

# 电刺激诱导大鼠海马癫痫电网络神经信息分析

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探讨电刺激致海马 (hippocampus, HPC) 癫痫网络的神经信息特征和M型胆碱能受体阻断剂东莨菪碱 (scopolamine) 对该信息特征的调制作用。实验用雄性SD大鼠45只, 体重150~250g。急性强直电刺激 (60 Hz, 2s, 0.4~0.6mA) 右侧后背HPC (acute tetanization of the right posterior dorsal hippocampus, ATPDH), 双电极同步记录同侧HPC网络和单个神经元电活动。分析癫痫发作样高频电振荡 (ripple) 功率谱 (power spectrum); 尖波连续发放进行峰间间隔 (interpeak interval, IPI)、单位时间内平均频率 (Hz); 并同步分析单个神经元放电脉冲间隔 (interspike interval, ISI) 的变化特征。结果: (1) ATPDH诱导的HPC网络癫痫放电模式主要包括ripple和具有稳定频率特征的尖波样连续发放。(2) 东莨菪碱 (i. p.) 可以提前ripple第1组分最大功率 ( $\mu\text{V}^2$ ) 与单个神经元原发性单位后放电最大ISI出现的时间, 对最大ISI的作用更明显。(3) 东莨菪碱可以部分再现重复施加ATPDH诱导出现巨大尖波连续发放IPI和神经元放电ISI平行发展特征。结果提示: M胆碱能受体阻断剂东莨菪碱可以同时调制HPC癫痫网络成员电场和细胞的瞬时编码信息。而成员电场ripple功率谱/连续尖波IPI和神经元放电ISI点分布的对比研究可以用于分析癫痫网络瞬时编码信息和药物生物学效应。

## An analysis of neural information within electrogenic hippocampal epileptic network in rats

The present work was to detect the modulation of scopolamine on characteristics of neural information of electrogenic hippocampal epileptic network in rats. Experiments were performed on 45 SD male rats, weighting 150~250g. The hippocampal epilepsy was induced by the acute tetanization (60Hz, 2s, 0.4~0.6mA) of the right dorsal hippocampus (ATPDH). The ipsilateral hippocampal field potentials and single unit discharges were simultaneously recorded. The power spectrum, power/time of the hippocampal ripples (up to 150 Hz), the interpeak intervals (IPI), of continual robust sharp waves, and the interspike intervals (ISI) of single neuronal firing were analyzed for extracting temporal code information of hippocampal network epilepsy. The result demonstrated that (1) Ripples and continual sharp waves were evoked by the repetitive ATPDH. (2) Scopolamine (0.05 mg/kg, i. p.) shortened the occurrence time of the maximal power spectra ( $\mu\text{V}^2$ ) during the first ripple component and of the maximal ISI of single neuronal firing, but remarkably shortened the latter. (3) A parallel development of robust sharp wave IPI and neuronal firing ISI reappeared partially after the injection of scopolamine, which was induced by repetitive ATPDH trains. It suggested that the temporal coding information of the member fields and neurons could be modulated by the scopolamine simultaneously within hippocampal epileptic network. Both the ripple power spectra and the IPI scatter of hippocampal network could be matched with single neuronal firing ISI scatter for extracting temporal code information.

### 关键词

海马癫痫 (hippocampal epilepsy); 功率谱 (power spectrum); 峰间隔 (interpeak interval); 放电脉冲间隔 (interspike interval); 电刺激 (electric stimulation); 大鼠 (rat)