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Perspective

Pathophysiology and Molecular Imaging of Alzheimer's Disease

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DESCRIPTION

Molecular imaging of Alzheimer disease pathology has gained attention thanks to the development of molecular imaging agents for fibrillar-amyloid positron-emission tomography. Molecular imaging has shown that amyloid deposition can be detected several years before the onset of symptoms and that its progression can be tracked longitudinally in patients with mild cognitive impairment and Alzheimer disease as well as cognitively normal persons. With there is no pathologic overlap between 2 dementia syndromes, as there is when frontotemporal lobar degeneration and Alzheimer disease, the efficacy of amyloid PET in the differential diagnosis of Alzheimer disease is best. The two most prevalent types of dementia after Alzheimer disease dementia with Lewy bodies and vascular dementia may be difficult to detect by amyloid PET alone. These dementia syndromes frequently share overlapping amyloid pathology. The use of molecular imaging in clinical trials for Alzheimer's disease is expanding quickly, especially since those preventive therapies are intended to eliminate the pathology that molecular imaging agents target.

Neurofibrillary tangles of hyperphosphorylated and extracellular plaques of Amyloid (A) proteins, which involve the brain many years before the emergence of symptoms, are the pathologic hallmarks of Alzheimer Disease (AD). In the preclinical period, when the course of the disease may be changed by early intervention, molecular imaging using compounds that bind to the A and proteins may be used to identify the existence and progression of Alzheimer disease pathology.

PET imaging of the A pathology has been used in clinical research settings for almost ten years, and it was just given the green light for use in actual clinical settings by the US Food and Drug Administration. Less research has been done on PET imaging of pathology, although it would have a big influence on our knowledge of the pathophysiology of AD and our ability to develop effective treatments. During the preclinical, prodromal, and clinical stages of AD, imaging of both A and will probably independently help with early detection, differential diagnosis, and the monitoring of disease progression.

The past ten years have seen the development of A imaging using Pittsburgh compound-B (PiB)1 PET, which has opened a window into the pathophysiology of AD in living people. Mild Cognitive Impairment (MCI) is a feature of the prodromal stage of Alzheimer's Disease (AD), according to the NIA-new AA's recommendations, and research criteria further categories patients with MCI as having MCI related to AD on the basis of biomarker evidence of AD pathogenesis. The majority of MCI patients in both community and clinical trial settings meet the NIA-AA criteria, according to a recent study from the Mayo Clinic Study of Aging and Alzheimer Disease Neuroimaging Initiative; however, a sizable percentage of patients had contradictory biomarkers, which warrant further investigation. According to molecular imaging studies with A binding ligands in preclinical AD, 71% of patients with MCI in the general population and about one-third of the population of cognitively normal people have high cortical A loading.

The age at which symptoms first appear in autosomal dominant AD can be anticipated. Increased A deposition is thought to precede clinical signs by around 15 years, giving preventive treatments a large window of opportunity. In clinical trials focusing on the pathology captured with the molecular imaging agent, molecular imaging can play two roles: 1) to identify patients with the target pathology and enrich trials with this data; and 2) to assess whether a treatment is altering the target pathology.

Current clinical trials of amyloid-modifying medicines for the treatment and prevention of AD use both of these A imaging applications. In a similar vein, it is anticipated that imaging of AD's pathology, especially with agents tailored to the pathology that are currently being developed and tested, will open up possibilities for the creation of new prevention targets.

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