

Effect of Brain Lesions on Hypothalamic Noradrenalin in Rats

The noradrenalin content of the hypothalamus is higher than it is in other cerebral regions of brain in rats (ISHIKAWA and IWASAKI¹; DONOSO and STEFANO²). This amine is synthesized by hypothalamic tissue, and is also concentrated from blood³. Fine varicose fibres, considered to be adrenergic endings, have been detected in the hypothalamus by means of the histochemical fluorescence method^{4,5}.

Noradrenalin concentration in rat brain stem decreases under several experimental conditions such as cold stress⁶, electric shock^{6,7,8}, intensive muscular exercise^{9,10}, and hypoxia¹¹. Functional ablation of the cerebral cortex performed by the spreading depression method reduces the amount of noradrenalin in the hypothalamus^{2,12,13}. In order to clear up the role played by different cerebral regions in their possible influence on the noradrenalin content of the hypothalamus, this amine was fluorometrically assayed¹⁴ in rats with bilateral electrolytic brain lesions set according to DE GROOT coordinates¹⁵.

Methods. 11 experiments with a total of 300 male rats, weighing 170–220 g, were performed. In each experiment, lesioned rats, normal and sham-operated rats were studied simultaneously. Lesions were verified histologically in each animal. Each value of noradrenalin represents a pool of the hypothalamus of 4 rats. The animals were sacrificed by decapitation 20 days after lesioning.

Results. As is shown in the Table, lesions in the hippocampal region (A-P, 4; V, + 1.5; L, 2) produced an important reduction in the hypothalamic noradrenalin concentration. In 4 groups of rats sacrificed 10 days after lesion, the values obtained were normal. The lesion in the thalamus (A-P, 5.8; V, + 0.5; L, 2) determined a slight decrease of noradrenalin content in the hypothalamus. No differences were noted in rats with lesions in amygdala, corpus callosum, cerebral cortex (frontal, parietal or posterior lobes), habenula, olfactory bulb, or those with sham operation, as against normal rats (Table). The lesions in the basal hippocampus occasionally damaged the thalamus (ventral and medial nucleus) and other adjacent structures, such as the stria medullaris. In some brains they extended into the corpus callosum. Thalamic lesions were situated in the zone of ventralis and antero-medialis nucleus.

Effect of cerebral lesions on the noradrenalin concentration in the rat hypothalamus

Group	No. of extracts	Noradrenalin $\mu\text{g per g}^a$	P value ^b
Normal rats	17	1.87 \pm 0.09	—
Sham operated rats	8	1.92 \pm 0.07	n.s. ^c
Lesioned rats:			
Thalamus	6	1.57 \pm 0.14	< 0.05
Amygdala	6	1.71 \pm 0.17	n.s.
Hippocampus	8	1.35 \pm 0.06	< 0.01
Corpus callosum	9	1.81 \pm 0.11	n.s.
Habenula	3	2.42 \pm 0.58	n.s.
Olfactory bulb	4	2.01 \pm 0.27	n.s.
Cerebral cortex	7	1.92 \pm 0.16	n.s.

^a Mean \pm standard error. ^b Operated rats versus normal rats. ^c Non-significant difference.

Comments. Several authors have suggested that noradrenalin-containing fibres in the hypothalamus originate from mesencephalic neurons. Supporting this view, DAHLSTRÖM and FUXE⁵ have presented evidence showing that fibre bundles from the reticular formation are distributed in different nuclei of the rat hypothalamus. Also, electrolytic lesions in rabbit mesencephalon cause a reduction in brain noradrenalin content¹⁶. A similar effect is produced in rats by lesions in the medial forebrain bundle^{17,18}.

The results reported here induce one tentatively to postulate that lesions in the hippocampus, or in structures situated in that zone, interrupt pathways regulating the hypothalamic noradrenalin content. At present it is not possible to determine if the results shown in this paper are related to the aforementioned evidence.

Résumé. Des lésions bilatérales, localisées par stéréotaxie dans la région de l'hippocampe chez le Rat, produisent au bout de 20 jours une diminution significative de la concentration en noradrénaline de l'hypothalamus. Si les rats sont sacrifiés 10 jours seulement après la lésion, il n'y a pas de modifications dans cette concentration. Le contenu en noradrénaline de l'hypothalamus est légèrement réduit par des lésions thalamiques, mais n'est pas modifié par des lésions faites au niveau du cortex cérébral, de l'amygdala, de l'habénula, du corpus callosum, et du bulbe olfactif.

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- 18 DONOSO and STEFANO have recently observed (unpublished results) a clear decrease of noradrenalin content in rat hypothalamus, cerebral cortex and thalamus, after lesions of the medial forebrain bundle. Noradrenalin content in mesencephalon was not modified in these conditions.
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