Monoamine Oxidase-A and -B Activities in the Brain Stem of Schizophrenics and Non-Schizophrenic Psychotics

C. J. Fowler1, A. Carlsson2, and B. Winblad3

Departments of 1Pharmacology and 2Pathology, University of Umeå, and 3Department of Pharmacology, University of Göteborg, Sweden

With 1 Figure

Received March 16, 1981

Summary

In the pons of autopsy cases who had suffered from chronic schizophrenic or nonschizophrenic psychoses, an increased activity of monoamine oxidase -B but not -A was found, as compared with age-matched controls. Consequently, the ratio of the activities of MAO-B : MAO-A was elevated in the cases of psychosis. There was no significant difference in enzyme activities between schizophrenic and nonschizophrenic psychoses. Lobotomy appeared not to influence the monoamine oxidase activity.

Increased ratios of the activities of MAO-B : MAO-A in various brain parts of chronic schizophrenics in comparison with age-matched controls was found in the previously published data of Eckert et al. (1980) and Schwartz et al. (1974) but not Crow et al. (1979).

The mechanism underlying the change in enzyme activities is unclear. There seems to exist an association between an increased monoamine oxidase-B activity and degenerative processes in the brain resulting in loss of neuronal activity. The change observed may be linked either to pathological processes associated with chronic psychosis or to long-term treatment with neuroleptic drugs.

Key words: Human brain, monoamine oxidase, schizophrenia, psychosis.

Introduction

Monoamine oxidase (MAO, EC 1.4.3.4) is thought to exist as two catalytically active forms, termed MAO-A and MAO-B, where the
-A form is sensitive to inhibition by clorgyline and the -B form sensitive to inhibition by l-deprenil (Johnston, 1968; Knoll and Magyar, 1972). In both human and rat brains, 5-HT and noradrenaline are metabolized by MAO-A alone, whereas benzylamine is metabolized by MAO-B alone (Johnston, 1968, White and Glassman, 1977; Goridis and Neff, 1971; Tipton et al., 1973). In the rat brain, the activity of MAO-A appears to be localized, in the main, to the neuronal tissue, whereas the activity of MAO-B is more nonneuronal in character (Student and Edwards, 1977). As a consequence, changes in the proportion of neuronal to non-neuronal tissues, as found in the human brain with age (Fowler et al., 1980c) and Alzheimer's disease (Adolfsson et al., 1980), and in the rat brain after hemitransection (Oreland et al., 1980; Carlsson et al., 1981) result in an increased activity of MAO-B with no significant change in the activity of MAO-A.

In two recent studies conducted on a large number of brain regions, it was reported that the activities of MAO-A and MAO-B showed no statistically significant abnormalities in autopsy cases of chronic schizophrenic and nonschizophrenic psychoses (Crow et al., 1979; Eckert et al., 1980) with a lower activity of the enzyme forms being found in some regions for cycloid psychotics (Eckert et al., 1980). However, in some brain regions, particularly the pons, there was a tendency towards an increased MAO-B activity in schizophrenics. In consequence, in the present study, the activities of MAO-A and -B have been determined in homogenates of pons from controls, schizophrenics and from nonschizophrenic psychotics.

**Materials and Methods**

Autopsy was performed on 24 cases (11 male, 13 female, age range 26–99 years) without histories of neurological or psychiatric disease, and in 19 cases (13 male, 6 female, age range 46–86 years) from patients who had been inmates of a mental hospital and suffered from chronic psychoses. Of these 19 cases, 11 patients (8 male and 3 female) fulfilled the criteria of both Bleuler and Feighner for the diagnosis of schizophrenia, with the addition that the disease should have been chronic and should have included a defect state (for discussion of these definitions, see Kendall, 1975). The other 8 patients (5 male and 3 female) were grouped as “nonschizophrenic psychotics”. The “nonschizophrenic psychotics” formed a very heterogeneous group. In most cases a definite classification of the psychosis was not possible. A schizoaffective syndrome or cycloid psychosis was suggested in two cases and mental retardation in two other cases. In three cases, the symptoms suggested the existence of an unspecified organic brain lesion. Seven out of the nineteen chronic psychotic cases (4 schizophrenics and