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Research report

The association between the disruption of motor imagery and the number of depressive episodes of major depression

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ABSTRACT

Background: Mental rotation performance may be used as an index of mental slowing or bradyphrenia, and may reflect, in particular, speed of motor preparation. Previous studies suggest depressive patients present the correlates of impaired behavioural performance for mental rotation and psychomotor disturbance. The aim of this study is to compare the mental rotation abilities of patients with a first episode of depression, recurrent depression and healthy control subjects with regard to hand tasks.
Methods: We tested 32 first episode of depression, 38 recurrent depression and 36 healthy control subjects by evaluating the performance of depressed patients with regard to the hand mental rotation tasks.
Results: First, the first episode and recurrent depression subjects were significantly slower and made more errors than controls in mentally rotating hands. Second, the first depressive episode but not the recurrent depression displayed the same pattern of response times to stimuli at various orientations relative to control subjects in the hand task. Third, in particular, recurrent depression subjects were significantly slower and made more errors during the mental transformation of hands than first depressive episode relative to control subjects and the differences were significantly larger in female than male subjects in the mental rotation hand task.
Limitations: Patients were on antidepressant medication.
Conclusions: These results suggest that the impaired behavioural performance for mental representation processing are related to the number of previous episodes. Moreover, the recurrent major depressive episodes may contribute to the reinforcement of cognitive impairments and further the development or maintenance of mental representation dysfunctions, especially in female patients. A deficit on mental rotation in the depressive patients may be potential biomarkers for recurrence chronically.

1. Introduction

Mental rotation is the ability to turn mental representations of two- and three- dimensional objects, and usually involves the creation of a mental image of an object and its subsequent rotation (Parsons, 1987), which requires the integrity of specific cortical–subcortical motor structures (motor and premotor areas and basal ganglia) and sensory systems (somatosensory and visual) (de Lange et al., 2006). Mental rotation performance may be considered a mental analogue of bradykinesia rather than as a measure of global bradyphrenia (Rogers et al., 2002). Mental rotation may be useful for assessing the potential role of bradyphrenia in the slowed motor preparation that occurs during psychomotor retardation.

Clinical studies have revealed that those with major depressive disorder (MDD) were impaired significantly in attention and executive function and visuo-spatial learning and memory, compared with controls (Porter et al., 2003). Psychomotor disturbances in MDD might not be simply a secondary reaction to impaired mood and motivation, but rather a reflection of an underlying neurophysiological deficit (Rogers, 1986). This type of impairment might also be an important and possibly defining marker of MDD in particular (Nelson and Charney, 1981). Indeed, psychomotor signs might be among the first to remit (Sobin and Sackheim, 1997). MDD subjects exhibited a cognitive component (slowing) on a motor task. Bradyphrenia may play a role in psychomotor retardation, specifically in terms of slowed motor preparation (Rogers et al., 2002). MDD subjects present with serious mental rotation deficits specific to the hand task. If specific MDD characteristics can be identified during mental rotation tasks, they may be useful potential biomarkers for MDD (Chen et al., 2012).

There is no study on the relationship between previous depressive episodes and the ability of mental representation. However, several

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studies have determined that a relationship exists between the number of previous major depressive episodes and cognitive operation levels (Nandrino et al., 2004; Fossati et al., 2004; Kronmüller et al., 2009).The recurrence of episodes might aggravate cognitive impairment and encourages the development and maintenance of cognition dysfunctions in recurrent depression (Nandrino et al., 2002; de Jonge et al., 2010). In recurrent depression, the episodes become more spontaneous and more independent of environmental contingencies (Solomon et al., 2000; Milne et al., 2009). Accordingly, episodes would become more autonomous with repeated depressive experience. Negative thoughts may also be considered as a consequence or correlate of depression and may not be descriptive of vulnerability factors (Teasdale and Barnard, 1993; Cusin et al., 2000).

The aim of the present study therefore was to compare the mental representations of male and female patients with a first episode and recurrent depression to that of healthy control subjects. Based on the previous literature (Rogers et al., 2002; Chen et al., 2012), we expect that major depression patients will have difficulty performing the tasks. We hypothesised that depressed patients present with mental rotation deficits in comparison to healthy control subjects and that patients with multiple episodes have more serious mental rotation deficits in comparison to patients with a first episode of major depression. Knowing more about the cognitive consequences of the processing mechanisms of mental rotation will provide a more profound understanding of such patients and may help to establish rehabilitation procedures along those lines.

2. Materials and methods

2.1. Subjects

Fifty-seven inpatients with major depression according to DSM-IV (American Psychiatric Association, 1994) treated in the *Centre for Mental disease Control and Prevention*, *Third Hospital of the People's Liberation Army*, *Baoji*, *China*, from October 2011 to November 2012 were recruited. The patients included in the protocol were all in-patients who were all receiving the same medical treatment (serotoninergic antidepressive treatment) and the same psychological treatment (psychotherapic interviews and group therapy). The severity of depression was evaluated with the 17-item Hamilton Depression Rating Scale (HDRS; Zheng et al., 1988) with a minimum score of 21 needed to participate. Patients were right-handed and had normal or corrected-to-normal vision. All patients were receiving standard antidepressant medications and were clinically stable at the time of testing.

There were 32 first-episode major depressive patients (16 females and 16 males), and 38 recurrent depressed patients with at least two previous major episodes (20 females and 18 males). Recurrence implies the return of an entirely new episode after clinical recovery (Mueller and Leon, 1996).

A control group of 36 healthy subjects (19 females, 17 males), without any history of psychiatric illness, was matched for age, gender, and social level. The control subjects were matched by subject to both the first-episode patients and the recurrent patients. Subjects' ages did not differ between groups (Kruskall–Wallis test: $K=4.9$, $p=0.109$).

Patients with a first episode of major depression and recurrent depression did not differ significantly from healthy comparison subjects with respect to age, gender, height, weight, handedness, social class, education and alcohol consumption (see Table 1). There was a trend for first episode patients to be younger than multiple episode patients ($F_{(4,92)}=1.493$, $p=0.136$); this effect, however, was not statistically significant. Therefore, age was included as a covariate in the volumetric analyses. No statistically significant sex effect was found between the groups ($chi^2_{(2,92)}=1.21$, $p=0.503$). There was a significant main effect ($F_{(4,92)}=12.04$, $p<0.001$) for severity of depression (HDRS) with control subjects having lower HDRS scores compared with depressed patients. No significant difference in severity of depression was found between first episode patients and patients with recurrent depression. Patients with a first episode of major depression and recurrent depression did not differ significantly regarding age at onset of depression ($Z_{(1,69)}=0.126$, $p=0.608$). Patients with recurrent depression, as would be expected, had a significantly longer duration of illness compared with first episode patients ($Z_{(1,69)}=-3.88$, $p<0.001$), but no significant differences were found for the duration of the current episode ($Z_{(1,69)}=-1.02$, $p=0.226$). Multiple episode patients had suffered 5.06 ± 2.04

Table 1
Sociodemographical and clinical characteristics of the sample ($n=87$).

		Total sample patients ($N=70$)		First episode patients ($N=32$)		Recurrent patients ($N=38$)		Control subjects ($N=36$)	
		Mean (N)	S.D.	Mean (N)	S.D.	Mean (N)	S.D.	Mean (N)	S.D.
Sex[a]	Men	34 (48.6%)		16 (50.0%)		18 (47.3%)		17 (47.2%)	
	Women	36 (51.4%)				16 (50.0%)		19 (52.8%)	
Age (years)[a]	Men	37.25	13.02	33.02	13.81	40.21	12.75	37.05	11.50
	Women	35.22	13.82	32.64	14.66	38.02	11.98	36.18	10.92
Education (years)[a]	Men	14.32	7.31	13.08	5.82	14.90	6.26	15.02	7.70
	Women	13.14	6.90	12.92	6.82	14.12	6.99	14.98	7.86
$HDRS_{17}$[b]	Men	26.04	6.22	26.31	5.75	26.78	8.92	1.62	1.14
	Women	26.97	6.64	26.82	6.34	28.90	8.03	1.47	1.30
Number of episode		3.32	1.82	1.00	0.00	5.06	2.04	NA	
First		32 (45.7%)		26 (100%)		0 (0.0%)			
Second		13 (18.6%)		–		13 (34.2%)			
Third		14 (20.0%)		–		14 (36.8%)			
Fourth or more		11 (15.7%)		–		11 (29.0%)			
Age at onset[c]	In years	31.58	13.99	32.46	14.51	31.06	13.82	NA	
Duration of illness[d]	In years	3.16	2.32	0.86	1.04	5.34	4.02	NA	
Duration of current episode[c]	In weeks	27.93	17.04	27.52	24.36	28.04	22.05	NA	
Antidepressant[c] comedication		70 (100%)		32 (100%)		38 (100%)		NA	
Duration of AD medication	In weeks	22.38	16.95	20.68	16.92	23.09	18.22	NA	

For detailed F and p values see text.

[a] No significant differences were found between patients and controls or between first episode patients and patients with recurrent depression.
[b] Significant differences were found between patients and controls but not between first episode patients and patients with recurrent depression.
[c] No significant differences were found between first episode patients and patients with recurrent depression.
[d] Significant differences were found between first episode patients and patients with recurrent depression.