Spreading depolarization

Spreading depolarization (SD) is a fundamental pathophysiological mechanism of both pannecrotic and selective neuronal lesions following deprivation of energy.

Spreading depolarization is a phenomenon that occurs in the brain during certain neurological conditions, such as traumatic brain injury, stroke, and migraine. It is characterized by a sudden, self-propagating wave of electrical activity that spreads across the brain and causes a temporary loss of cellular membrane potential.

During spreading depolarization, the neurons in the affected area become hyper-excited and release large amounts of neurotransmitters, including glutamate, which can cause further damage to the surrounding tissue. The wave of depolarization can also cause a decrease in blood flow to the affected area, which can contribute to tissue damage and cell death.

Spreading depolarization is associated with a number of neurological symptoms, including headache, nausea, dizziness, and confusion. It can also lead to more severe outcomes, such as seizures, coma, and even death.

Treatment for spreading depolarization typically involves addressing the underlying condition that is causing the depolarization, such as administering medication for migraines or performing surgery to remove a brain tumor. Researchers are also investigating potential therapies to prevent or reduce the occurrence of spreading depolarization in the brain.

Spreading depolarizations (SDs) induced noninvasively using optogenetics do not worsen tissue outcomes. The findings compel a careful reexamination of the notion that SDs are causally linked to infarct expansion [1)]

SD with brain injury has been reported including in one patient during an intracranial operation. However, the incidence of SDs in operative resections is unknown.

Santos et al., performed (a) retrospective analysis of intraoperative AC-recordings of 69 patients and (b) a prospective study using intraoperative near-DC recording. All patients had the diagnosis of pharmaco-resistant epilepsy. Both studies were designed to determine the incidence and characteristics of SDs intraoperatively. In the retrospective analysis, we used intraoperative electrocorticography (iECoG) recordings obtained from AC-recording of 69 patients. In the prospective analysis, we used an Octal Bio Amp and Power Lab ECoG recorder with near-DC range.

In the retrospective study, we included 69 patients with a mean of 1 h 3 min of iECoG recordings. In the prospective study, we recruited 20 patients with near DC recordings. A total of 35 h 41 min of iECoG recordings with mean of 2 h 32 min/patient were analyzed. We did not find SD in either study.

SDs were not detected during intraoperative recordings of epilepsy surgery using AC- or DC-amplifiers [2)].

Stevens RD, Koehler RC. Pathophysiological Insights into Spreading Depolarization in Severe Traumatic Brain Injury. Neurocrit Care. 2019 Mar 15. doi: 10.1007/s12028-019-00705-8. [Epub ahead of print] PubMed PMID: 30877553 [3].

[1]
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[2]
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