MODULE 1-P1: SPACE and biomarkers for cognitive impairment

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1 Tools for the detection of cognitive impairment

Cognitive assessments
- Montreal Cognitive Assessment
- Mini-Mental State Examination
- Quick Dementia Rating System
- Number Cancellation
- Trail Making Test
- Maze Test

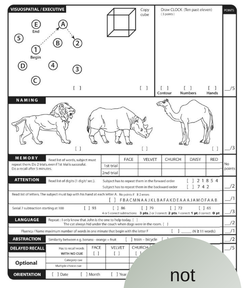

Fig. 1. MoCA.

not sensitive enough

Plasma biomarkers
- Amyloid β 1-42 ($A\beta_{1\text{-}42}$)
- Phosphorylated tau 181 (p-tau181)

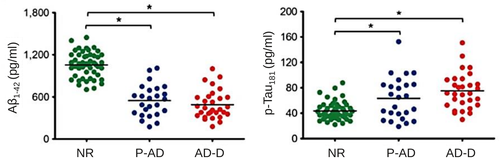

Fig. 2. Park et al. (2021) Plasma contact factors as novel biomarkers for diagnosing Alzheimer's disease.

invasive

Imaging biomarkers
- Magnetic Resonance Imaging (MRI)

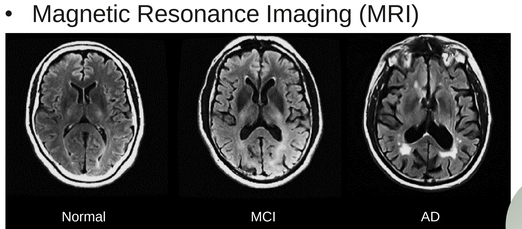

Fig. 3. Chandra et al. (2018) Magnetic resonance imaging in Alzheimer's disease and mild cognitive impairment.

costly

2 **BIO-SPACE** study

Background: Individuals with mild cognitive impairment (MCI), Alzheimer's disease (AD) and vascular dementia (VaD) experience a significant impairment in navigation ability in addition to other cognitive deficits. The evaluation of individual differences in navigation ability may be effective for detecting early cognitive deterioration and improve the sensitivity and specificity of current cognitive screening tools.
Furthermore, there are differences in navigation and gait between AD and VaD, and these may constitute novel measures to facilitate the differentiation between the two most common forms of dementia.

Aim: To evaluate the ability of novel digital tools that assess navigation and gait to differentiate individuals across cognitive spectrum.

Fig. 4. SPACE tool.

Fig. 5. ZurichMOVE sensor.

Recruitment: 300 subjects (HC, MCI, AD, VaD)

The efficacy of the novel digital tools in the assessment of cognitive status will be compared against:
- Full neuropsychological assessment
- Fluid biomarkers (e.g., plasma $A\beta_{1\text{-}42}$, p-tau181)

3 **TRAIN-SPACE** study

Background: Aging is accompanied by structural changes in the brain and it affects a variety of cognitive functions such as navigation. Training interventions including cognitively demanding navigation tasks may have direct effects on neural and cerebrovascular correlates, and protect against age-related decline.

Aims:
(a) To evaluate if performance in the different spatial tasks in SPACE is associated with imaging markers of neurodegeneration and cerebro-vascular pathology.
(b) To examine whether a training program using SPACE can trigger brain structural plasticity and improve cognitive performance.

Recruitment: 40 healthy subjects

Control group (n=20) — Experimental group (n=20)

Full neuropsychological assessment, questionnaires, MRI (baseline and 6 months after)

Navigation assessment
(baseline + 6 months) (2 x week for 6 months)

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