

SERUM ACETYLCHOLINESTERASE ACTIVITY IN PSYCHIATRIC PATIENTS

S. C. TIWARI¹, M.D.
J. S. SIDDIQUI², M.Sc.
NARENDRA TUTEJA³, M.Sc.
NAROTTAM LAL⁴, M.D.
J. K. TRIVEDI⁵, M.D.
L. M. BAHUGUNA⁶, Ph.D.

SUMMARY

Serum acetylcholinesterase activity was measured in hospitalized 30 schizophrenic and 30 depressive patients. It was observed that the enzyme activity was significantly higher in depressive patient than controls (Comprising of 20 surgical subjects). An increase in activity with the duration of illness was also noted in such patients. In contrast, schizophrenics did not show any significant increase except a little increase along with the number of episodes on comparison with control subjects. In view of the cholinergic predominance in depression it is suggested that increased serum cholinesterase activity in the aforementioned disorder may be due to a biochemical defence against the stress of higher acetylcholine content in the body fluids.

A large number of reports are available which indicate an alteration in cholinergic function in psychotic disorders. In search of a noninvasive *in vivo* biological index for the state of cholinergic function, several workers recorded an increase in cholinesterase activity *vis a vis* depression and schizophrenic patients (Gal, 1963; Gastaldo & Colucci D'Amato, 1964; Kaczynski *et al.*, 1964 and Murovich, 1966). However, a few reports present contradictory data to the above (Plum, 1960 and Ellman & Callaway, 1961). Though the research work exploring acetylcholinesterase activity in psychotic disorders has been inconclusive, yet the reported alterations keep on generating interest among investigators. The present work is aimed at studying the activity of enzyme acetylcholinesterase in schizophrenic and depressive patients.

MATERIAL AND METHOD

The cases for the present study consisted of 30 schizophrenics, 30 depressives (experimental group) and of 20 surgical subjects (control group). The diagnosis of experimental group was based on the criteria proposed by Feighner *et al.* (1972). The age ranged between 17-50 years and body weight 45 kilograms or more. Those with physical illness, pregnancy, mental retardation (Primary or Secondary) or history of intake of drugs, e.g. immunosuppressives, antipsychotics, antidepressants and lithium and /or addicting drugs in past three months were not included as these psychoactive drugs may modify the cholinergic activity. For controls, surgical patients between 17-50 years of age and with body weight 45 Kgs. or more were taken up who were not having any family and past history of neuropsychiatric illness. These patients were

1 Chief Resident, Department of Psychiatry

2 Research Assistant, Department of Pathology & Bacteriology

3 Research Assistant, Department of Pathology & Bacteriology

4 Reader, Department of Psychiatry

5 Lecturer, Department of Psychiatry

6 Pool Officer, Department of Pathology & Bacteriology

} King George's Medical College, Lucknow

having non-infective, non-degenerative and non-neoplastic minor surgical problems, viz., hernia, haemorrhoids etc.

These patients were kept drug free for two weeks from the date of hospitalization, all of them received uniform hospital diet and only phenobarbitone was administered if and when required during the washout period. 3.0 ml of venous blood was collected and serum was separated and acetylcholinesterase activity was measured by the method as described by Dela Huerga *et. al.* (1952). The data was analysed by using Wilcoxon-Mann-Whitney 'U' test.

RESULTS

In the experimental and control group, majority of the subjects were male, Hindu and married. Almost equal number of them hailed from rural and urban areas. The mean body weight was above 50 kilograms and they all were in the age range of 17-50 years as predecided, with mean for schizophrenics— 31.8 ± 7.3 , for depressives— 40.5 ± 7.7 , and for surgical controls— 33.7 ± 7.4 . The serum acetylcholinesterase enzyme activity in patients of depression was found to be significantly increased when compared with schizophrenic patients, and surgical controls, whereas, no significant difference was observed between schizophrenics and controls (Table 1).

TABLE 1.—Activity of Serum Acetylcholinesterase in Depression and Schizophrenia Patients

Groups	N	Mean (I.U./ ml)	'U' Statistics	P
Depression vs Surgical Control	(30)	4.5	5.2	<0.001
Depression vs Schizophrenia	(30)	4.5	6.4	<0.001
Schizophrenia	(30)	2.76		

A positive relationship was noted in the activity of serum acetylcholinesterase and duration of illness (time from onset of first episode till the day of present investigation). The enzyme activity was found to be increased in depressives with 1-5 years duration as compared to patients with less than 1 year duration. Schizophrenic patients showed no alteration of enzyme activity with respect to duration of illness (Table 2).

Regarding the relationship of enzyme activity with the number of episodes it was found that enzyme activity registers a rise with increasing number of episodes in schizophrenia; but significant increase was observed only when patients with 3 or more episodes were compared with patients with I or II episodes of Schizophrenia (Table 2). In case of patients of depression, there was no relationship between the enzyme activity and number of episodes.

DISCUSSION

The results reveal that the schizophrenics do not have an increased serum acetylcholinesterase activity. Although this does not preclude the absence of a possible imbalance in central cholinergic function in these patients, as it was observed that a slight increment in the enzyme activity with the number of episodes was there. These results are in contrast to the earlier observations of Gal (1963), Castalde & Colucci D'Amato (1964), Kaczynski *et al.* (1964) and Parveen *et al.* (1970) who reported an increment in the cholinesterase with some variance in schizophrenia patients. Castaldo & Colucci D'Amato also failed to note any relationship between enzyme activity and severity of the disease. In the present work a partial degree of relationship was noted in enzyme activity and the number of episodes.

The acetylcholinesterase in the serum of patients of depression was found to be significantly higher when compared to con-

TABLE 2. *Activity of Acetylcholinesterase in Depression and Schizophrenia Patients vis a vis Duration of illness and number of Episodes**

	N	Depression			Schizophrenia		
		Mean IU/ ml	U Statistics	P	N	Mean IU/ ml	U Statistics
EPISODE ..	<I vs II	(12) 3.4		1.3 >0.05	(14) 2.6		0.7 >0.05
	<I vs III or >III	(12) 4.3		1.3 >0.05	(14) 2.6		2.0 <0.05
	II vs III or >III	(9) 4.8		0.1 >0.05	(9) 3.1		
	1 Year vs <1-5 Years	(12) 4.3		2.3 <0.05	(12) 2.8		0.9 >0.05
	1 Year vs >5 years	(12) 4.3	**	—	(12) 2.8		0.4 >0.05
	1-5 Years vs >5 year	(15) 4.6	**	—	(8) 2.8		1.8 >0.05
DURATION ..		(3) 4.3			(9) 2.6		

*—Number of clear cut exacerbations during entire period of life till the present investigation including the present one, retrospectively meeting the criteria of Feighner *et al.* (1972).

**—These groups were not compared due to small sample size in the corresponding group.

trol subjects. Since, these patients were drug free prior to investigation, such increment in the enzyme activity appears to be related solely to their illness.

This increased activity may reflect the involvement of the central cholinergic system in these disorders, which is claimed so since long (Growdon *et al.*, 1978 ; Barbeau, 1978). A suggestion of a presence of a factor responsible for an increase in the cholinesterase activity in the body fluid (including CSF) seems plausible. Hanin *et al.* (1980) have reported a substantial increase in erythrocyte choline level with no

change in plasma choline content in depressed patients. This may be due to the increased hydrolysis of acetylcholine by an increased enzyme activity as found in the present report. If it is presumed, as also suggested by Jonowsky *et al.* (1972) that depression is due to a cholinergic predominance, it is tempting to speculate that the higher release of acetylcholine in nerve endings which is later released in blood (and or also other body fluids) may trigger a defence mechanism in the body against the neurotransmitter induced physiological stress, is responsible for the increased activity

of the enzyme. The present study points in this direction which needs to be substantiated in further studies.

REFERENCES

- BARBEAU, A. (1978) Emerging treatment: Replacement therapy with choline or lecithin in neurological diseases. *Le. J. Can. Sci. Neuro.*, 5, 157.
- CASTALDO, A. AND COLUCCI D'AMATO, F. (1964). Cholinesterase activity in blood serum of schizophrenics. *Boll. Soc. Ital. Biol. Sper.*, 40, 1326.
- DELA, H. J., YESINICK, C. AND POPPER, H. (1952) Colorimetric method for the determination of serum cholinesterase. *Am. J. Clin. Path.*, 22, 1126.
- ELLMAN, G. L. AND CALLAWAY, E. (1961) Erythrocyte cholinesterase levels in mental patients. *Nature*, 192, 1216.
- FEIGHNER, J. P., ROSINS, E., GUZE, S. B., WOODRUFF, R. A., WINOKUR, G. AND MUÑOZ, R. (1972) Diagnostic criteria for use in psychiatric research. *Arch. Gen. Psychiat.*, 26, 57.
- GAL, E. M. (1963) Cholinesterase activity of whole blood from healthy and schizophrenic individuals. *Nature*, 198, 1118.
- GROWDON, J. H., GELENBERG, A. J., DOLLER, J., HIRSCH, M. J. AND WURTMAN, R. J. (1978) Lecithin can suppress tardive dyskinesia. *New Eng. J. Med.*, 298, 1029.
- HANIN, I., KOPP, U., SPIKER, O. G., NEIL, J. F., SHAW, D. H. AND KUPFER, D. J. (1980) RBC and plasma choline levels in control and depressed individuals : A critical evaluation. *Psychiat. Res.*, 3, 345.
- JONAWSKY, D. S., EL YOUSEF, M. K., DAVIET, J. M. AND SEKEREK, H. J.? (1972) A cholinergic-adrenergic hypothesis of mania and depression. *Lancet*, II, 632.
- KAVEZYNSKI, M., BERNASKIEWICZ, E., WYPYCH, M. AND WOJNICKA, H. (1964) Sialic acid, cholinesterase and certain electrolyte levels in early and treated schizophrenic. 62, 572, *Polski. Tygod. Lekar.*, 19, 1074.
- MUROVICH, B. V. (1966) Acetylcholine and cholinesterase in schizophrenia—their clinical importance. *Zh. Neuropatals, Psichitr.*, 66, 904.
- PARVEEN, B., RAHMAN, M. A. AND HASSAN, Z. (1970) Serum pseudocholinesterase activity in schizophrenia. *Clin. Chim. Acta*, 30, 497.
- PLUM, C. M. (1960) Cholinesterase activity in nervous and mental disorders. *Clin. Chem.*, 6, 332.