

EXECUTIVE FUNCTIONS IN DEPRESSION: A CLINICAL REPORT

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ABSTRACT

Fifty patients of depression and thirty normal subjects were assessed using clinical rating scales and also for the executive functions by Wisconsin Card Sorting Test (WCST). The depressed subjects demonstrated poor performance on WCST suggesting cognitive inflexibility and prefrontal dysfunction. More severe illness was associated with greater impairment in the executive functioning. This pattern of result in conjunction with previous studies supported the idea that depressed patients may have fixed frontally based dysfunction and calls for the use of cognitive assessment and rehabilitation in the patients with depression.

Key Words: Executive function, depression, WCST

Unipolar depression is associated with a range of cognitive difficulties (Brand et al., 1992, King et al., 1995). Prominent cognitive disturbances may be one of the presenting symptoms of depression. Reviewing the studies on depression Williams et al. (1988) concluded that depression may be associated with a range of neuropsychological deficits, however these tend to be minimal and return to normal on clinical recovery. Several other authors have reported these deficits as trait dependent, which remain even after the recovery and predict the long-term course of the illness (Paradiso et al., 1997, Bulbena & Berrios, 1993).

An important issue is whether the cognitive impairment is global or focal in nature. Neuropsychological studies have suggested that localised areas of brain dysfunction may be associated with the state of depression (Cain et al., 1984, Fromm & Schopflocher, 1984, Killian et al., 1984). Some studies suggest an association between the degree of frontal lobe dysfunction and cognitive impairment in depressed patients.

The perseverative response score on WCST is often impaired in patients with brain damage of varying cause. It has been particularly sensitive

to frontal lobe dysfunction. The frontal lobes are the seat for abstract reasoning ability and the ability to shift cognitive strategies in response to changing environmental contingencies (Berg, 1948)

The WCST can be considered a measure of executive function, requiring the ability to develop & maintain an appropriate problem solving strategy across changing stimulus condition in order to achieve a future goal (Shallice, 1982). The card sorting during WCST requires strategic planning, organised searching, utilizing environmental feedback to shift cognitive sets, directing behaviour towards achieving goal and modulating impulsive responding (Welsh & Pennington, 1988, Chelune & Baer, 1986).

The current study was conducted with an aim to study the executive function ability of the depressive patients as compared to normal healthy controls and to look for effect of the severity of psychopathology & duration of illness upon it

MATERIAL AND METHOD

Fifty patients meeting ICD-10 (WHO, 1992) criteria for unipolar depression and meeting other

inclusion criteria formed the sample of this study. None of the patient exhibited psychotic symptoms outside the period of depression and none met the criteria for schizophrenia or schizoaffective disorder. All the patients with history of neurological disease or any past or current physical disorder that could have affected brain function were excluded. No patient had the history of any substance abuse nor had received electroconvulsive therapy in the last one year. Most of the patients were on medication including antidepressants & anxiolytics. Patients with normal premorbid IQ as estimated by reading ability (Nelson, 1982) were included. All the patients selected were educated minimum up to class 8th standard or more.

30 normal controls were chosen from the care givers of the patients and recruited so that they were comparable with respect to the social class. Controls were subject to the same exclusion criteria with the addition of any past history of psychiatric illness. All the controls had GHQ score of 3 or less.

PROCEDURE: The patients were assessed upon;

1. Sociodemographic proforma.
2. Wisconsin Card Sorting Test (WCST)-computer version. (Heaton,1981)
3. Montgomery Asberg Depression Rating Scale (MADRS) (Montgomery & Asberg,1979).
4. Reading ability test for assessment of premorbid IQ.

All the controls were administered general health questionnaire (GHQ) and WCST subsequently.

In the Wisconsin Card Sorting Test subjects are required to sort cards according to categories of colour, form and number. They are not informed of the target category. When a subject has sorted 10 consecutive cards into the correct category, the nature of category is changed without informing the subject, who is told clearly that a sort is correct or incorrect. The computer version of WCST was used and all the instructions were given to the subjects as given in the text manual.

RESULTS

50 unipolar depressive patients and 30 controls, found suitable for the study were included. Table-1 shows the demographic characteristics of the sample in the two groups. Patients were grouped according to the duration of illness, educational level and severity of illness in the following manner; duration of illness 0 to 6 months (n=38) and 6 months to one year (n=12), education level \leq 12th standard (n=35) and $>$ 12th standard (n=15), mild level of severity of illness i.e. score. \leq 19 on MADRS (n=18), and moderate to severe level of severity of illness i.e.. Score $>$ 19 on MADRS (n=32)

TABLE 1
DEMOGRAPHIC CHARACTERISTICS

	Experimental	Control group
<u>Age</u>		
Mean(SD)	34.98(10.63)	34.26(11.11)
<u>Sex</u>		
Male	84 (%)	83.33(%)
Female	16 (%)	16.67(%)
<u>Marital status</u>		
Single	24(%)	23.33 (%)
Married	76(%)	76.67 (%)

Table-2 shows that the patients having longer duration of their illness showed more impairment in executive functions in comparison to the group with shorter duration of illness. The first group committed more preservative errors (mean-51.58,s.d.-22.74) and completed lesser number of categories (mean-1.58,s.d.-1.29) in comparison to the other group, (mean-34.89, s.d.-14.77) and (mean-2.58, s.d.-1.54) respectively. The difference of mean values of the two groups was statistically significant. The group with moderate to severe level of illness had shown more number of preservative errors (mean-45.0, s.d.-18.93) in comparison to the group with mild severity of illness (mean-27.66,s.d.-11.56) and completed lesser no. of categories as compared to the other

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group(mean-1.75,s.d.-1.48 Vs mean-3.33,s.d.-1.66) This differences was also statistically significant.

TABLE 2
COMPARISON OF SCORES ON WCST OF DIFFERENT GROUPS

	N	Perseverative errors		Categories Completed	
		Mean	SD	Mean	SD
Duration of illness					
0-6 months	38	34.89	14.77	2.58	1.74
6-12 months	12	51.58	22.74	1.58	1.29
		t=2.388*		t=2.128*	
Educational level					
≤12th	35	40.45	18.64	2.11	1.70
>12th	15	34.8	17.98	2.86	1.59
		t=1.007		t=1.509	
Severity level on MADRS					
Mild	18	27.66	11.52	3.33	1.66
Moderate to Severe	32	45.0	18.93	1.75	1.48
		t=4.024**		t=3.357**	

**p<0.01. * p<0.05

TABLE 3
COMPARISON OF PATIENTS & CONTROLS ON WCST

	N	Perseverative errors		Categories Completed	
		Mean	SD	Mean	SD
Control group	30	26.06	15.3	4.17	1.81
Total patient	50	38.9	18.46	2.30	1.69
		t=3.3614**		t=4.485**	

**p<0.01. * p<0.05

Table-3 shows that depressive patients had done more preservative errors (mean-38.9 s.d.-18.46) in comparison to the normal group (mean-26.06,s.d.-15.30) and completed categories were significantly less (mean-2.3,s.d.-1.69) as compared to the control group (mean-4.17, s.d.-1.81).

DISCUSSION

This study compared the executive

functions of depressed individuals of varying severity with that of healthy individuals. Depressed patients were also compared with each other depending upon the severity of psychopathology and duration of illness. Results indicate that patients with depression, irrespective of the severity demonstrate significant deficits as compared to the controls in the executive functions as assessed by the WCST. This finding is consistent with the observation that there is definite cognitive deterioration associated with unipolar depression howsoever mild it may be. The pattern of deficit resembles with that of a prefrontal type syndrome with difficulties in set shifting that was tested by the WCST. Patients with illness severity of moderate to severe were significantly more impaired as compared to those who had relatively milder illness. This finding confirms that not only the cognitive deficits are the trait factors but also are state dependent and show course characteristics like any other symptom of depression.

The patients who had illness duration of more than six months had greater deficits on WCST over those with less than 6 months of illness. This finding was unexpected. It can be assumed that poor performance of WCST might predict a longer duration of illness, however this requires confirmation in a larger sample with all the confounding factors controlled.

In this study the patients were not withdrawn from the medication. Most of the patients, except few were taking some kind of an antidepressant. A majority of the patient were also receiving benzodiazepines along with the antidepressant. The fact that patients were not taken off the medication made the study sample more close to that what is found in a clinical setting and also reduced the possible interference of slow relapse on the cognitive performances. It has been shown that antidepressant do not interfere much on the cognitive performance on the usual doses (Thompson 1991) ; However the use of benzodiazepines is definitely known to affect the judgement capacities and this might have enhanced the relatively poor performance of the study sample on WCST.

The impairment of set shifting ability and inhibitory control in unipolar depression as reported in this study is consistent with the functional neuroanatomical findings in depression (Cummings, 1993, Mayberg et al, 1994). A recent study showed reduced blood flow to the subgenual area of prefrontal cortex in the bipolar and unipolar depression (Drevets et al, 1997). The core cognitive deficits may be present in the unipolar depression that is independent from the depressed state (Paradiso et al 1997).

An important issue in interpreting any study of WCST would be the consideration of complex interplay of sampling procedure, patient characteristics, assessment setting, techniques and the sorting criteria. The finding of relatively the greater deficits in the control population in this study as compared to western data might be due to the several reasons. Firstly education is known to affect the performance on the WCST. Although all the patients & controls included were educated for >8 years, most of the patients were coming from a low socioeconomic background with poor quality education facilities & non-stimulating environment. These factors are known to have effect on the abstraction abilities of an individual. Secondly the computer version of the WCST used in this study might have contributed in the poor performance as shown by both the groups.

The major limitation of this study is the small sample size and inability to address the multiple confounding factors. Despite these limitations this study provides a further evidence of neuropsychological impairment in the patients with depressive disorder. Frontal lobe abnormality is known to lead to serve difficulty in coping with every day life particularly in terms of goal setting self regulation and decision making. The identification of these symptoms and providing appropriate advise on coping with these would be of considerable benefit to patients.

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REFERENCES

- Berg,E.A.(1948)** A sample objective test for measuring flexibility in thinking. *Journal of General Psychology*, 39,15-22.
- Brand,A.N., Jolles,J., Gispen-de Wied,C.(1992)** Recall and recognition memory deficits in depression. *J. Affect Disord*,25,77-86.
- Bulbena,A., Berrios,G.E.(1993)** Cognitive function in the affective disorders. A prospective study. *Psychopathology*,26,6-12.
- Cain,E.D., Boghos,M.D., Yerevanian, B.I. & Bamford,K.A.(1984)** Cognitive function in the dexamethasone suppression test in depression. *Am. J.Psychiatry*,141,116-118.
- Chelune,G.J.& Baer,R.L.(1986)** Developmental norms for the wisconsin card sorting test. *Journal of Clinical and Experimental Neuropsychology*. 8, 219-228.
- Cummings,J.L.(1993)** The neuroanatomy of depression. *J. Clin.Psychiatry*, (Suppl.54),14-20.
- Drevets, W.C., Price, J.L.& Simpson, J.R., et al.(1997)** Subgenual prefrontal cortex abnormalities detected in bipolar affective disorder using magnetic resonance imaging. *Archives of General Psychiatry*,47,55-59.
- Fromm,D. & Schopflocher,D.(1984)** Neuropsychological test performance in depressed patients before and after drug therapy. *Biol. Psychiatry*,19,55-71.
- Heaton,R.K.(1981)** A manual for the wisconsin card sorting test . Odessa, Fla: Psychological Assessment Resources.
- Killian,G.A., Holzman,P.S., Davis,J.M. & Gibbons,R.(1984)** Effects of psychotropic medication on selected cognitive and perceptual measures. *J. Abnorm. Psychol.*,1:58-70.

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King, D.A., Cox, C., Lyness, J.M. & Caine, E.D. (1995) Neuropsychological effects of depression and age in an elderly sample: A confirmatory study. *Neuropsychology*, 9, 399-408.

Mayberg, H.S., Lewis, P.J., Regenold, W. & Wagner, H.N., Jr. (1994) Paralimbic hypoperfusion in unipolar depression. *J. Nucl. Med.*, 35, 929-934.

Montgomery, S.A. & Asberg, M. (1979) A new depression rating scale designed to be sensitive to change. *British Journal of Psychiatry*, 134, 382-389.

Nelson, H.E. (1982) National Adult Reading Test. Test Manual NFER-NELSON: Windsor.

Paradiso, S., Lambert, G.J., Gravey, M.J. & Robinson, R.G. (1997) Cognitive Impairment in the Euthymic Phase of Chronic Unipolar Depression. *J. Nerv. Ment. Dis.*, 185, 718-754.

Shallice, T. (1982) Specific impairments in planning. In D.E. Broadbent & L. Weiskrantz (Eds.), *The Neuropsychology of cognitive function* pp 199-209. London: The Royal Society.

Thompson, P.J. (1991) Antidepressants and memory. *Annual Review of Human Psychopharmacology*, 6, 79-90.

Welsh, M.C., & Pennington, B.F. (1988) Assessing frontal lobe functioning in children: Views from developmental psychology. *Developmental Psychology*, 4, 199-230.

Williams, J.M.G., Watts, F.N. & Macleod, C. et al. (1988) Cognitive psychology and emotional disorder. Chichester: Wiley

World Health Organisation (1992) ICD-10 classification of Mental and Behavioral Disorders: Clinical Descriptions and Diagnostic Guideline. Geneva: World Health Organisation.

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