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PDF文档

应用小波熵分析大鼠脑电信号的动态变化特性

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应用小波熵（一种新的信号复杂度测量方法）分析大鼠在不同生理状态下脑电复杂度的动态时变特性。采用慢性埋植电极记录自由活动大鼠的皮层EEG，使用多分辨率小波变换将EEG信号分解为δ、θ、α和β四个分量，求得随时间变化的小波熵。结果表明：在清醒、慢波睡眠和快动眼睡眠三种生理状态下，EEG的小波熵之间存在显著差别，并且在不同时期其值与各个分解分量之间具有不同的关系，其中，慢波睡眠期小波熵还具有较明显的变化节律，反映了EEG微状态中慢波和纺锤波的互补性。由此可见，小波熵既能区别长时间段EEG复杂度之间的差别，又能反映EEG微状态的快速变化特性。

DYNAMIC ANALYSIS OF THE RAT EEG USING WAVELET ENTROPY

Wavelet entropy (WE), a new method of complexity measure for signals, was used to analyze the dynamic features of rat EEG under three vigilance states. The EEGs of the freely moving rats were recorded with implanted electrodes and were decomposed into four components of δ、θ、α and β by using multi-resolution wavelet transform. Then, the wavelet entropy curves were calculated as a function of time. The results show that there were significant differences among the WEs of EEGs recorded under the vigilance states of wake, slow wave sleep (SWS) and rapid eye movement sleep (REM). The changes of WE had different relationship with the four power components under different states. Furthermore, there were certain rhythm in the WE of SWS sleep for most rats, which indicated a reciprocal relationship between slow wave and sleep spindle in the micro-state of SWS sleep. Therefore, WE can be used not only to distinguish the long-term changes in EEG complexity, but also to reveal the short-term changes in EEG micro-state.

关键词

小波熵(Wavelet entropy); 脑电(EEG); 谱熵(Spectral entropy); 慢波睡眠(Slow wave sleep)