Magnetic Resonance Imaging and machine learning make a valuable combined tool for the screening of preclinical AD

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Themes: Neuroimaging. ***Optimal neuroimaging measures for early detection***

Background: Worldwide efforts are turning to pharmacological prevention strategies to fight the dementia epidemic that confronts the next decades. However, prevention trials face huge ethical and logistic challenges. Efficient, cost-effective and noninvasive identification and follow-up assessment of subjects at the preclinical stages of Alzheimer's disease (AD) is currently an unmet medical need. We offer an efficient and minimally invasive pre-screening solution to identify subjects at risk of AD that would likely benefit from prevention strategies, based on advanced Magnetic Resonance Imaging and machine learning approaches.

Methods: Multimodal Magnetic Resonance Imaging (T13D, DWI and rs-fMRI) data was acquired from two independent cohorts with available CSF data that enabled biomarker based diagnostic classification: a local cohort from Hospital Clinic of Barcelona (HCB) with 87 subjects (40 controls, 12 preclinical, 21 MCI due to AD, 14 AD) and a subset of the ADNI cohort comprising 96 subjects (28 controls, 16 preclinical, 23 MCI due to AD, 29 AD) for which data is publicly available. We applied machine learning techniques to identify subjects at the preclinical stages of AD, as well as other categories in the AD continuum. A receiving operator characteristic analysis was performed and we also estimated the economic impact of this pre-screening framework on recruitment in a typical prevention trial.

Results: Accuracy to detect the preclinical stage of AD achieved an AUC 0.85 and this performance was robust across both studied cohorts. Used as a pre-screening tool, this approach is estimated to save 50% of the expenses of clinical trial recruitment by sparing 80% invasive PET or CSF acquisitions from volunteers that are unlikely to be in the course of the disease.

Conclusions: Our work establishes a proof of principle that pre-screening with MRI-based classifiers can significantly reduce clinical trial cost and lower the time and effort put by volunteers and caregivers. Our approach represents a valuable tool which shall foster public participation in prevention AD trials by minimizing invasive intervention.

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