

Visual Aura in Migraine

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INTRODUCTION

Migraine and its specific clinical symptoms have been the focus of attention of neurologists since older days. Also, many ophthalmologists have done clinical research because of the many ocular symptoms seen as aura. In the pre-headache phase of migraine, visual aura and other neurological symptoms, such as hemiparesis and sensory disturbance, were found. We have investigated the visual auras mostly seen in migrainous patients and would like to introduce interesting cases in relation to occurrence of aura.

OBJECTS AND RESULTS OF STUDY

The objects of this study were based on 32 cases with visual aura out of 286 migrainous patients in the outpatients' department of the Neurological Institute, Tokyo Women's Medical College. They correspond to 5.5% of all the patients with chronic headache and to 11.2% with migraine.

As contents of the 32 cases of visual aura, scintillating scotoma with elemental hallucination was mostly found (22 cases), and adding together with three other cases would bring the total to 25 cases (Table 1). Visual

field defect was found in six cases, of which two cases were clearly seen as homonymous hemianopsia. There were two other cases of diplopia and one case of blurred vision.

Incidentally, when 350 epileptic patients were examined in our recent survey, it was found that five cases had visual aura—a very small percentage of 1.4%. Three of these five cases had also scintillating scotoma with elemental hallucination and the other two cases had visual field defect. One case had both of these symptoms (Table 2). Our electroencephalographic findings (Table 3) revealed that there were no abnormalities in awake EEG in 26 cases of migraine. There were only six cases (18.8%) of abnormalities in EEG, of which four cases had diffuse slow wave bursts and two cases had slow wave focus in the occipital region.

Many researchers have reported a high frequency of EEG abnormalities in migrainous patients, but our statistics on 140 migrainous patients show about 20% abnormalities in awake EEG and not much difference in the appearance of EEG abnormalities in patients with visual aura. In EEG of epileptic patients with generalized convulsion following visual aura, epileptic discharges were found in four cases out of five; one case of diffuse slow wave burst, two cases of slow wave bursts localized in the occipital region and one case of focal-

ized spike and wave in the occipital region.

Migraine and epilepsy show clinical resemblance of visual aura and are said to have considerable discrepancy in the appearance rate of epileptic discharges in EEG. Three cases with repeated migrainous attacks and visual aura in organic diseases of the occipital region were introduced.

Case 1.: K. H., a 40-year-old male with repeated attacks of headache and nausea with few minutes of scintillating scotoma of 15-year duration, visited the hospital. Upon admission, neurological examination revealed right hypoglossal palsy, right tinnitus but no other abnormalities and normal EEG. Cerebral angiography revealed arterio-venous malformation which mostly fed by the posterior temporal artery and drained into the transvers sinus (Fig. 1). By carotid angiography, the feeding artery was seen from the external carotid system. Craniotomy was done on April 22, 1974 and subtotal removal was done. Postoperatively, headache attacks disappeared, but scintillating scotoma and right homonymous

hemianopsia remained.

Case 2.: K. H., a 10-year-old female child, who had 5 minutes of scintillating scotoma with appearance of unilateral throbbing headache afterward, together with vomiting. The attacks became gradually frequent to about 4-5 times a month, so she visited the hospital. Upon initial examination, bruit was audible in the left temporal region, but other neurological symptoms were not seen. A large arterio-venous malformation was seen in left parieto-occipital region and fed by the external carotid artery and anterior, middle and posterior cerebral artery and drained into the straight sinus and great cerebral vein (Fig. 2). This case is under careful observation and surgical intervention is not done.

Case 3.: N. O., an 11-year-old female child. Since four years old, she has had attacks of headache and generalized convulsive seizures. Since eight years old, the patient has developed headache with 10 minutes of scintillating scotoma as aura. The patient received medication because she was told to have abnormalities in EEG, but visited the hospital because convulsive attacks did not disappear. There were no neurological changes, but spike wave focus was seen in the right occipital region on

Table 1: Visual Aura in Migraine

Elemental visual hallucination	
Scintillating scotoma	21 (+2)
Others	1 (+1)
Blurred vision	1
Visual field defect	6
Double vision	2
Unknown in detail	1
Total	32 cases

Table 2: Visual Aura in Epilepsy

Elemental visual hallucination	
Scintillating scotoma	2
Others	1 (+1)
Visual field defect	2
Total	5 cases

Table 3: EEG Findings in Migraine and Epilepsy with Visual Aura

	Migraine (32 Cases)	Epilepsy (5 Cases)
Normal	26	1
Abnormal	6	4
Diffuse slow wave burst	4	1
Slow wave focus in occipital	2	0
Localized slow wave burst in occipital	0	2
Spike & wave focus in occipital	0	1

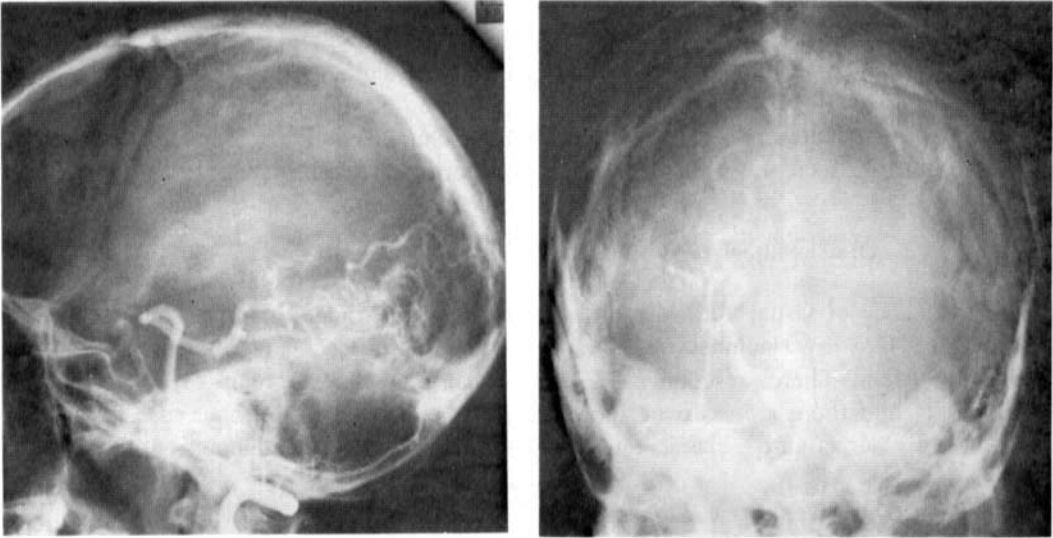


Fig. 1: A 40-year-old male.

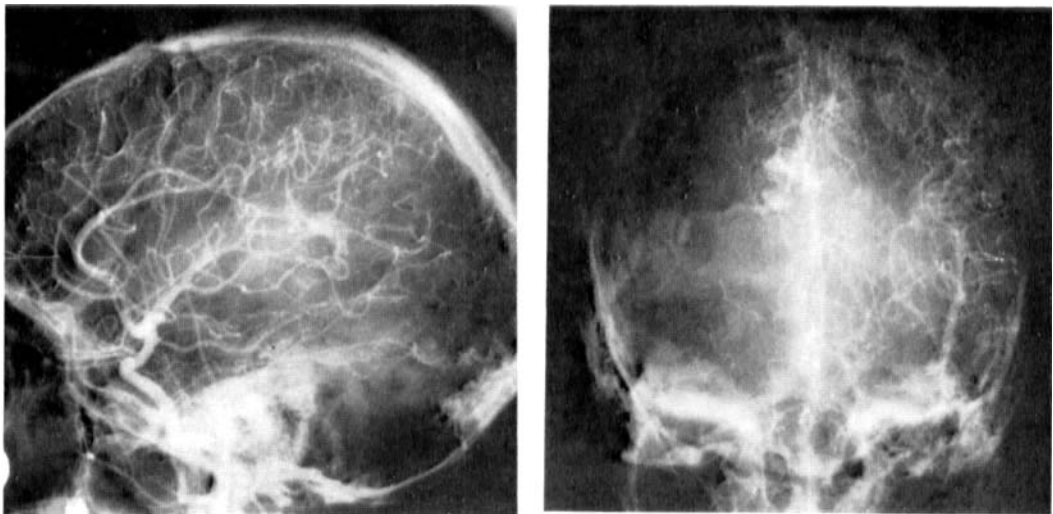


Fig. 2: Case 2—a 10-year-old female.

EEG. By brain scintiscanning, abnormalities were found in the same region, and craniotomy was performed under suspicion of brain tumor. Gliosis was found in the right occipital lobe which was extirpated (Fig. 3). After operation, attacks of headache and convulsion disappeared, but scintillating scotoma could be seen sometimes.

DISCUSSION

The frequency of visual aura in migraine is said to be 41% by Hachinski *et al.*³ and 49.5% by Allan. There were only 11.2% in our study and there seems to be quite a difference. In our country, classic migraine

also seems to be less than in foreign countries.

The development mechanism of visual aura in migraine is pursued in paroxysmal electrophysiologic alteration,⁶ spreading depression⁵ and postparoxysmal phenomenon,⁴ but Schumacher *et al.*⁸ consider scotoma as posterior cerebral artery spasm and ischemia in the occipital cortex. Richards *et al.*⁷ based it on biochemical alteration.

Scintillating scotoma may possibly be due to the appearance of impediment of retinal artery, optic tract and occipital cortex, but visual field defect seems to appear mostly homonymously. There have also been cases of homonymous hemianopsia following ap-



Fig. 3: An 11-year-old female.

pearance of scintillating scotoma. The fact that there were a case with central sparing and cases which are effective to vasodilator drugs⁹ suggests the impediment of optic radiation or cerebral cortex.

On the other hand, Engel *et al.*² reported three cases which showed appearance of irregular slow waves and disappearance of alpha waves in unilateral occipital region during prodromal phase of migraine attacks and also showed that the appearance of scintillating scotoma had strong correlation with EEG abnormality, and that EEG abnormality could be seen in long-term aura.

Symonds found slow activity in cerebral hemisphere during pre-headache phase. Rosenbaum, Smyth and Winter reported the same. Almost all reports show appearance of local and unilateral abnormal waves which coincide with visual hallucination and focal motor deficit in pre-headache phase.

In alterations in visual seizure of epilepsy and visual aura of migraine, Miyake *et al.* surmised that symptomatic and EEG analysis could be essentially different. Hachinski *et al.* investigated 244 cases of migraine in children, of which visual aura was seen in 100 cases (41%) and found that biochemical trigger resulting in the development of cerebral ischemia and followed by appearance of aura.

Of the three cases shown above, two cases of cerebral arteriovenous malformation did not have convulsive seizures clinically with normal EEG and only migrainous attacks were seen.

Also in the case of gliosis, epileptic seizure and migraine appeared clearly independent. Long-term visual aura appeared only during migrainous attacks. Cerebral circulatory disturbance is considered to possibly have a big part in the appearance of sensory aura in migraine. What sort of relationship exists between only pain as the main symptom in migraine and visual aura

which is considered due to impediment of optic radiation or occipital cortex?

Firstly, migraine aura appearing as neurological symptom is enumerated (Table 4). As ocular symptom, transient visual loss such as blurred vision and blackout, scintillating scotoma, visual field defect are mostly seen, especially the existence and impediment localization of macular sparing, quadrantanopsia, homonymous hemianopsia, etc., in visual defect could be clearly seen. Diplopia is mostly due to oculomotor palsy and rarely shows total ophthalmoplegia. Also, motor and sensory deficits of the extremities, aphasia, dysarthria, alexia, auditory and equilibratory impairment, etc., are reported in no small numbers. Most of these symptoms have the possibility of diagnosis of localization. The upper brain stem, thalamus, hypothalamus, internal capsule and occipital lobe are considered as the most publicized localization. These regions are also considered as distribution regions of the posterior cerebral artery, posterior communicating artery and basilar artery.

According to vertebral angiography, patients complaining of transient scintillating scotoma are sometimes seen. In 1964, Duke *et al.*¹ reported on the experience of the following interesting phenomenon which

Table 4: Neurologic Manifestation Associated with Migraine

Transient disturbance of vision
Scintillating scotoma
Visual field defect
Metamorphopsia
Diplopia
Ophthalmoplegia
Hemiparesis (-plegia)
Hemiparesthesia and hemianesthesia
Aphasia
Dysarthria
Dyslexia
Disturbance of hearing and balance

recovered during the headache phase: Upon cerebral angiography of migraine patients, during prodrome, the reflux of the contrast medium could be seen flowing from the internal carotid artery to the posterior communicating artery and basilar artery.

As indicated above, there seems to be a strong correlation between allergy, endocrine secretion and migraine, and correlation between the hypothalamus and the development of headache. Also, the feeding artery of the hypothalamus is the perforators developing from the posterior communicating artery and posterior cerebral artery.

The localized diagnosis of neurological signs in migraine, specific phenomenon seen in vertebral angiography, correlation of the hypothalamus, visual auras seen in arteriovenous malformation with migrainous attacks are considered to have correlation with headaches and circulatory disturbances of the posterior cerebral artery, posterior communicating artery and basilar artery.

CONCLUSION

1. Scintillating scotoma is mostly found in visual aura of migraine and followed by visual field defect. The rate of appearance is rather low in comparison with the ones in foreign literature.

2. In awake EEG recordings, slow waves in the occipital region are seen as the main abnormal change.

3. Visual aura in migrainous patients is similar to that in epileptic patients, but the difference in the rate of appearance of epileptic changes in awake EEG could also be seen.

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