Reliance on external cues during serial sequential movement in major depression

M A Rogers, J L Bradshaw, J G Phillips, E Chiu

Abstract
Maintenance of motor set in patients with unipolar major depression was examined. Twelve melancholic and 12 non-melancholic depressed patients and 24 age matched controls performed a serial choice reaction time task while external cues aiding maintenance of a motor set were systematically removed. Melancholic patients were significantly slower than controls with no reduction in external cues and with a moderate reduction in external cues. At a high level of reduction in external cues, seven of 12 melancholic patients (but only three of 12 non-melancholic patients and controls) were unable to complete the task; suggesting a greater reliance on external cues, perhaps implicating a failure of motor planning ability in melancholic patients. This, in turn, may point to a prefrontal (premotor) deficit in melancholic depression, with possible commonalities with Parkinson's disease.

Keywords: major depression; parkinsonism; motor sequencing

The cognitive and motor slowing, or psychomotor retardation, of patients with melancholic major depression may not be entirely secondary, but rather a direct consequence of underlying neurophysiological disturbance. Findings from neuropsychology; functional, and to a lesser extent structural, imaging; and from neurochemistry and lesion studies' implicating frontostriatal impairment in major depression. Thus motor slowing in such patients may be viewed as arising from dysfunction of the basal ganglia-thalamocortical motor circuit. Indeed there is a similarity in the clinical presentation of psychomotor retardation in patients with depression and that of bradykinesia in Parkinson's disease, a disorder involving the basal ganglia.

This apparent similarity between psychomotor retardation and bradykinesia, and the fact that patients with Parkinson's disease (and other basal ganglia disorders) show abnormally high rates of depression may reflect some commonality of causation between the two disorders. The depth of this similarity has, however, been little studied and findings are contradictory. Sachdev and Annis' found similarities in performance of patients with Parkinson's disease and depressed patients with psychomotor retardation during simultaneous and sequential movement, suggesting common elements of neuropathology. Fleming, however, found that depressed patients with psychomotor retardation did not show difficulty with simultaneous movements or the rapid fatiguing effect shown by patients with Parkinson's disease.

To consider the underlying nature of any motor slowing common to Parkinson's disease and depression we examined performance on a serial choice reaction time task previously validated on patients with basal ganglia disorders. These disorders lead to a greater reliance on external cues to initiate and maintain movement. The present study employed the same task to assess whether patients with major depression also show a deficit in maintenance of motor set when external cues aiding maintenance were systematically removed. Undue reliance on external cues might indicate impaired ability to maintain motor set.

Method and participants
Participants performed a serial choice reaction time button pressing task involving 10 two way choice button presses along a response board. The correct "pathway" to follow was initially illuminated thereby providing external cues to aid maintenance of motor set. External cues were progressively removed in advance of each movement according to three protocols: no reduction in advance information, where the next correct button remained illuminated until the current button was released; moderate reduction in advance information, where the next correct button was extinguished when the current button was released; and high level of reduction in advance information, where the next correct button was extinguished when the current button was pressed; finally, at a high level of reduction in advance information, the next correct button was extinguished when the previous button was released. Eight equidistant pathways appeared in random order, each occurring twice at each level of reduction in advance information. The three cue reduction conditions were therefore matched for sequence difficulty. Order of presentation of conditions was counterbalanced. The measure obtained, "interbutton time", was the mean
Table 1 Clinical data for the depressed patient group

<table>
<thead>
<tr>
<th>Group (Mel/Non-mel)</th>
<th>Sex</th>
<th>Age</th>
<th>Beck</th>
<th>Core</th>
<th>NART IQ</th>
<th>Medication (daily dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-mel M</td>
<td>M</td>
<td>57</td>
<td>45</td>
<td>5</td>
<td>105</td>
<td>Venlafaxine hydrochloride 75 mg, Paroxetine hydrochloride 25 mg</td>
</tr>
<tr>
<td>Non-mel F</td>
<td>F</td>
<td>71</td>
<td>30</td>
<td>27</td>
<td>135</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 20 mg</td>
</tr>
<tr>
<td>Non-mel M</td>
<td>M</td>
<td>78</td>
<td>40</td>
<td>15</td>
<td>120</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 100 mg</td>
</tr>
<tr>
<td>Non-mel F</td>
<td>F</td>
<td>81</td>
<td>20</td>
<td>8</td>
<td>105</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 20 mg</td>
</tr>
<tr>
<td>Non-mel M</td>
<td>M</td>
<td>72</td>
<td>30</td>
<td>13</td>
<td>117</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 100 mg</td>
</tr>
<tr>
<td>Non-mel F</td>
<td>F</td>
<td>80</td>
<td>15</td>
<td>10</td>
<td>108</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 20 mg</td>
</tr>
<tr>
<td>Non-mel M</td>
<td>M</td>
<td>73</td>
<td>20</td>
<td>12</td>
<td>105</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 100 mg</td>
</tr>
<tr>
<td>Non-mel F</td>
<td>F</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>112</td>
<td>Venlafaxine hydrochloride 75 mg, Sertraline hydrochloride 20 mg</td>
</tr>
<tr>
<td>Non-mel M</td>
<td>M</td>
<td>50</td>
<td>30</td>
<td>5</td>
<td>111</td>
<td>Venlafaxine hydrochloride 187 mg, Fluoxetine 20 mg</td>
</tr>
<tr>
<td>Non-mel F</td>
<td>F</td>
<td>43</td>
<td>30</td>
<td>5</td>
<td>111</td>
<td>Venlafaxine hydrochloride 187 mg, Fluoxetine 20 mg</td>
</tr>
<tr>
<td>Mel M</td>
<td>M</td>
<td>78</td>
<td>40</td>
<td>21</td>
<td>118</td>
<td>Lithium carbonate 1000 mg, Zopiclone 7.5 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>74</td>
<td>30</td>
<td>12</td>
<td>118</td>
<td>Lithium carbonate 1000 mg, Zopiclone 7.5 mg</td>
</tr>
<tr>
<td>Mel M</td>
<td>M</td>
<td>79</td>
<td>37</td>
<td>11</td>
<td>118</td>
<td>Lithium carbonate 1000 mg, Zopiclone 7.5 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>50</td>
<td>30</td>
<td>11</td>
<td>111</td>
<td>Oceanemide 600 mg, Oxazepam 22.5 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>39</td>
<td>30</td>
<td>9</td>
<td>95</td>
<td>Chlorpromazine hydrochloride 25 mg, Mianserin hydrochloride 20 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>74</td>
<td>30</td>
<td>12</td>
<td>118</td>
<td>Venlafaxine hydrochloride 175 mg, Fluoxetine 20 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>81</td>
<td>30</td>
<td>12</td>
<td>105</td>
<td>Venlafaxine hydrochloride 175 mg, Fluoxetine 20 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>73</td>
<td>30</td>
<td>11</td>
<td>105</td>
<td>Venlafaxine hydrochloride 175 mg, Fluoxetine 20 mg</td>
</tr>
<tr>
<td>Mel F</td>
<td>F</td>
<td>82</td>
<td>30</td>
<td>11</td>
<td>117</td>
<td>Sertraline hydrochloride 100 mg, Alprazolam 1 mg</td>
</tr>
</tbody>
</table>

*Non-native speaker of English.

Results
Ten patients (seven melancholic and three non-melancholic) and three controls were unable to complete the high level of reduction in advance information condition. Fisher's exact test (two tailed) showed that significantly more melancholic (p=0.007), but not non-melancholic (p=0.300) patients were unable to complete this condition relative to controls. To avoid unequal sample sizes the data for that level were not included in the overall analysis.

There were no significant effects between controls (mean 265 (SD 48.73)) and non-melancholic patients (mean 304 (SD 85.60)) (F(1,34)= 3.052, p<0.05). There was, however, a significant main effect between controls and melancholic patients (mean 516 (SD 323.48)) (F(1,34)=14.160, p<0.001). Finally a direct comparison showed that melancholic patients (mean 516 (SD 323.48) ms) were significantly slower than non-melancholic patients (mean 304 (SD 85.60) ms) (F(1,22)= 6.70, p<0.05). There was no significant effect of cue (F(1,46)= 0.39, p<0.05) nor of group × cue (F(1,46)= 0.89, p<0.05).

Discussion
Maintenance of motor set in patients with major depression was examined. Melancholic, but not non-melancholic, patients were slow overall relative to controls. A moderate reduction in external cues did not further degrade melancholic patients' performance, indicating that they were able to retain at least one movement ahead in a motor set. However, a significant main effect of cue (F(1,46)= 0.39, p<0.05) and a group × cue (F(1,46)= 0.89, p<0.05) was observed.

www.jnnp.com
were unable to complete the task. Of the 10 patients who failed at this condition, seven were melancholic and only three were non-melancholic. This reflects the overall finding that non-melancholic patients performed at about the level of the controls, whereas performance of melancholic patients was poor.

That over half the melancholic group was unable to perform with a high level of reduction in advance information suggests a difficulty in maintaining a motor set involving more than one element or movement. Melancholic patients therefore showed a qualitatively similar, though more severe, pattern of deficits to that previously found in patients with Parkinson’s disease and Huntington’s disease who, while able to complete the high level of reduction condition, did so significantly slower than in the other conditions. Such deficits in self initiated movements in Parkinson’s disease are associated with reduced motor circuit activity. The presence of similar behavioural deficits in melancholic depression might indicate a functionally similar motor circuit deficit. That non-melancholic patients were indistinguishable from controls indicates that they do not share the motor deficits of the melancholic patients.

We sincerely thank Professor Gordon Parker of the Mood Disorders Unit, Prince Henry Hospital and The University of New South Wales, for his assistance with the CORE rating scale, and Bob Wood, Frank Devlin, Truong Nguyen, and Mike Durham for designing and maintaining the apparatus and software.

Reliance on external cues during serial sequential movement in major depression

M A Rogers, J L Bradshaw, J G Phillips and E Chiu

*J Neurol Neurosurg Psychiatry* 2000 69: 237-239
doi: 10.1136/jnnp.69.2.237

Updated information and services can be found at:
http://jnnp.bmj.com/content/69/2/237

These include:

**References**
This article cites 8 articles, 2 of which you can access for free at:
http://jnnp.bmj.com/content/69/2/237#BIBL

**Email alerting service**
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Topic Collections**
Articles on similar topics can be found in the following collections

- Mood disorders (including depression) (221)
- Drugs: CNS (not psychiatric) (1945)
- Parkinson's disease (690)

**Notes**

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/