Movement disorders and inactivity in Dementia

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Overview IPTOP symposium

- Movement Disorders in dementia
  - Dr. Hans Hobbelen
  - Treatment strategies for movement disorders and cognitive decline
    - Dr. Jennifer Bottomley
  - The dangers of inactivity in dementia
    - Prof. Dr. Erik Scherder
Movement disorders in dementia
objectives

- Movements disorders are part of all types of dementia
- Every type of dementia has its specific motor disorders
- Movement disorders are possible early biomarkers
Motor control

• Movements are originated in the brain
• Yet it is a complex system of feed-forward and control variables
• The correct performance of a movement is dependent on a diversity of feedback loops.
• Adaptation is a key factor
The quality of the Movement is dependent on:

- The complexity of the task
- The familiarity with the task
- The quantity of training
- The integrity of the system
- The demands of surroundings
- The cognitive state (motivation, concentration and emotion)
Major neurocognitive disorder (NCD) DSM V

- Primarily Cognitive disorder
- Acquired and represent decline (i.e. not developmental)
- Underlying brain pathology
Cognitive domains DSM V

- Complex attention
- Executive function
- Learning and memory
- Language
- Perceptual-motor
- Social cognition
dementia

- Alzheimer (50-80%)
- Lewy-body (15-25%)
- Vascular dementia
- Other causes of dementia
Auguste D

A. Alzheimer 1907; Maurer 1997

- Reduced comprehension
- Memory deficits
- Aphasia
- Unpredictable behaviour
- Auditory hallucinations
- Reduced muscle strength Left side
- Rigid radial reflex
In early stage clumsiness (apraxia)

- Slowing down of movements
- Apathy or restlessness (aimless walking)
- Walking on forefoot, no armsway and stiff trunk
- Losing the ability to walk, severe paratonia and the development of contractures
Survival curve showing time to first fall by diagnosis.

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0005521
Movement dysfunction in mild AD

Gorus 2005

Fig. 1 - Reaction Time Test apparatus. A: Personal computer; B: control panel with 8 illuminating pushbuttons and a central ready pushbutton; C: loudspeaker; D: foot pedal.
Movement dysfunction in early AD

- Movement time equal
- Slowing of reaction time
- Selective attention declines
- Double tasks more difficult
- Error rate increases

Gorus et al, 2005, 2006
Walking in AD van Iersel 2004

• Walking speed declines
• Shortened step length
• Increased double support
• Greater step to step variability
Processing speed, walking speed and dementia Welmer 2014
Fig 3 Interaction between cognitive status and 3 different walking conditions for gait velocity (A) and gait variability (B). Abbreviation: % CoV, percent coefficient of variation in stride time.

Manuel Montero-Odasso, Susan W. Muir, Mark Speechley

Dual-Task Complexity Affects Gait in People With Mild Cognitive Impairment: The Interplay Between Gait Variability, Dual Tasking, and Risk of Falls

Archives of Physical Medicine and Rehabilitation, Volume 93, Issue 2, 2012, 293 - 299

http://dx.doi.org/10.1016/j.apmr.2011.08.026
• Performed TUG vs Imagined TUG
• MCI patients perform the iTUG significantly faster in comparison to Healthy controls and Mild AD
Paratonia

- A distinctive form of hypertonia
- movement disorder with an estimated prevalence of 10% in the early/mild stages, 90-100% in later/severe stages of AD.


Prevalence, incidence and risk factors of paratonia in patients with dementia: a one-year follow-up study

Johannes S. M. Hobbelen,1,2,3,4,5 Frans E. S. Tan,2,6 Frans R. J. Verhey,3,8 Raymond T. C. M. Koopmans7 and Rob A. de Bie2,4

In early stage dementia a prevalence of 10%
If paratonia is present a direct effect on the functional mobility
This has a direct impact on the quality of life
• In early stage of life developed Neural circuits are less vulnerable than those who develop in later stages.
• Different forms of dementia have different effects on various circuits.
Vascular dementia

• Motor disorders in diagnostic criteria
• Spasm and hemiparesis
• Walking speed declined
• wider walking base
• Paratonia/rigidity
• Balance (static and dynamic) control disturbed
Lewy Body dementie

- Bradykinesia
- Parkinsonian rigidity (lead-pipe phenomenon)
- Slowing down
- Small steps in walking
- Stability problems
- Freezing of gait
• Difficulties in initiating movements
• Core stability disturbed
• Balance disturbed
**Fig. 1.** Average number of contacts in the 5 years prior to diagnosis. * p < 0.05; *** p < 0.001.
Table 2. Predictive values of symptoms for the development of dementia

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Years prior to diagnosis</th>
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<tr>
<td>Cognitive symptoms</td>
<td>5.5 (0.5–51.8)</td>
<td>2.9 (0.9–9.5)</td>
<td>5.4 (1.1–28)*</td>
<td>13 (3.7–46)**</td>
<td>56 (16–194)***</td>
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<td>0.91</td>
<td>0.11</td>
<td>0.08</td>
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<td>0.96</td>
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<td>Affective symptoms</td>
<td>1.5 (0.6–3.7)</td>
<td>0.7 (0.3–1.8)</td>
<td>1.0 (0.4–2.2)</td>
<td>1.1 (0.5–2.3)</td>
<td>3.0 (1.5–6.2)**</td>
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<td>0.14</td>
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<td>0.15</td>
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<td>0.9</td>
<td>0.85</td>
<td>0.85</td>
<td>0.83</td>
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<td>Behavioural symptoms</td>
<td>1.1 (0.2–7.0)</td>
<td>0.9 (0.2–4.8)</td>
<td>3.5 (0.6–20)</td>
<td>2.4 (0.8–7.2)</td>
<td>14 (3.2–65)**</td>
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<td>Vascular symptoms</td>
<td>0.7 (0.3–1.9)</td>
<td>0.9 (0.4–2.1)</td>
<td>1.4 (0.6–3.2)</td>
<td>0.96 (0.4–2.4)</td>
<td>1.6 (0.7–3.5)</td>
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<td>Gait disturbances</td>
<td>3.0 (1.2–10)*</td>
<td>1.5 (0.6–3.6)</td>
<td>3.8 (1.4–11)*</td>
<td>2.2 (0.98–4.9)</td>
<td>6.1 (3.1–12)***</td>
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<td>0.95</td>
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<td>0.9</td>
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<td>Changes in weight and appetite</td>
<td>0.6 (0.1–2.8)</td>
<td>0.8 (0.2–3.5)</td>
<td>1.1 (0.4–3.0)</td>
<td>1.8 (0.5–5.6)</td>
<td>5.9 (2.2–16)**</td>
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CI = Confidence interval. * p < 0.05; ** p < 0.01; *** p < 0.001.
Motor impairment predicts AD

- The degree of motor impairment in lower extremity in MCI is related to the risk of AD. Aggerwal et al 2006

- Lower levels of physical performance were associated with an increased risk of dementia and AD. Wang et al 2006
But what are we looking at?

• Physical frailty in old age is associated with Alzheimer disease pathology in older persons with and without dementia. Buchman et al Neurology 2008

• 10 years or more before the cognitive decline is visible in Alzheimer’s Disease deposition of A-Beta already present Sperling 2011
Figure 5. Revised dynamic biomarkers of the AD pathological cascade model – 2012
So what are we looking at?

- Is a lower level of motor performance a risk-factor for dementia?
- Or is it a first sign of brain pathology?
Figure 5. Revised dynamic biomarkers of the AD pathological cascade model – 2012
If it is a first sign of brain pathology than motor assessment can be of importance in early diagnostics → easy, not invasive and low costs:

- Gait parameters (speed, variability, functional)
- Paratonia
- Processing speed
- Imagery movement
- Dual tasks
Movements disorders are part of all types of dementia

Every type of dementia has its specific motor disorders

Research necessary if Movement disorders are possible early biomarkers

A good analysis of the present motor disorder is a good starting point for rehabilitation.

lecture dr. Jennifer Bottomley
Thank you for your attention!