Emotional stress markedly inhibited E1 mouse convulsions. Norepinephrine and dopamine levels in E1 mouse brain were hardly affected by stress, though a marked decrease in norepinephrine and dopamine levels was observed in the ddY mouse brain. The serotonin levels decreased in the E1 mouse brain in the same degree as in the ddY mouse brain. These findings suggest that the serotoninergic system is involved in the inhibition of E1 mouse convulsions, through an enhanced serotonin release in the brain brought on by the emotional stress. Noradrenergic and dopaminergic systems may also be involved.

INTRODUCTION

E1 mice, described in 1954 by Imaizumi et al. (1, 2), are an inbred mutant strain susceptible to convulsive seizures. Convulsions occur in all mice at about seven weeks of age after being given a throwing stimulation (3) once a week from four weeks of age.

Sporadic spike and multiple polyspikes during the interictal period (4) and paroxysmal discharges during convulsions (5) have been recorded electroencephalographically. Biochemical investigations have been made of acetylcholine, amino acids, and some other brain constituents (6).

In regard to biogenic amines in the brain, we have reported that non-stimulated and non-convulsed E1 mice have higher levels of brain do-

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pamine (DA) and serotonin (5-HT) and a lower level of brain norepinephrine (NE) than do other strains of inbred mice, and that in the interictal stage of "stimulated" E1 mice (7), the brain DA, NE, and 5-HT levels are significantly lower than in non-stimulated E1 mice (3).

Furthermore, Hiramatsu (8) observed that the administration of 5-hydroxytryptophan (5-HP), a precursor of serotonin, with MK 486 (a peripheral decarboxylase inhibitor) resulted in the elevation of the brain 5-HT level and markedly depressed the incidence of E1 seizures. These findings suggest that 5-HT is closely related to the susceptibility of E1 mice to seizures.

In the present study, we observed the effect of emotional stress on E1 mouse convulsions, and on brain catecholamine (CA) and 5-HT levels.

**EXPERIMENTAL PROCEDURE**

E1 mice were bred in our laboratory, and ddY mice, which are the mother strain of the former and are not susceptible to seizures, were used as controls. Two kinds of emotional stress were given to the mice. One was immersion in 25°C water by the apparatus of Porsolt, Bertin, and Jalfre (7) for 15 minutes every day for 3 days, and the other was immobilization with a wire net for one hour every day for 3 days.

The throwing stimulation was performed between 9 a.m. and noon. The mice were killed by exposure to microwave irradiation at 3kW for 0.2 sec with Metabostat NJE 2601 (New Japan Radio Co. Ltd., Saitama). The whole brain was removed and the cortex, striatum, hippocampus, hypothalamus, midbrain, medulla oblongata, and cerebellum were rapidly separated on an ice-plate and stored at −80°C until analysis.

The levels of CA, 5-HT, and their metabolites were measured by high-pressure liquid chromatography with electrochemical detection (Westerink and Mulder) (10), with the Yanagimoto HPLC system L-4000W (Yanagimoto, MFG., Ltd., Kyoto).

The data were subjected to statistical analysis by Student’s paired t test.

**RESULTS AND DISCUSSION**

The immersion stress completely inhibited E1 mouse convulsions immediately after it was given. No convulsions occurred in 13 of 34 E1 mice (38%) even 24 hours after the last stress treatment. In the immobilization experiment, no convulsions were observed in 9 of 22 E1 mice (41%) just after the stress treatment. This inhibitory effect lasted 24 hr in 8 cases (36%).

In another series of experiments with ddY mice, we observed that after the immersion stress the NE level markedly decreased in the striatum, hippocampus, hypothalamus, and midbrain (Figure 1); the DA level decreased markedly in the cerebral cortex and striatum (Figure 2); and the