About 15% of migraine patients suffer from migraine with aura. Most patients have visual or sensory symptoms. The assumed mechanism of aura in humans is a phenomenon called spreading cortical depression (1,2). Cortical spreading depression is characterized by a short cortical neuronal excitation followed by long-lasting depression. Both excitation and depression travel across the cortex at a slow speed. The clinical equivalent of the excitation could be the flickering light perception and fortification spectra in visual aura and the paresthesias in sensory aura. The equivalent of the cortical depression would be the scotoma in visual aura and sensory loss in sensory aura (3). Cortical spreading depression has been shown to occur in humans in ischemic stroke, severe traumatic brain lesions and following hypoxia. The Copenhagen group provided the first evidence of cerebral blood flow changes during human migraine aura (4). A positron-emission tomography (PET) study in a patient who suffered a migraine attack in the scanner indicated that spreading oligemia could even occur without symptoms of aura (5).

The scientifically relevant question is how spreading depression is triggered in patients who suffer from migraine with aura. The assumed mechanism should lower the cortical threshold for spontaneous excitation. Possible internal and external factors could include hormonal changes in women, changes of day-night rhythm, strong sensory stimuli, hunger, stress or intense physical activity. It is, however, difficult to validate these triggers by trying to provoke a migraine attack with aura (6).

The paper by Petusic et al. (7) in this issue of *Cephalalgia* proposes another possible trigger, namely microemboli. The authors investigated 34 migraine patients with higher cortical impairment during aura (language and memory), 31 patients with only visual and/or somatosensory symptoms during aura and 34 healthy controls. The investigators used transcranial Doppler and monitored blood flow in the middle cerebral artery bilaterally for 30 minutes. Microembolic signals (MES) were recorded according to international standards (8). The recordings were performed interictally outside of migraine attacks.

MES were detected in 29.4% of patients with higher cortical aura, in 3.2% of patients with visual or somatosensory aura and in 5.9% of healthy controls. What does this finding implicate? The nature of MES is unknown in patients without atherosclerotic plaques. One assumed mechanism is right-left shunt either through a patent foramen ovale or through pulmonary shunts. Patent foramen ovale is associated with a higher prevalence of migraine with aura. Animal experiments have indicated that cortical spreading depression can be provoked by the injection of microemboli (9,10).

The major shortcoming of the study is the recording of MES outside migraine attacks. It is difficult to understand how MES occurring outside migraine attacks should play a role in the rare events of complex aura. Many of the assumptions and implications of the authors in the discussion are not supported by scientific evidence:

1. The authors conclude that the detection of frequent MES in patients with migraine with aura should prompt thrombophilia screening. This recommendation is based on an underpowered study implicating that hypercoagulable states are associated with stroke in young women who suffer from migraine with aura (11). Stroke is an extremely rare event in patients below the age of 55 years and migraine with aura. The small increase in absolute stroke risk is most probably due to a different pattern of vascular risk factors in this population (12).

2. If we assume that migraine with aura is a channelopathy (13), there is no need for external triggers to provoke spreading cortical depression. Like in other diseases of neuronal ion channels, these events can occur spontaneously.

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3. The authors investigated the middle cerebral artery. The aura symptoms are, however, related to the posterior circulation. Whether MES are increased in frequency in the posterior circulation is unknown.

In summary, the paper by Petrusic et al. is an interesting observation with very limited relationship to the pathophysiology of migraine aura. Therefore I agree with the final statement of the authors, that further research is needed (as always).

Declaration of conflicting interests

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