Involvement of the Medial Amygdaloid Nucleus in the Action of Imipramine in Rats Subjected to the Forced Swimming Test

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(Received October 15, 1987)

A forced swimming test proposed by Porsolt\(^1\) is a useful method for screening antidepressants. To evaluate drug effects more objectively, vibration of the walls of a water tank caused by the escape behavior of the rat was recorded. Imipramine (IMI) increased the number of vibration and this effect was observed in the medial amygdala lesioned rat but not in the central or basolateral amygdala lesioned rat. The present result suggests that the medial amygdala is an important site of action of IMI.

**Keywords** — forced swimming; rat; medial amygdala; antidepressant; vibration

**Introduction**

Porsolt *et al.* (1977)\(^2\) proposed a forced swimming test to evaluate the action of antidepressants. This test is useful because atypical antidepressants like mianserin also show a positive effect. However this test lacks objectivity, because the experimenter measures immobility by behavioral observation. Therefore, in order to evaluate drug effects more objectively, vibrations of the walls of a tank caused by the escape behavior of rats from water such as wall scratching and jumping was recorded.\(^3\)

The amygdala is reported to be an important site of action of antidepressants.\(^4\) However, so far there are few reports indicating which subnucleus of the amygdala is the most important site of action of imipramine (IMI) in the forced swimming test. Thus we electrically lesioned the central (ACE), medial (AME) or basolateral (ABL) amygdala of rats and investigated the effect of IMI on these lesioned rats in the forced swimming test.

**Materials and Methods**

Male Wistar rats (Shizuoka Laboratory Animal Center) weighing 220—270 g at the beginning of the experiment were used. As described in our previous report (Shibata *et al.* 1982),\(^4\) surgical lesions of the amygdala and histological confirmation of lesion sites were conducted. Seven days after the lesions were made, rats were forced to swim daily for 15 min for 4 d in a tank (diameter: 15.5 cm, height: 27 cm) in which the water was 20 cm in depth and kept at 25 °C. The details of this apparatus was described in our previous paper.\(^2\) The drug effect was measured on the day after the 4 d swimming sessions. The swimming test was conducted 1 h after the last administration of 3 doses of imipramine hydrochloride (IMI, Sigma) 15 mg/kg or saline i.p. (24, 5 and 1 h before the test session) according to the method of Porsolt *et al.*\(^1\) Measurements of vibrations caused by escape behavior, like scratching, were made as described in our previous report.\(^3\) Results were evaluated by the Student’s *t*-test.

**Results and Discussion**

The maximal and minimal extent of lesions to the AME, ACE and ABL are shown in Fig. 1. Changes of vibration during the initial 5 min are shown in Fig. 2. In the sham, ABL and ACE lesioned rats, vibration was significantly increased by IMI when compared with that of the saline group. The values of vibration in the IMI treated groups are similar to those of normal rats (about 4500).\(^2\) In the case of the AME lesioned rats, vibration was not increased by IMI (175±62, *n* = 6). In the AME lesioned group, some rats showed a decrease in body weight but no difference in vibration.

Our results suggest that within the 3 sites of the amygdala, AME plays the most important...
role in the effect of IMI. Araki et al. (1985) reported similar results and Górka et al. (1979) and Duncan et al. (1986) had already reported on the importance of ABL, ACE and lateral nucleus of amygdala in the forced swimming test. The former mentioned investigators showed that, in ABL lesioned rats, duration of immobility was not reduced by IMI, and the latter groups of investigators demonstrated that the immobility period was significantly reduced by microinjection of IMI into the central and lateral areas of the amygdala. In the present experiment, we made a lesion in each subnucleus of the amygdala and compared the effect of IMI among these
Acknowledgements This investigation was supported in part by a Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Science and Culture, and the Naito Foundation.

References


