Effect of Electroshock on 5-HT Metabolism in Rat Brain

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Abstract. Repeated electroshock treatment (EST) on three consecutive days was administered to 72 rats. The last treatment was given immediately after an injection of a tryptophan-hydroxylase inhibitor, H 22/54. The animals were killed three hours later, two to four brain stems were pooled, analysed for 5-hydroxytryptamine (5-HT) and 5-hydroxyindoleacetic acid (5-HIAA) and the values compared with a group of animals receiving H 22/54 only. A significant decrease in 5-HT was seen in the EST group indicating an increase in the release of 5-HT after the repeated treatment. When the level of 5-HIAA in the EST group was compared with the level in the group treated with H 22/54 alone, the difference was slight. The small increase could be explained by the rather slow turnover rate of 5-HIAA in the central nervous system (CNS) and thus of the synthesis of 5-HIAA. The possibility of an accelerated outflow of 5-HIAA from the CNS after EST should also be considered.

Key-Words: Electroshock — 5-Hydroxytryptamine — 5-Hydroxyindoleacetic Acid.

In a previous study (Engel et al., 1968) it was observed that a single electroshock treatment (EST) caused an increase in homovanillic acid (HVA) level in the corpus striatum, while the dopamine (DA) level was unchanged. These findings suggested that increased DA turnover was induced by a single EST, although the exact mechanism of this acceleration could not be explained.

Repeated EST twice daily for one week has been reported to induce an increased turnover of noradrenaline (Kety et al., 1967), but no consistent effects on 5-HT turnover were reported after a single EST. Cooper et al. (1968) have shown in a small number of dogs that a course of electroconvulsive shocks increased the 5-HIAA in CSF.

The purpose of the present work was to study the effect of repeated EST on the turnover of 5-HT in the central nervous system (CNS) in rats. Turnover was studied by means of synthesis inhibition (for rev. see Andén et al., 1969).

Methods

The experiments were performed on male Sprague-Dawley rats weighing about 200 g. The animals were randomly divided into four
experimental groups and two control groups that received no treatment. Two of the experimental groups received an inhibitor of tryptophane hydroxylase (H 22/54, α-prohydopacetamide, Carlsson et al., 1963), and two EST and H 22/54. Each group was further subdivided into two parts for the determination of 5-HT and 5-HIAA, respectively.

The EST was administered as described previously (Engel et al., 1968). The current (60 mA, sinusoidal 50 cps, 0.2 sec) was given via alligator clips attached to the ears of the rats, and the criteria of a general convulsion were in accordance with the description by Woodbury and Davenport (1952). Five EST were given on three consecutive days (2+2+1), the last EST being administered immediately after an injection of H 22/54, 500 mg/kg i.p. The tryptophanhydroxylase inhibitor, H 22/54, was given to all rats except the controls. The animals were sacrificed by decapitation three hours later, the brain was removed and the brain stem taken for analysis of 5-HT and 5-HIAA. Two and four brains were pooled for the determination of the amine and the acid respectively.

5-HT was determined according to the method by Andén and Magnussen (1967) and 5-HIAA according to a modification of the method by Roos (1962). The results were statistically evaluated using an one way analysis of variance followed by a t-test.

<table>
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<tr>
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<th>5-HT µg/g brain weight</th>
<th>5-HIAA µg/g brain weight</th>
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<tbody>
<tr>
<td>Control</td>
<td>0.50 ± 0.022 (8)</td>
<td>0.88 ± 0.098 (8)</td>
</tr>
<tr>
<td>H 22/54</td>
<td>0.28 ± 0.019 (11)</td>
<td>0.59 ± 0.050 (10)</td>
</tr>
<tr>
<td>EST + H 22/54</td>
<td>0.19 ± 0.020 (10)</td>
<td>0.65 ± 0.057 (13)</td>
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</table>

**Results**

The administration of H 22/54 three hours before death induced a statistically significant decrease in the levels of 5-HT and 5-HIAA. The EST, however, combined with the inhibitor significantly decreased the level of 5-HT, but the level of 5-HIAA was slightly increased (0.1 < p < 0.25). After recovering from the last EST, the H 22/54 treated animals showed marked aggressive behavior.