ADNI Alzheimer's Disease Neuroimaging Initiative

MRI Infarct Assessment in ADNI

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Summary

While Alzheimer's disease (AD) is the most common cause for dementia among older individuals [1,2] and the primary goal of ADNI, the lifetime risk for stroke equals and may exceed the risk of AD in some circumstances [3]. In addition, MRI evidence of asymptomatic cerebrovascular disease (CVD) occurs in one-third of older individuals [4]. In community based studies, mixed pathologies account for the most common cause of dementia [5] and the impact of cerebrovascular and AD pathology is additive, particularly when the AD pathological burden is mild [6]. Similarly, MRI community based studies have shown that white matter hyperintensities (WMH) increase with advancing age and associated vascular risk factors [4,7] and are associated with an array of cognitive deficits in cross-sectional studies [8-10]. Similar cross-sectional differences are also seen with clinically silent brain infarctions noted on MRI [4,11,12]. Importantly, community based studies show that both WMH and SBI are associated with cognitive decline and *incident* MCI and dementia [13,14].

These results strongly suggest that vascular brain injury (WMH, SBI) occurs commonly amongst older community dwelling cognitively normal individuals and is associated with subtle cognitive impairment, including memory impairment. Importantly, increasing survival from vascular disease including hypertension, diabetes, myocardial infarction and stroke is likely to increase the prevalence of asymptomatic vascular brain disease thereby increasing the public health consequences of cognitive impairment related to these disorders. Furthermore, the age of onset of these diseases is quite early and cognitive effects appear to begin similarly early in life, possibly before age 60 [10,14,15]. These findings have led us to postulate that clinically silent vascular brain injury is an important cause of cognitive impairment amongst otherwise healthy individuals, including ADNI participants. Understanding the impact of vascular disease on cognition will not only improve our understanding of the biology of cognitive impairment, but will assist the clinical therapeutic research community in identifying individuals in whom a second cause of cognitive impairment may be present and accounted for in their AD treatment efficacy analysis.

Method

MRI Infarct Detection

The image set of each individual imaging session in ADNI is reviewed by a physician specially trained in the detection of MRI Infarcts. The presence of MRI infarction is determined from the size, location and imaging characteristics of the lesion. Our image analysis system allows simultaneous projection of the complete imaging sequence dataset at three times magnified view to assist in interpretation of lesion characteristics. Signal void, best seen on the T2 weighted image was interpreted to indicate a vessel. Only lesions 3mm or larger qualified for consideration as cerebral infarcts. Other necessary imaging characteristics included: 1) CSF density on T1 and 2) if the infarct was in the basal ganglia area, distinct separation from the circle of Willis vessels. Kappa values for agreement amongst the three raters were generally good and ranged from 0.73 to 0.90 and consistent with previously published reports[4,16]. If an infarct is identified, the location is marked in image space and transferred to the database in image coordinates, enabling follow-up review. When multiple image sets are available spanning repeated imaging sessions, the operator reviews all available images to assure consistency in assessment.

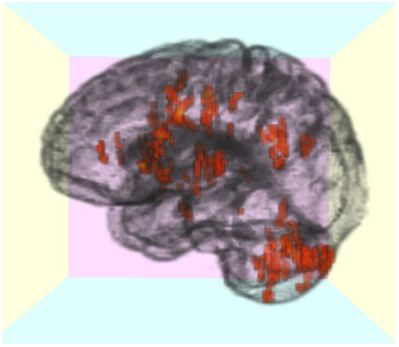

Figure MRI Infarct distribution.

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