Spatiotemporal Pattern of Neuropathology in the Olfactory System as a Biomarker for Onset of Alzheimer's Disease in a Rat Model

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Background: Alzheimer's disease (AD) is one of the most debilitating neurological diseases leading to impairments in cognitive, sensory, and motor functions. Amyloid Aβ plaques and neurofibrillary tangles are pathognomonic changes of the AD brain. The diagnosis of AD is often delayed by an average of over 3 years from the onset of symptoms There is an urgent need for early diagnosis of AD. Loss of smell has been detected as a biomarker for early onset Alzheimer's disease. This project studies the progression of Alzheimer's on the olfactory bulb as correlated to the hippocampus. Hypothesis: If Aβ plaques increase in the olfactory system with age, other key structures such as hippocampus will also be affected, and neurodegeneration will ensue. Methods: Rat brain and olfactory bulb sections were prepared and stained with appropriate stains for Aβ plaques and neuronal degeneration. Slides were viewed under fluorescence microscope and images were captured using Nikon microscope using NIS element software. Further evaluation was made using Image J software. Results: The average number of plaques in the olfactory bulb were significantly lower than the hippocampus. The number and the area covered by the plaques, the number and the area covered by the neurodegeneration lesions increased significantly with the age of the rats. Conclusion: The plaque and neurodegeneration density in the olfactory bulb was much lower than that in the hippocampus. However, both plaque and neurodegeneration density increased with the age of the rats and correlated well with the plaque and neurodegeneration markers in the hippocampus.