The Short Physical Performance Battery relates to neuroimaging biomarkers of Alzheimer’s Disease in cognitively normal elderly patients

Aline Mendes

INSIGHT-PreAD study group
CONFLICT OF INTEREST DISCLOSURE

I have no potential conflict of interest to report
Gait and Cognition

Complex cognitive task

Attention
Visuospatial functions
Motor processing functions
Executive Function

Interrelationship between gait and cognition
The Alzheimer’s Disease Continuum

Gait / physical function changes as early markers

PRECLINICAL PHASE

Abnormal

Biomarker magnitude

Normal

Cognitively normal

Clinical disease stage

MCI

Dementia

Alzheimers Res Ther. 2017
Gait and Cognition

Motor slowing may predict the onset of cognitive impairment.

Neurology. 1998 May;50(5):1496-8

Increased gait variability has been reported in individuals with Alzheimer’s disease.

→ subtle changes only assessed by quantitative methods


Determine if physical function assessed by SPPB is related to neuroimaging biomarkers of preclinical AD.
**Short Physical Performance Battery**

**SPPB**

- Balance
- Gait Speed
- Chair Stand

Short Physical Performance Battery

SPPB

- SPPB < 10 → all-cause mortality
- Disability
- Hospital Admission
- COGNITION

Methods

**INSIGHT PRE-AD**

Ongoing prospective monocentric cohort of 318 elderly people with a subjective cognitive decline – with **NO** cognitive impairment

- **Cross-sectional analysis**
  - Observational physical function/gait analysis
    - SPPB
  - Quantitative automated multimodal neuroimaging assessment
    - MRI
      - Hippocampal volume
    - FDG PET
      - SUV
    - Amyloid PET
      - SUVR
## Results

**-characteristics of the study population**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total n=318</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female, n (%)</td>
<td>204 (64.2)</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>76.08 (3.5)</td>
</tr>
<tr>
<td>Education level, mean (SD)</td>
<td>6.19 (2.062)</td>
</tr>
<tr>
<td>ApoE4, n (%)</td>
<td>59 (18.6)</td>
</tr>
<tr>
<td>Comorbidities total, mean (SD)</td>
<td>2.37 (1.46)</td>
</tr>
<tr>
<td>0-1 comorbidity, n (%)</td>
<td>95 (29.9)</td>
</tr>
<tr>
<td>≥2 comorbidities, n (%)</td>
<td>223 (70.1)</td>
</tr>
</tbody>
</table>
# Results

- **characteristics of the study population**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total n=318</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female, n (%)</td>
<td>204 (64.2)</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>76.08 (3.5)</td>
</tr>
<tr>
<td>Education level, mean (SD)</td>
<td>6.19 (2.062)</td>
</tr>
<tr>
<td>ApoE4, n (%)</td>
<td>59 (18.6)</td>
</tr>
<tr>
<td>Comorbidities total, mean (SD)</td>
<td>2.37 (1.46)</td>
</tr>
<tr>
<td>0-1 comorbidity, n (%)</td>
<td>95 (29.9)</td>
</tr>
<tr>
<td>≥2 comorbidities, n (%)</td>
<td>223 (70.1)</td>
</tr>
</tbody>
</table>

### SPPB

<table>
<thead>
<tr>
<th>SPPB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total score (0-12), mean (SD)</td>
<td>10.84 (1.32)</td>
</tr>
<tr>
<td>Gait speed m/s, mean (SD)</td>
<td>1.025 (0.22)</td>
</tr>
<tr>
<td>Chair stand sec, mean (SD)</td>
<td>11.645 (2.95)</td>
</tr>
<tr>
<td>Balance score (0-4), mean (SD)</td>
<td>3.85 (0.41)</td>
</tr>
</tbody>
</table>
# Results

- **SPPB total score**

<table>
<thead>
<tr>
<th></th>
<th>SPPB total score (0-14)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Univariate</strong></td>
<td><strong>Multivariate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Coeff (SE)</strong></td>
<td><strong>P value</strong></td>
<td><strong>Adj R²</strong></td>
<td><strong>Coeff (SE)</strong></td>
<td><strong>P value</strong></td>
</tr>
<tr>
<td>Hippocampal volume cm³</td>
<td>0.47 (0.24)</td>
<td>0.05</td>
<td>0.009</td>
<td>0.44 (0.26)</td>
<td>0.09</td>
</tr>
<tr>
<td>FDG PET SUV</td>
<td>0.70 (0.3)</td>
<td>0.019</td>
<td>0.01</td>
<td>0.73 (0.31)</td>
<td>0.02</td>
</tr>
<tr>
<td>Amyloid PET SUVR</td>
<td>-0.43 (0.4)</td>
<td>0.29</td>
<td>0.0005</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>
Results - GAIT SPEED (m/sec)

Hippocampal volume cm³

Amyloid PET SUVR

\[ P = 0.89 \]
\[ \text{Adj R}^2 = -0.003 \]

\[ P = 0.24 \]
\[ \text{Adj R}^2 = 0.001 \]
Results - *GAIT SPEED (m/sec)*

FDG PET SUV

\[ P = 0.01 \]
\[ \text{Coeff} = 0.1 \ (0.05) \]
\[ \text{Adj } R^2 = 0.08 \]
Results – *CHAIR STAND TEST (sec)*

FDG PET SUV

\[ P = 0.02 \]
\[ \text{Coeff} = -1.4 \ (0.7) \]
\[ \text{Adj R}^2 = 0.03 \]
Results – *CHAIR STAND TEST (sec)*

**Hippocampal volume cm³**

- **P** = 0.05
- Adj R² = -0.009

**Amyloid PET SUVR**

- **P** = 0.14
- Adj R² = 0.004
Short Physical Performance Battery

SPPB

1. Balance
2. Gait Speed
3. Chair Stand

Hippocampal volume cm³
Amyloid PET SUVR

FDG PET SUV
Discussion & Perspectives

★ SPPB scores, gait speed and the chair stand test are independently associated with brain metabolism, with no association with amyloid deposition.

★ Gait changes should be part of a multimodal model of assessment of preclinical AD phases, combined to neuroimaging, CSF, etc.

★ Increasing accuracy in determining preclinical phases can help new effective preventive strategies, as well as reduce the burden of dementia.
Thank you