Anisotropy Non-Uniformity of Cortical Spreading Depression: Relevance to Migraine

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What can the non-uniformities of CSD tell us about
-CSD itself?
-migraine with aura?

1. Differences in susceptibility to CSD.

2. Differences in propagation of CSD.

3. Differences in CSD susceptibility and propagation in migraine transgenic mice?
1. Differences in susceptibility to CSD.

Not all cortices appear equally susceptible in migraine. Why do we get aura where we get it?
Not all cortices are equally susceptible to CSD.

-CSD does not propagate into retrosplenial granular cortex (RSG).
-CSD not inducible in RSG.

Susceptibility to CSD-like events varies in different regions of cortex.

Leao AAP / Neurophysiol' 1944a,b
van Harreveld A Am J Physiol 1958

Natalie Schultz
2. Differences in propagation of CSD.

CSD typically thought of as a concentric and isotropic phenomenon

CSD in mammalian cortex is not spatially isotropic, and not uniform with time.

Propagation of CSD is anisotropic.
The speed of the front at a position is the inverse of the length of the gradient vector of the arrival times.

Despite anisotropy, mean velocities similar by direction.

But large difference in first vs subsequent CSD.
No apparent correlation of speed maps with surface vascular pattern

3. Differences in CSD susceptibility and propagation in migraine transgenic mice.

Josh Chang, Katie Zyuzin
Anisotropy to space and time in casein kinase 1 delta migraine transgenic mice

Take home points

1. The experience of aura is likely due to cortical physiology as well as perception. *Somatosensory cortices are more susceptible to CSD.*

2. The apparent uniformity of CSD masks a striking heterogeneity in the response. *Different intrinsic susceptibility of cortices, variable wavefront and velocity. Changing neuronal, glial, vascular response to CSD over space and time.*

3. Mechanistic insight from CK1 delta migraine transgenic mice. *Increased number of partial CSD contributes to susceptibility*
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