Howard A Rowley, J Alzheimers Dis Parkinsonism 2014, 4:5
http://dx.doi.org/10.4172/2161-0460.S1.005

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference on
Alzheimer's Disease and Dementia
September 23-25, 2014 Valencia Convention Centre, Spain

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Advancements in the Field of Imaging: In relation with Alzheimer's and Dementia

Diagnosis and management of patients with memory impairment and dementia requires a multidisciplinary approach, and imaging techniques play a crucial role in structural and functional assessment. Routine clinical CT and MRI are used to identify treatable causes of memory disturbance and to refine the likely substrates of dementia. Initial imaging referral is appropriate to exclude treatable lesions such as brain tumors, normal pressure hydrocephalus, and Wernicke disease. In the patient with rapidly progressive dementia, MRI including high B-value diffusion weighted imaging is very sensitive for detection of prion diseases. Imaging triage may help suggest vascular damage as a contributor to what appeared to be pure neurodegenerative disease on clinical assessment; while in other cases a complex clinical pattern is refined to a single causal pattern based on structural changes. Gradient echo T2* and susceptibility sequences may be helpful in detection of vascular amyloid, and the addition of gadolinium contrast can help identify inflammatory amyloid in some cases. Based on ADNI data, the presence of elevated temporal horn to hippocampal volume ratios predict those patients with mild cognitive impairment (MCI) most at risk for progression to Alzheimer's disease. Such structural changes are more sensitively detected and characterized with the aid of newer volumetric T1, T2, and T2 FLAIR sequences, amenable to tissue-specific thresholding, computer-aided detection, and true volumetric assessments.

More advanced techniques such as MRI-based perfusion imaging can detect decreased blood flow in at-risk areas, including the posterior cingulate, which in turn is correlated with functional deficits in self-appraisal. PET-based functional tracers for glucose metabolism, amyloid, and tau proteins are showing new ways to detect molecular changes directly linked to the pathogenesis of AD. When used in conjunction with cerebrospinal fluid biomarkers, such techniques allow earlier (pre-symptomatic) detection of risk profiles for AD, and may provide surrogates for therapeutic trials. This important work is helping us understand brain injury not only in dementing illnesses, but in other neurodegenerative conditions and traumatic brain injury.

Biography

Howard A Rowley received his MA and MD degrees from Washington University in St. Louis, and completed multiple specialty training at the University of California, San Francisco. He is board-certified and active in the disciplines of Neurology, Radiology, and Neuroradiology. He is Chief of MRI for Neuroradiology at the University of Wisconsin, working closely with Medical Physics in the integration of new imaging techniques for clinical trials and practice. He has special interests in the areas of brain perfusion, gadolinium applications, and high resolution structural imaging as applied to aging, dementia, stroke, brain tumors, and trauma. He is incoming Vice President and President-Elect of the American Society of Neuroradiology.

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