Analysis of the Montreal Cognitive Assessment (MoCA) and its Individual Domains versus the Mini-Mental State Examination in Cognitively Impaired versus Cognitively Normal Patients as Assessed by Neuropsychological Testing

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INTRODUCTION

The Mini-Mental State Exam (MMSE) has been widely used for more than 30 years as a screening instrument for cognitive impairment. It has proven to be particularly useful in the evaluation of delirium and cortical dementias such as Alzheimer’s disease (AD). It has been less useful in the detection of milder forms of cognitive impairment such as Mild Cognitive Impairment (MCI), and in the evaluation of frontal/subcortical dementias. The Montreal Cognitive Assessment (MoCA), which was introduced by Nasreddine and colleagues in 2005, has been found in a number of studies to be superior to the MMSE in the detection of MCI and non-cortical dementias such as Parkinson’s disease dementia.

Previous studies performed suggest that the MoCA is more sensitive and specific than the MMSE in the detection of cognitive impairment. To date, no studies have examined individual items or domains of the MoCA using the gold standard of neuropsychological testing to determine whether the items contributed equally to the instrument’s sensitivity and specificity. Our experience with the MoCA suggests that certain items and domains are better discriminators than others. This study was designed to test that hypothesis.

SUBJECTS & METHODS

- The objective of this study was to compare the sensitivity and specificity of the MoCA and its individual components with the MMSE in the detection of cognitive impairment using neuropsychological testing as the gold standard.
- The study was performed at the Banner Sun Health Research Institute in Sun City, AZ, in a cohort of mostly elderly patients who participate in the Brain and Body Donation Program.
- On an annual basis, program participants are evaluated with neurological and physical examinations, movement evaluations, and a battery of neuropsychological tests designed for the detection of Alzheimer’s disease and other dementias (Alzheimer’s Disease Clinical Consortium protocol) and Parkinson’s disease (Arizona Parkinson’s Disease Consortium protocol).
- For this project, 135 Program participants were administered the MoCA by a single evaluator (SJ), and the MMSE by a project nurse. Subjects were classified as cognitively impaired on the basis of neuropsychological test results, and PD was diagnosed by the movement specialist.

• Diagnostic accuracy was quantified by calculating the area under the ROC curve using the gold standard of neuropsychological testing to determine whether the items contributed equally to the instrument’s sensitivity and specificity. Our experience with the MoCA suggests that certain items and domains are better discriminators than others. This study was designed to test that hypothesis.

RESULTS

<table>
<thead>
<tr>
<th>Primary Cognitive Domain</th>
<th>Sens</th>
<th>Spec</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE &lt; 25</td>
<td>30%</td>
<td>97%</td>
<td>69%</td>
<td>85%</td>
</tr>
<tr>
<td>MoCA &lt; 26</td>
<td>98%</td>
<td>52%</td>
<td>34%</td>
<td>99%</td>
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<tr>
<td>MoCA &lt; 21</td>
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<td>96%</td>
<td>76%</td>
<td>90%</td>
</tr>
<tr>
<td>MMSE &lt; 28</td>
<td>76%</td>
<td>75%</td>
<td>43%</td>
<td>93%</td>
</tr>
<tr>
<td>MoCA &lt; 24</td>
<td>87%</td>
<td>75%</td>
<td>47%</td>
<td>96%</td>
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<tr>
<td>Orientation &lt; 6</td>
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<td>84%</td>
<td>55%</td>
<td>94%</td>
</tr>
<tr>
<td>2*Orientation + Recall &lt; 14</td>
<td>89%</td>
<td>81%</td>
<td>54%</td>
<td>97%</td>
</tr>
<tr>
<td>2*Orientation + Recall + Language 85%</td>
<td>91%</td>
<td>70%</td>
<td>96%</td>
<td></td>
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<tr>
<td>+0.5Visuospatial &lt; 17</td>
<td>89%</td>
<td>89%</td>
<td>54%</td>
<td>97%</td>
</tr>
<tr>
<td>2*Orientation + Recall + Language +0.5Visuospatial &lt; 19</td>
<td>89%</td>
<td>89%</td>
<td>54%</td>
<td>97%</td>
</tr>
</tbody>
</table>

DISCUSSION

- Findings were in agreement with earlier studies showing better sensitivity of the MoCA in detecting cognitive impairment in both Parkinson’s disease and dementia populations.
- Receiver Operating Characteristic (ROC) curves for the MoCA and the MMSE showed that the MoCA consistently outperformed the MMSE in both sensitivity and specificity.
- Individual domains on the MoCA made substantially different contributions to the instrument’s sensitivity and specificity.
- An abbreviated, weighted combination of items comprising 2xMoCA Orientation score + Item Recall from the MMSE + Language testing from the MoCA > ½ Visuospatial testing from the MoCA optimized the AUC. Additional items did not improve the outcome.
- These results suggest that an abbreviated screening tool may be as useful as the MoCA itself in the detection of cognitive impairment.
- Further studies will be directed towards testing this hypothesis in our cohort.

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REFERENCES


