System and method for in vivo estimation of brain amyloid burden using X-rays

Technology Summary

Amyloid plaque in the brain is associated with a wide range of neurodegenerative diseases such as Alzheimer's and Parkinson's Disease, and it is defined as aggregates of amyloid fibrils rich in β-sheet structures. Unfortunately, current approaches to detection of amyloid plaque in the in vivo brain are based on positron emission tomography (PET) using amyloid specific radioactive tracers. Estimation of brain amyloid load is limited by variation in the uptake and binding of the tracer. Thus, not only are PET-based approaches complicated by the need for radioactive tracers, but the tracer quantification also introduces significant uncertainties to amyloid load measurements. Other approaches such as magnetic resonance imaging (MRI) require a gadolinium contrast agent and have low specificity. Alternative approaches are needed that can avoid the use of tracers or contrast agents for practical in vivo assessment of human brain protein aggregates.

This novel system overcomes the shortcomings of other amyloid detection methods by providing a label-free, rapid, non-invasive imaging and measurement method for in vivo estimation of amyloid plaques. The invention comprises irradiating a region of interest (ROI) with a collimated, polychromatic x-ray beam and in response to the irradiating, obtaining energy- and angle-resolved scattering intensities associated with a reference path and a measurement path. The energy and angle-resolved scattering intensities can be processed to produce scattering cross section as a function of a momentum transfer parameter which can be combined within a predetermined range to determine amyloid burden or otherwise assess a tissue. The methods are suitable for use in vivo and in conjunction with CT scanning.

Potential Commercial Applications

- High throughput clinical assessment of amyloid level in the brain
- Standalone, dedicated brain, in vivo amyloid imaging scanner
- Add-on in vivo amyloid imaging module for existing CT clinical scanners

Competitive Advantages

- Rapid and convenient, label-free, non-invasive brain imaging for in vivo amyloid detection and assessment
- More cost-effective than PET and MRI/CT with faster acquisition times for high patient throughput
- Improved accuracy without the need for radioactive tracers or contrast agents

Development Stage: prototype, proof of concept studies

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