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The effect of electroconvulsive shock at a clinically equivalent schedule on rat cortical β-adrenoceptors

R. H. BELMAKER*, B. LERER, J. BANNET, B. BIRMAHER, *Jerusalem Mental Health Center—Ezrath Nashim, P.O.B. 140, Jerusalem, Israel*

Vetulani & Sulser (1975) reported that daily electroconvulsive shock (ECS) for seven days reduced rat forebrain noradrenaline-sensitive cyclic (c)AMP accumulation. Bergstrom & Kellar (1979) similarly found that daily ECS for seven days reduced rat cortical binding of the β-blocking compound dihydroalprenol (DHA) by 25%. Pandey et al (1979) found identical results, using daily ECS for 12 days they caused a 27% reduction in rat cortical DHA binding.

It has been proposed that all antidepressant treatments reduce β-adrenoceptor sensitivity (Vetulani & Sulser 1975). However, Lerer et al (1981) noted that some neurochemical effects of ECS disappear when the schedule of treatments is reduced to 3 times per week for a total of 12 treatments. Since in man treatment occurs at a schedule of 3 ECS per week for 9–12 treatments, biochemical effects that can be shown at 3 treatments per week for 9–12 treatments are more likely candidates as biochemical correlates of the therapeutic mechanism of electroconvulsive therapy (ECT). We therefore decided to study the effect of three ECS weekly for 4 weeks on rat cortical β-adrenoceptors.

Male albino rats, sabra strain, 150–200 g were housed four to a cage in identical plastic cages in a temperature-controlled (24 °C) environment with a regular 12-h light-dark cycle, and free access to water. ECS was administered (150V for 1·5 s) through ear clip electrodes, 3 times a week during a four week period. Control animals were identically handled and ear-clipped without current being applied. No anaesthetic was used.

Four days after the last ECS, animals were decapitated and the cortex dissected for assay. The assay was performed after the method of Bylund & Snyder (1976). The weighed frontal cortices were homogenized in 30 volumes of 50 mM Tris-HCl buffer (pH 8·0) centrifuged at 49 000 *g* for 15 min and washed twice with the Tris buffer to obtain a crude membrane preparation. The washed membranes were resuspended in 100 volumes of the Tris buffer and aliquots of 1·0 ml were incubated for 20 min at 25 °C with 0·05 ml aliquots containing varying concentrations of [^{3}H]dihydroalprenolol ([^{3}H]DHA), specific activity 49 Ci mM^{-1}, NEN. Five concentrations of [^{3}H]DHA were used from 2·0 to 12 nM. Binding was terminated by filtration through Whatman GF/B filters. Each Scatchard plot was done on an individual rat cortex.

Results are shown in Table 1. A significant 21% reduction in DHA binding (B_{max}) was observed in the ECS group, with no change in Kd. The 21% reduction found in this experiment appears almost identical to the 27% reported by Pandey et al (1979) or the 25% reported by Bergstrom & Kellar (1979). The latter two groups measured DHA binding one day after the last of a series of ECS. The present results suggest that a reduction of β-adrenoceptor number occurs even after clinically equivalent treatment schedules, and is still present at least four days after the last of 12 ECS. This would support the concept of reduction in β-adrenoceptor number as a biochemical mechanism of ECS.

* Correspondence.

Table 1. The Effect of ECS on DHA Binding (*p* mol g^{-1} weight).

	B_{max}	Kd	n
Control	24·5* (s.d. 4·5)	5·5	13
ECS	19·5 (s.d. 4·5)	5·6	12

* $P < 0.05$ (Student's *t*-test, two-tailed).

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