SHORT REPORT

Reliance on external cues during serial sequential movement in major depression

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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.

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The cognitive and motor slowing, or psychomotor retardation, of patients with melancholic major depression may not be entirely secondary,[1] 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[2] implicate 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,[3] a disorder involving the basal ganglia.[4]

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[5] 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[6] 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. Fleminger,[3] 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.[7 8] 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.[7 8] 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 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

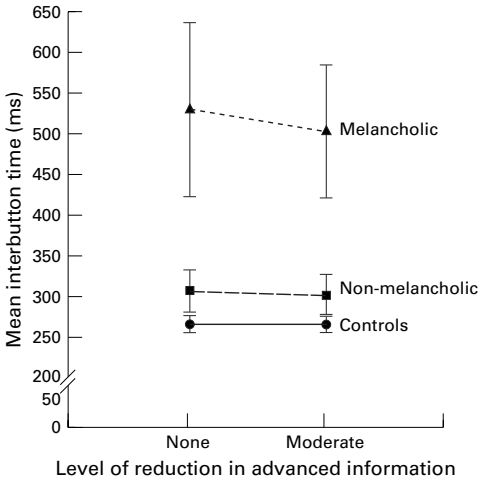
Table 1 Clinical data for the depressed patient group

Group (Mel/Non-mel)	Sex	Age	Beck	Core	NART IQ	Medication (daily dose)
Non-mel	F	75	19	4	105	Venlafaxine hydrochloride 37.5 mg
Non-mel	F	41	33	1	122	Nefazodone 500 mg Temazapam 10 mg
Non-mel	F	85	20	1	120	Venlafaxine hydrochloride 75 mg
Non-mel	F	71	11	0	102	Sertraline hydrochloride 50 mg
Non-mel	F	78	25	1	—*	Venlafaxine hydrochloride 75 mg
Non-mel	F	76	21	0	118	Sertraline hydrochloride 50 mg
Non-mel	M	73	10	1	117	Venlafaxine hydrochloride 75 mg
Non-mel	F	34	20	3	112	Venlafaxine hydrochloride 75 mg
Non-mel	M	24	25	5	115	Venlafaxine hydrochloride 37.5 mg Alprazelam 0.5 mg
Non-mel	M	28	35	5	111	Sertraline hydrochloride 100 mg
Non-mel	F	32	44	4	115	Fluoxetine hydrochloride 40 mg
Non-mel	M	32	29	6	119	Venlafaxine hydrochloride 187 mg Lithium carbonate 1000 mg Potassium clorazepate 10 mg
Mel	M	43	20	17	—*	Sertraline hydrochloride 200 mg
Mel	M	43	42	12	116	Venlafaxine hydrochloride 150 mg Zopiclone 7.5 mg
Mel	F	29	43	11	95	Paroxitine hydrochloride 20 mg
Mel	M	48	40	22	97	Venlafaxine hydrochloride 150 mg Lithium carbonate 250 mg
Mel	M	79	37	21	118	Venlafaxine hydrochloride 112.5 mg Digoxin 62.5 µg
Mel	F	50	40	17	112	Moclobemide 600 mg Oxazepam 22.5 mg Chlorpromazine hydrochloride 25 mg
Mel	F	39	47	14	95	Mianserin hydrochloride 20 mg Lithium carbonate 250 mg
Mel	F	74	20	12	—*	Venlafaxine hydrochloride 175 mg
Mel	F	82	15	10	108	Venlafaxine hydrochloride 150 mg
Mel	F	81	12	9	105	Venlafaxine hydrochloride 75 mg
Mel	F	73	19	17	110	Fluoxamine maleate 100 mg Lithium carbonate 500 mg
Mel	F	82	15	8	117	Sertraline hydrochloride 100 mg Alprazolam 1 mg

*Non-native speaker of English.

time between depression of one button and that of the next.

Participants were 24 patients with unipolar major depression (DSM-IV) and 24 age matched controls. All were dextral, with 10 men and 14 women in each group. The patient and control groups were matched for age (patients: mean 57.15, range 24–85 years, controls: mean 57.70, range 24–85 years; $t(46)=-0.09$, $p>0.05$); and according to the new adult reading test (NART) estimate of premorbid IQ (patients: mean 110.9, range 95–122, controls: mean 112.0, range 100–121, $t(41)=-0.52$, $p>0.05$). All patients had a primary diagnosis of unipolar major depression and a Beck depression inventory score of nine or greater at time of testing. Exclusion criteria were high potency neuroleptic medication, neurological impairment, dementia, musculoskeletal pathology, and poor corrected vision. Controls had no known psychiatric history. The patient group was divided into melancholic and non-melancholic subgroups on the basis of DSM-IV criteria for melancholic features, and the CORE measure of psychomotor disturbance (table). A CORE rating of 8 or greater was considered an indication of melancholic depression.[9] The melancholic group (mean 14.2, range 8–22) had a significantly higher mean CORE score than the non-melancholic group (mean 2.6, range 0–6) ($t(22)=7.80$, $p<0.001$). The melancholic group (mean 29.2, range 12–47) and non-melancholic group (mean 24.3, range 10–44) did not differ in their mean Beck score measures of depression severity ($t(22)=-1.01$, $p>0.05$). All patients were tested within 2 months of diagnosis except five melancholic and six non-melancholic patients tested between 6 and 12 months after diagnosis. Patients were in their first episode except for four melancholic and four non-melancholic patients.



Mean interbutton times (ms) for melancholic patients, non-melancholic patients, and controls at the "none" and "moderate" levels of reduction in advance information.

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.

A two way mixed model analysis of variance (ANOVA) with factors of group (controls *v* non-melancholic *v* melancholic) and reduction in advance information (none *v* moderate) was carried out. There was a significant effect of group ($F(2,45)=9.094$, $p<0.001$; fig).

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. When advance information was further reduced, however, 10 patients and three controls

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[8] and Huntington's disease[9] 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.[10] 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.

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1 Widlöcher DJ. Psychomotor retardation: clinical theoretical and psychometric aspects. *Psychiatr Clin North Am* 1983;**6**:27–40.
2 Rogers MA, Bradshaw JL, Pantellis C, *et al*. Frontostriatal deficits in unipolar major depression. *Brain Research Bulletin* 1998;**47**:297–310.
3 Fleminger S. Depressive motor retardation. *International Journal of Geriatric Psychiatry* 1991;**6**:459–68.
4 Bradshaw JL, Mattingley JB. *Clinical neuropsychology: behavioural and brain science*. San Diego: Academic Press, 1995.
5 Tandburg E, Larsen JP, Aarsland D, *et al*. Risk factors for depression in Parkinson's disease. *Arch Neurol* 1997;**54**: 625–30.
6 Sachdev P, Annis AM. Slowness of movement in melancholic depression. *Biol Psychiatry* 1994;**35**:253–62.
7 Georgiou N, Bradshaw JL, Iansek I, *et al*. Reduction in external cues and movement sequencing in Parkinson's disease. *J Neurol Neurosurg Psychiatry* 1993;**57**:368–70.
8 Georgiou N, Bradshaw JL, Phillips JG, *et al*. Reliance on advance information and movement sequencing in Huntington's disease. *Mov Disord* 1995;**10**:472–81.
9 Parker G, Hadzi-Pavlovic D. Development and structure of the CORE system. In: Parker G, Hadzi-Pavlovic D, eds. *Melancholia: a disorder of movement and mood*. Cambridge: Cambridge University Press, 1996:82–129.
10 Jahanshari M, Jenkins IH, Brown RG, *et al*. Self initiated versus externally triggered movements. I. An investigation using measurement of regional cerebral blood flow with PET and movement-related potentials in normal and Parkinson's disease subjects. *Brain* 1995;**118**:913–33.