr>
<td>Scotoma</td>
<td>4 (15)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (19)</td>
</tr>
<tr>
<td>Diffuse visual loss</td>
<td>5 (19)</td>
</tr>
</tbody>
</table>

*Characteristic unknown in 1 subject.  †Characteristic unknown in 4 subjects.  ‡Characteristic unknown in 12 subjects.  §Characteristic unknown in 2 subjects.  ||Characteristic unknown in 3 subjects.  ¶Characteristic unknown in 15 subjects.  #Characteristic unknown in 5 subjects.

Visual symptoms that were never accompanied with headache was 0.71% overall (0.70% in women and 0.72% in men).

Details on the clinical features of the episodes, personal characteristics of the subjects, and their medical and family histories were recorded, whenever available (Table 3). In the majority of subjects the episodes were stereotyped (65%). The age of onset of the episodes ranged from 9 to 71 years and was greater than 50 years in 77% of subjects. Mean ± SD age of onset was 56.2 ± 18.7 years overall (58.1 ± 16.3 years in women and 52.9 ± 23.2 years in men). In 58% of subjects visual symptoms were never accompanied by headaches, and 12% experienced headaches with the spells occasionally. Forty-two percent of subjects had no history of recurrent headaches. In 8 of 11 subjects (73%) who had a documented family history, recurrent headaches occurred in siblings, parents, or children. The number of episodes ranged from 1 to 500 and was 10 or more in 69% of subjects. In the majority (77%) the episodes lasted either several minutes or 15 to 60 minutes. The episodes lasted seconds in one case (4%), and their duration varied from seconds to hours in another (4%). Positive visual phenomena such as bright images (“bright lines,” “flashes of light,” “silver lightning,” “sunburst,” “disco lights”), colors (“zigzag rainbow colors,” “colored lights”), and movement of images (“dancing,” “jumping,” “wavy or wiggling lines”) were often reported (77%). Frequent descriptions of visual images included zigzag, wavy, or wiggling lines and wavy blurring of vision “as if heat is rising from the pavement” (38%). Exclusively negative visual phenomena were described in only one subject who experienced for more than 20 years “monthly episodes of marked decrease in peripheral vision either to the left or right lasting 5 minutes and not associated with any other symptoms.” The most common pattern of visual loss was a hemianopia (27%). Neurological symptoms (other than migrainous visual symptoms) were associated with the episodes in 19% of subjects and included diplopia, dizziness, numbness, paresthesias, tinnitus, and aphasia. The migrainous nature of these symptoms was suggested by their occurrence in association with typical visual migrainous phenomena and the progression from one neurological symptom to the other in a stereotyped fashion in multiple episodes. Associated nonneurological symptoms included nausea in four subjects and eye pain in one.

Sixty-five percent of subjects were interviewed and examined by a study neurologist, and the clinical records of 81% were evaluated by a panel of investigators including a neurologist. The episodes of migrainous visual symptoms were always transient, and persistent visual deficits were not reported. Formal ophthalmologic examination was documented as normal in three subjects. All subjects that were examined by one of the study neurologists had full visual fields to confrontation and sharp discs on funduscopic examination. Neuroimaging studies were not routinely obtained in subjects in this study, largely because of the presumed diagnosis of migraine. Furthermore, CT imaging was not available in Framingham until 1978. Only in 19% of subjects did the migrainous visual episodes meet the criteria for migraine with aura or migraine aura without headache of the IHS, usually because one of the criteria (“at least one aura symptom develops gradually over more than 4 minutes”) could not be reliably ascertained.

Three of 26 subjects (11.5%) sustained a stroke after the onset of episodes of migrainous visual phenomena: a subarachnoid hemorrhage 1 year after symptom onset (with negative carotid angiogram), an atherothrombotic brain stem infarct 3 years after symptom onset, and a cardioembolic stroke in the setting of atrial fibrillation 27 years after symptom onset. This stroke incidence rate of 11.5% was significantly lower than the stroke incidence rate of 33.3% in subjects with TIA in the same cohort (P = 0.030) and did not differ from the stroke incidence rate of 13.6% of those without migrainous phenomena or TIA (Table 4). Among the cohort members with TIA who developed a stroke, two thirds developed their stroke within 6 months of TIA onset.

Discussion

These data indicate that visual migrainous phenomena are not rare since they occur in 1.33% of women and in 1.08% of men in a general population sample. Previous studies have used various methodologies to estimate the prevalence of
Migrainous Visual Accompaniments in Late Life

TABLE 4. Stroke Rate in Subjects With Migrainous Visual Symptoms, Subjects With TIA, and Subjects Without TIA or Migrainous Visual Symptoms

<table>
<thead>
<tr>
<th>Group of Subjects</th>
<th>No. of Subjects</th>
<th>Stroke Rate, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects with migrainous visual symptoms</td>
<td>26</td>
<td>3 (11.5)</td>
</tr>
<tr>
<td>Subjects with TIA</td>
<td>87</td>
<td>29 (33.3)*</td>
</tr>
<tr>
<td>Subjects without TIA or migrainous visual symptoms</td>
<td>1997</td>
<td>272 (13.6)†</td>
</tr>
<tr>
<td>Total</td>
<td>2110</td>
<td>304 (14.4)</td>
</tr>
</tbody>
</table>

*Significantly different from subjects with migrainous visual symptoms (P=0.030).
†Not significantly different from subjects with migrainous visual symptoms.

These phenomena. Rasmussen et al17 conducted a general health survey with a focus on headache disorders in Denmark using the IHS criteria. Among 740 persons, lifetime prevalence of migraine was 16% (119/740), and that of migraine aura without headache was 0.95% (7/740). Details on the clinical features and personal characteristics of these subjects were not reported. Since subjects with visual migrainous phenomena may not seek medical attention, studies based on medical diagnosis are likely to underestimate their prevalence. In one such study, Stang et al18 used a modification of the IHS criteria and identified 629 residents of Olmsted County, Minnesota, who met the criteria of migraine. Aura without headache was identified in 6.3% of the cohort (11% of men and 4.3% of women), and the mean age of presentation was 43.2 years (SD, 15.6). In clinical series, Alvarez19 found in 618 cases of migraine with aura that 12% of men and 0.7% of women experienced episodes of migrainous visual symptoms without headache. Selby and Lance20 reported migraine accompaniments in 6 (1.2%) of 500 subjects. Two of them had suffered typical migraine in earlier years.

The prevalence of migraine equivalents in our study may well be an underestimate because our case ascertainment aimed at identifying subjects with visual symptoms. Although data from clinical series indicate that the vast majority of subjects with migraine accompaniments experience visual phenomena as part of the symptom complex, some subjects only experience nonvisual neurological disturbances during the attack.1,3 These subjects were not identified in our study. In addition, in a few subjects who reported an SVD, migraine accompaniments were suspected, but a reliable diagnosis could not be established because of limited documentation of the details of the episode. Furthermore, a number of subjects with visual migraine accompaniments may have recognized these episodes as being similar to the visual aura that they experienced earlier in life in association with migraine headaches and may not have reported their symptoms as an SVD.

There are several clinical series of patients reporting symptoms of migraine aura in the absence of headache.1,3,11 Fisher1,11 described a total of 205 cases of migrainous accompaniments in subjects older than 40 years in two reports. He excluded subjects with exclusively scintillating visual phenomena, stating that these episodes were well known to physicians.1 Headache occurred in association with the spells in 40% to 50% of cases, and a history of recurrent headache was present in 50% to 65%.1,3 O’Conner and Tredici9 described 61 cases, all men, seen during a 15-year period at the US Air Force School of Aerospace Medicine. These cases were derived from a selected group of highly trained young men whose profession requires outstanding visual abilities. Age of onset of spells was 12 to 44 years. Family history was present in 15 (24.6%) of the cases, and a history of migraine was present only in 2 (3.3%). Eighteen subjects (29.5%) experienced neurological deficits other than visual phenomena during the episodes. Permanent neurological deficit occurred in 1 patient. Cohen et al10 reported 31 cases of transient visual phenomena attributed to migraine. Headache was present in 20 patients (64.5%). Sixty-one percent of cases had a positive family history, and 57% had a personal history of migraine. During a mean follow-up of 2.2 years, 1 patient had died of cardiac disease, none suffered a stroke, 1 developed amaurosis fugax, and 1 developed transient global amnesia. Whitty11 described 16 cases, 7 women and 9 men. Headaches occurred with some of the spells in 9 cases (56%). None of them developed a persistent neurological deficit. Wiley21 reported 10 patients, 7 women and 3 men, with scintillating scotomas without headache. Eight of the 10 had no family history of migraine, and none developed persistent neurological sequelae after an average follow-up of 1.5 years.

The findings of our study are comparable to those described in these clinical series. Mean age of onset of spells was 56.2 years in our study. Headache was present with all spells in 30% and with some spells in 12% of cases. Fifty-four percent of cases had a history of recurrent headaches. A family history of migraine headaches was present in 72% of subjects with a documented family history.

One of the characteristic features that distinguish migraine accompaniments from TIAs is a benign course in the former.1 In one study,12 vascular events occurred in 1 of 50 cases (2%) of “migraine aura without headache” compared with 5 of 50 (10%) in age-matched controls with TIA. However, there are occasional reports of ischemic23 and hemorrhagic24 cerebral infarction associated with migraine accompaniments. In addition, migraine has been identified as an independent risk factor for ischemic stroke in men older than 40 years20 and in women younger than 45 years.26–28 However, the absolute risk of stroke associated with migraine is small.21 In this study we did not find an increased stroke risk in association with migrainous visual symptoms, confirming the experience derived from previous clinical series.

Study Strengths and Limitations

This study was based on a general population sample and thus minimized the bias of case selection encountered in clinical series. Cohort members were systematically queried every 2 years on the occurrence of visual symptoms during an 18-year period, ensuring that as many index cases as possible were identified. Because of the prospective study design, stroke risk in subjects with migraine accompaniments could be directly compared with cases with TIA and cases without migraine accompaniments within the same cohort. Because of the nature of the study we had to rely on documentation of symptoms in the medical record, which were obtained before the publication of the IHS criteria.12 Therefore, fulfillment of the criteria of migraine with aura or migraine aura without

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headache could not be verified in the majority of subjects. Nevertheless, we believe that the migrainous character of the visual episodes was convincing and consistent with the diagnosis of migraine. Finally, the Framingham population is predominantly white, and it would be difficult to justify generalizing the results of this study to other racial groups.

Conclusions and Clinical Implications

Episodes of migrainous visual symptoms in mid or late life are not rare and occur in 1.33% of women and 1.08% of men. These episodes may occur for the first time after age 50 years, in the absence of headache, and a history of recurrent headaches may not be present. Diagnosis is largely based on the clinical features of the episodes; however, noninvasive tests (carotid duplex, transcranial Doppler, MR angiography) may occasionally be indicated to exclude vascular disease in cases with an atypical presentation. Migrainous visual symptoms appear not to be associated with an increased risk of stroke, and invasive diagnostic procedures or risky therapeutic measures are generally not indicated.

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References

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