Neuropsychological impairment in patients with MCI and PD_{MCI}

Simon Brezovar
Laboratory for Cognitive Neuroscience
Department of Neurology
University Medical Centre Ljubljana
Tracking pathophysiological processes in Alzheimer’s disease

Jack et al., 2013
Mild cognitive impairment (MCI)

• an intermediate stage between the expected cognitive decline of normal aging and the dementia
• increased risk of later progressing to dementia
• impaired cognitive functioning but preserved everyday functioning
• MCI → Dementia (10 % - 15 % per year)

Grundman et al., 2004
Subtypes of MCI

FIGURE 1. Current diagnostic algorithm for diagnosing and subtyping MCI

MCI=mild cognitive impairment.
MCI in Parkinson’s disease

- MCI common in non-demented PD patients, occurring in about 20 – 50 %
- PD-MCI patients exhibit nonamnestic deficits in cognitive domains such as executive function, attention, and visuospatial function
- recent studies: the cognitive phenotype of PD-MCI is heterogeneous with some patients demonstrating greater amnestic deficits

Goldman and Litvan, 2011
Motivation for our study

• better understanding of early cognitive changes in MCI and PD patients
• contrast differences in cognitive processing between different neurological diseases
• potential mechanisms of these changes by means of different research tools
• to follow our subjects and to assess predictive power of combined methods (biomarkers)
### Sample information

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>MCI</th>
<th>PD&lt;sub&gt;MCI&lt;/sub&gt;</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>20</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>66.72 (7.82)</td>
<td>69.4 (7.1)</td>
<td>68.33 (6.2)</td>
<td>66.25 (5.85)</td>
</tr>
<tr>
<td>Eduaction (yr)*</td>
<td>14.50 (2.81)</td>
<td>11.6 (2.96)</td>
<td>12 (2.93)</td>
<td>14.80 (2.44)</td>
</tr>
</tbody>
</table>

* F = 4.930; p = 0.004
Neropsychological tests

Stroop test

BLUE
PINK
GREY
TAN
GREEN
RED
ORANGE
WHITE
YELLOW
PURPLE
BROWN

Verbal learning test

Digit span
4 1 5 9 – 4 1 5 9
1 9 0 5 – 5 0 9 1

Verbal fluency

cat
zebra
silver
car

sweet
salad

soft
truck

sleep
spinach

silence
motor

scissors
onion

Trail Making Test

Visual memory test

Begin

End

Tower test
**Attention span**

- **Digit Span (F):** $F = 2.093; p = 0.109$
- **Digit Span (B):** $F = 2.049; p = 0.115$
**Speed of mental processing**

- **Cognitive speed**: $F = 5.171; p = 0.003$
- **Switching**: $F = 12.570; p = 0.000$
- **Motor speed**: $F = 3.966; p = 0.012$
Verbal memory test (free recall)

N of retrieved words

<table>
<thead>
<tr>
<th>Group</th>
<th>Short delay free recall</th>
<th>Long delay free recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>MCI</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>PBMC</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>PB</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

short: $F = 5.498; p = 0.002$

long: $F = 6.301; p = 0.001$
Verbal memory test (cued recall)

<table>
<thead>
<tr>
<th>Group</th>
<th>Short delay cued recall</th>
<th>Long delay cued recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBMCi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Short: $F = 7.893; p = 0.000$

Long: $F = 8.161; p = 0.000$
Visual memory

Recalled elements

<table>
<thead>
<tr>
<th>Group</th>
<th>Immediate recall</th>
<th>Delayed recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>MCI</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>PBMCI</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>PB</td>
<td>23</td>
<td>22</td>
</tr>
</tbody>
</table>

short: $F = 6,667; p = 0,001$

long: $F = 6,670; p = 0,001$
Verbal fluency performance

Number of listed words

Control MCI PBMCI PB

Group

phonetic fluency: $F = 3,660; \ p = 0,017$
semantic fluency: $F = 7,834; \ p = 0,000$
switching fluency: $F = 3,873; \ p = 0,013$
Tower test performance

Control MCI PBMCI PB

Group

Tower achievement score

$F = 4.502; \ p = 0.006$
Stroop test performance

N of inhibited words

<table>
<thead>
<tr>
<th>Group</th>
<th>Control</th>
<th>MCI</th>
<th>PBMCI</th>
<th>PB</th>
</tr>
</thead>
</table>

$F = 4.132; p = 0.010$
most of the neuropsychological tests can differentiate between different subgroups in our sample

switching (TMT) and long-delay verbal memory recall (CVLT) – greatest differences

post-hoc analysis: no differences between MCI and PB_{MCI} group

in contrast to the population as a whole, where amnestic MCI is the most common subtype, non-amnestic PD-MCI dominates (Yarnal, et al., 2013)

Goldman & Litvan (2011): PD-MCI has heterogenous cognitive phenotype
# Sample information

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>MCI</th>
<th>PD&lt;sub&gt;MCI&lt;/sub&gt;</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>20</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>66.72 (7.82)</td>
<td>69.4 (7.1)</td>
<td>68.33 (6.2)</td>
<td>66.25 (5.85)</td>
</tr>
<tr>
<td>Eduaction (yr)*</td>
<td>14.50 (2.81)</td>
<td>11.6 (2.96)</td>
<td>12 (2.93)</td>
<td>14.80 (2.44)</td>
</tr>
</tbody>
</table>

MCI<sub>a</sub> = 12  MCI<sub>n</sub> = 8  MCI<sub>mix</sub> = 3

More PD-MCI subgroups?

* F = 4.930; p = 0.004
Plans for the future

• combining neuropsychological results with other biomarkers
• increase sample and further subdivide MCI and PD-MCI group
• to expand our research longitudinally (track changes and assess clinical predictability of biomarkers)
Thank you for your attention!