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静息态fMRI评价阿尔茨海默患者大脑功能网络效率变化

Resting fMRI evaluation of altered network efficiency in patients with Alzheimer disease

投稿时间： 2013-05-10　最后修改时间： 2013-07-20

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中文摘要：

　　目的　采用图论方法探讨阿尔茨海默病(AD)对大脑功能网络效率的影响.方法　对33例AD患者(AD组)和20名健康老年志愿者,以简易智能状态量表(MMSE)和Mattis痴呆评定量表(DRS)评估认知水平;采集静息态BOLD-fMRI的数据,应用解剖学自动标记模板把大脑分为90个区域,提取每个区域内所有体素的BOLD信号平均值,计算每两个区域间的相关系数,构建功能网络.利用图论方法检验两组人群脑功能网络的小世界属性;计算网络的效率,评价AD组脑网络效率的特征性变化.结果　AD组MMSE和DRS平均分值均显著低于正常对照组($P<0.01$).以连接矩阵的稀疏度(Sparsity)为阈值,在0.1~0.4范围内,两组受试者的全局效率低于相应的随机网络,高于规则网络;局部效率高于随机网络,低于规则网络,都具有小世界属性.与正常对照组比较,AD组全局效率显著降低,局部效率显著增高($P<0.05$).结论　AD患者的大脑功能网络仍具有小世界属性,但其全局效率显著降低,局部效率显著增高,提示AD患者脑功能网络的信息传递能力和效率受损.

英文摘要：

Objective To observe the impact of Alzheimer disease (AD) to the network efficiency of human brain by graph theory. **Methods** Thirty-three patients with AD (AD group) and 20 healthy old volunteers (control group) were enrolled. Cognitive function of all subjects was evaluated using the mini-mental state examination (MMSE) and Mattis dementia rating scale (DRS). Resting-state BOLD-fMRI data were acquired, preprocessed and then parcellated into 90 regions using Anatomical Automatic Labeling Template (AAL). The average time course of each region was extracted by averaging the BOLD signals time courses of all voxels in this region. Correlation coefficient of every pair of regions was calculated and the network was generated. Small-world property of network was detected by graph theory, and the network efficiency of human brain was calculated. The difference of network efficiency between the patients and normal controls was explored. **Results** MMSE and DRS scores of AD group were significantly lower than those of control group ($P<0.01$). Taking the sparsity of the connecting matrixes as the threshold, both of the AD and control group satisfied the small-world property in the range of 0.1-0.4. AD group had significantly lower global network efficiency than that of control group, but the local network efficiency was higher relative to controls ($P<0.05$). **Conclusion** The brain's functional networks in patients with AD still had the property of small-world, but the global network efficiency decreased and local network efficiency increased, indicating that the capacity of information transmission and network efficiency in brains functional networks were impaired.

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