

Whole-Brain Visual Rating Scales as Early Structural Markers of Conversion from Mild Cognitive Impairment to Dementia

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Whole-brain VRS approach may provide additional value beyond temporal atrophy in identifying early structural markers associated with AD conversion

INTRODUCTION

Visual rating scales (VRS) based on magnetic resonance imaging (MRI) is a non-computational method for the assessment of brain atrophy due to neurodegeneration¹ and support differential diagnosis across dementia syndromes².

The **prognostic value of VRS for Alzheimer's dementia (AD)** remains limited. Previous studies have focused primarily on medial temporal atrophy, potentially neglecting the contribution of other brain regions involved in early disease stages, such as in mild cognitive impairment (MCI).

This **pilot** study investigates whether a whole-brain VRS battery can **differentiate between MCI patients who convert to AD from those who remain clinically stable**.

METHOD

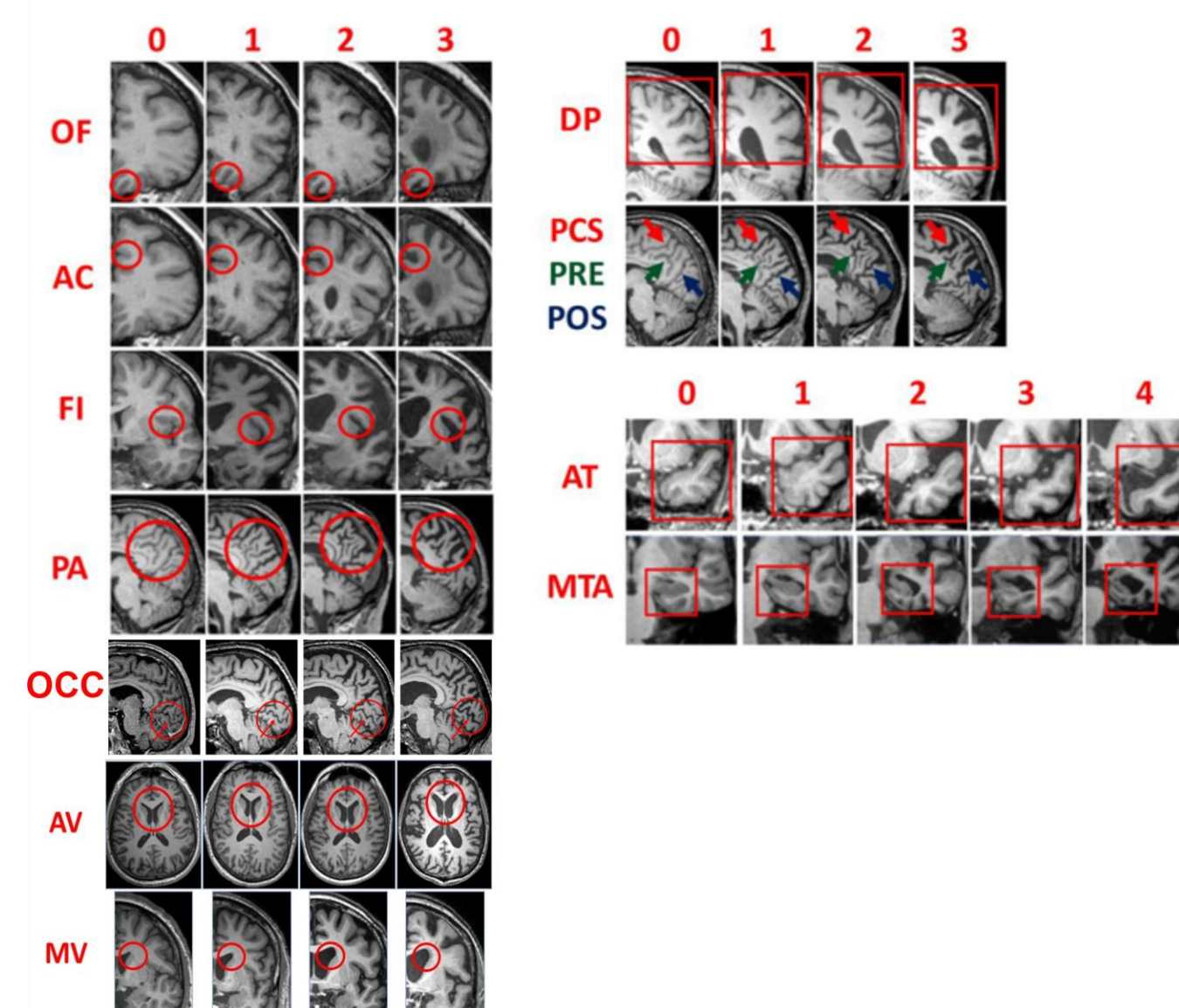
Participant selection

From the National Alzheimer's Coordinating Center (NACC)³ participants were classified as **healthy controls (HC)**; Mini-Mental State Examination, MMSE > 26) or **MCI** due to possible/probable AD (Clinical Dementia Rating scale, CDR = 0-0.5). Then, according to the follow-up clinical diagnosis, **MCI patients were categorized as stable (MCIs)** or **converters to AD dementia (MCICs)**.

Participants with psychiatric and/or other neurological conditions were excluded.

Visual Rating Scales protocol

Two blinded raters assessed brain atrophy **at baseline** from **T1-weighted MRI** using a VRS battery⁴ covering orbitofrontal (OF), anterior cingulate (AC), anterior temporal (AT), fronto-insular (FI), medial temporal (MTA), parietal (PA), dorsal-parietal (DP), precuneus (PRE), occipital regions (OCC), ventricular enlargement (AV and MV), and parietal-occipital (POS) and posterior cingulate (PCS) sulci.



RESULTS

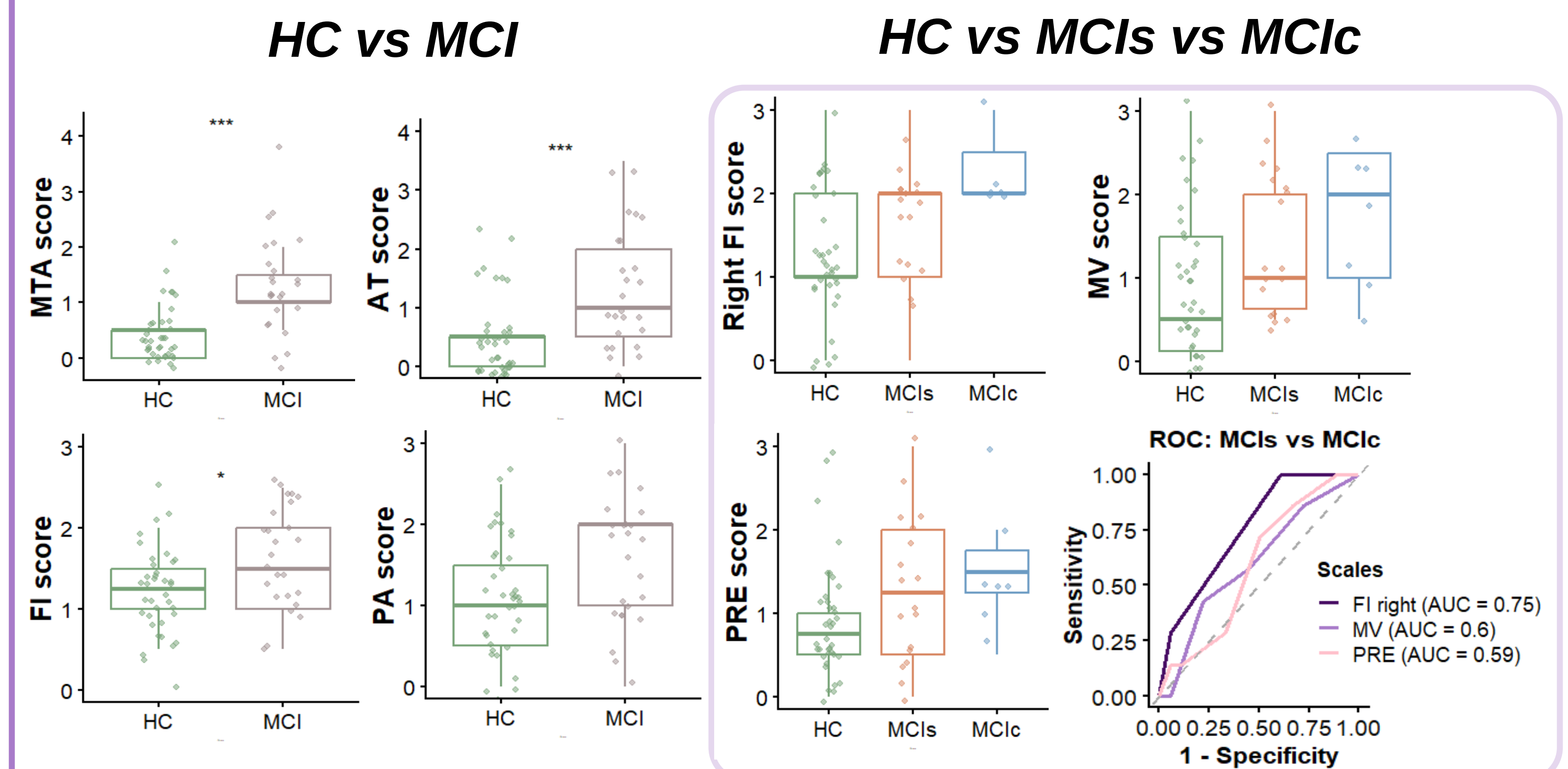
Demographics

	HC	MCIs	MCICs	Statistics	Post-hoc
N (F/M)	38 (27/11)	18 (10/8)	7 (3/4)	$\chi^2_{(2)} = 2.71, p = .258$	
Mean Age (sd)	77.7 (8.3)	84.4 (10.6)	77.1 (8.1)	$F_{(2,60)} = 3.71, p = .030$	MCIs > HC*
Mean Education (sd)	15.1 (4.1)	15.1 (3.04)	17.1 (1.6)	$F_{(2,60)} = 0.98, p = .38$	
Mean CDR (sd) with age as a covariate	0.05 (0.2)	0.25 (0.3)	0.43 (0.2)	$F_{(2,59)} = 17.0, p < .001$	MCICs > HC*** MCIs > HC***

Inter-raters agreement

Weighted Cohen's kappa ranged from 0.31 (**fair**) to 0.83 (**perfect**).

VRS differences



Correlation with the MMSE score

Negative between MMSE and right FI ($\rho = -0.26, p = .043$).

CONCLUSION

Right fronto-insular atrophy and involvement may be associated with conversion. These findings support the potential prognostic utility of multi-regional VRS, warranting confirmation in larger longitudinal cohorts.

¹ Loreto, Gontsarova, Scott, ... Malhotra. (2023). Visual atrophy rating scales and amyloid PET status in an Alzheimer's disease clinical cohort. <https://doi.org/10.1002/acn3.51749>

² Harper, Barkhof, Fox, Schott, (2015). Using visual rating to diagnose dementia: a critical evaluation of MRI atrophy scales. <https://doi.org/10.1136/jnnp-2014-310090>.

³ <https://www.naccdata.org/>

⁴ Fumagalli, Basilico, Arighi, ..., Galimberti. (2020) Parieto-occipital sulcus widening differentiates posterior cortical atrophy from typical Alzheimer disease. <https://doi.org/10.1016/j.nicl.2020.102453>