

Functional brain mapping of actual car-driving using [^{18}F]FDG-PET

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Aims: This study aims at identifying the brain activation during actual car-driving on the road, and at comparing the results to those of previous studies on simulated car-driving. **Methods:** Thirty normal volunteers, aged 20 to 56 years, were divided into three subgroups, active driving, passive driving and control groups, for examination by positron emission tomography (PET) and [^{18}F]2-deoxy-2-fluoro-D-glucose (FDG). The active driving subjects ($n = 10$) drove for 30 minutes on quiet normal roads with a few traffic signals. The passive driving subjects ($n = 10$) participated as passengers on the front seat. The control subjects ($n = 10$) remained seated in a lit room with their eyes open. Voxel-based t -statistics were applied using SPM2 to search brain activation among the subgroups mentioned above. **Results:** Significant brain activation was detected during active driving in the primary and secondary visual cortices, primary sensorimotor areas, premotor area, parietal association area, cingulate gyrus, the parahippocampal gyrus as well as in thalamus and cerebellum. The passive driving manifested a similar-looking activation pattern, lacking activations in the premotor area, cingulate and parahippocampal gyri and thalamus. Direct comparison of the active and passive driving conditions revealed activation in the cerebellum. **Conclusion:** The result of actual driving looked similar to that of simulated driving, suggesting that visual perception and visuomotor coordination were the main brain functions while driving. In terms of attention and autonomic arousal, however, it seems there was a significant difference between simulated and actual driving possibly due to risk of accidents. Autonomic and emotional aspects of driving should be studied using an actual driving study-design.

Key words: positron emission tomography, FDG, statistical parametric mapping, car driving