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Titel des Beitrags: Cross-approximate entropy of cortical local field potentials quantifies effects of anesthesia—a pilot study in rats.

Abstract: Anesthetics dose-dependently shift electroencephalographic (EEG) activity towards high-amplitude, slow rhythms, indicative of a synchronization of neuronal activity in thalamocortical networks. Additionally, they uncouple brain areas in higher (gamma) frequency ranges possibly underlying conscious perception. It is currently thought that both effects may impair brain function by impeding proper information exchange between cortical areas. But what happens at the local network level? Local networks with strong excitatory interconnections may be more resilient towards global changes in brain rhythms, but depend heavily on locally projecting, inhibitory interneurons. As anesthetics bias cortical networks towards inhibition, we hypothesized that they may cause excessive synchrony and compromise information processing already on a small spatial scale. Using a recently introduced measure of signal independence, cross-approximate entropy (XApEn), we investigated to what degree anesthetics synchronized local cortical network activity. We recorded local field potentials (LFP) from the somatosensory cortex of three rats chronically implanted with multielectrode arrays and compared activity patterns under control (awake state) with those at increasing concentrations of isoflurane, enflurane and halothane. Cortical LFP signals were more synchronous, as expressed by XApEn, in the presence...
of anesthetics. Specifically, XApEn was a monotonously declining function of anesthetic concentration. Isoflurane and enfurane were indistinguishable; at a concentration of 1 MAC (the minimum alveolar concentration required to suppress movement in response to noxious stimuli in 50% of subjects) both volatile agents reduced XApEn by about 70%, whereas halothane was less potent (50% reduction). The results suggest that anesthetics strongly diminish the independence of operation of local cortical neuronal populations, and that the quantification of these effects in terms of XApEn has a similar discriminatory power as changes of spontaneous action potential rates. Thus, XApEn of field potentials recorded from local cortical networks provides valuable information on the anesthetic state of the brain.

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